

# Strategic Framework for Departmental Research

from 2023 (20th Parliamentary Term)



Federal Ministry  
for Digital  
and Transport



# A message from the Federal Minister for Digital and Transport

Dear readers,

Climate action, the mobility transformation and digitalization: The challenges of our time are demanding and complex. To overcome them, we are relying on research-based progress. This is the foundation for innovation, and thus for a positive future for our country. The six departmental research establishments in the portfolio of the Federal Ministry for Digital and Transport (BMDV) contribute to this endeavour. They conduct cross-modal and application-oriented research. They ensure an ongoing exchange at the cutting edge of science. And they provide valuable insights into how we can make mobility climate-friendly and efficient, intelligent and connected, safe and affordable.

Our aim is to put in place attractive and sustainable mobility services – inspiring people and businesses to join us on this journey. Their acceptance of and willingness to adopt climate-friendly behaviour are what counts. We want them to view climate action as progress, not a constraint. Digitalization plays a key role in this. It can help us organize mobility for people, goods and commodities. For example, digitalization makes it possible to link different services such as on-demand shuttles, buses and trains, rental bikes or shared cars. It also lays the groundwork for intelligent traffic guidance systems that take us to our destination efficiently, directly and without unnecessary emissions. Digitalization is also making railways and rolling stock more modern, innovative and powerful. These few examples show that digitalization is influencing the transformation of mobility. At the same time, it is the key to ensuring that Germany remains competitive, strong and sovereign as a technology nation.

However, we have a long way to go in many areas relating to future mobility and digitalization, where we are just starting out. Time and again, there are new, varied questions that need to be answered. To this end, we rely on research and



the enormous creative drive of the researchers in our department, who work together innovatively, interdisciplinarily and across all modes of transport.

With this new Strategic Framework for Departmental Research, we are pointing the way forward for this, defining priorities and action areas, with a focus on the departmental goals and tasks.

The departmental research plan is drawn up on this basis each year. It maps the specific planned research funding and contracts. This allows us to assess in detail the priorities that are being implemented. We also identify lessons learned and potential research gaps.

Departmental research is a huge treasure trove that we want to continue to leverage and make intensive use of in the future. Innovation and progress need responsible and independent research. Policymakers, authorities and the scientific community continue to work closely together to achieve this.

Dr Volker Wissing,  
Member of the German Bundestag  
Federal Minister for Digital and Transport

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Political action in the various activity areas in the digital and transport sectors, from developing strategies and concepts to legislation and concrete investment decisions, requires a dependable evidence-based decision-making basis.

The aim of departmental research as a bridge between the scientific community and politics is to investigate research questions specifically with a view to performing and evolving the sectoral functions and policymaking of the Ministry and its executive agencies. It provides essential support to the Ministry and its executive agencies in the fulfilment of departmental tasks.

In addition, the research activities initiated by the Ministry as part of financial assistance programmes help to support third parties in making a very efficient contribution to achieving the goals of the respective research priorities through their research and measures triggered by this research.

The departmental research projects also inspire a wide range of further research and applications by third parties. The Ministry's departmental research thus represents an essential, important and independent element in the mobility and digital research landscape.

The present Federal Ministry for Digital and Transport Strategic Framework for Departmental Research

- describes the research priorities and action areas for the current parliamentary term and thus the medium-term orientation of departmental research as a whole;
- represents the organization of departmental research;
- serves to externally present, and thus ensure transparency of departmental research, also as an interdepartmental research coordination instrument; and
- forms the basis for the annual departmental research plans with the respective planned research contracts and research funding.



Figure 1: BMDV

## 2. Challenges of the future

### Transforming mobility sustainably and driving digital performance

Germany faces tremendous challenges. Successfully and sustainably transforming the mobility sector and enhancing digital capabilities are essential prerequisites for achieving the overarching objectives of transforming the energy system and reaching climate neutrality by 2045.



Mobility is a service of general interest. We can only transform our mobility system if we provide infrastructure in urban and rural areas with diverse, attractive, demand-driven, affordable and, in particular, sustainable mobility services. We want to take every single person along with us on the journey towards a mobile, digitally connected and sustainable society and economy, inspire enthusiasm for new technologies and make it easy and attractive for people to change their behaviour. The fundamental prerequisite is that the efficiency of infrastructure is ensured across all regions, whether urban or rural. It must be made as robust as possible to cope with changing requirements, such as adaptation to climate change and extreme weather conditions. The transport system as a whole must be enhanced both physically and digitally.

Mobility is a basic human need and a prerequisite for individual quality of life and equal living conditions in urban and rural areas, for safe transportation and reliable logistics, as well as for stable economic development. This makes it all the more important to drive forward the sustainability of mobility in all political decisions and thus also to think of future generations, particularly with regard to the longevity of investments. At the same time, the freedom of mobility and the use of global supply chains must not be restricted. On the contrary, an attractive range of low-emission mobility services must be made available, increasing the necessary acceptance in society. Thanks to research and innovation, and by putting the resulting findings into practice, we can choose from many options when making this change.

The transport sector must be decarbonized if we are to reach the climate change targets. Even though some of the technological developments required for this already exist, the speed required to meet the targets can only be achieved with a technology-neutral approach and an openness to new, innovative research findings and solutions, and by ensuring they reach market penetration.



This requires a holistic approach, taking into account supply chains and the relevant manufacturing processes, as well as a long-term mindset, incorporating recycling and the targeted circular economy.

The resulting research findings and innovations should also be shared beyond Germany's borders and applied in joint solutions. Only in this way can we maintain the efficiency and resilience of the mobility system through every step of a sustainable transformation. Transport policy dovetails closely with other policy areas, such as energy, economic and social policy, and always involves international relations in our globalized, collaborative world.

Digitalization is THE answer to many of our current challenges. That is why we want to continue to harness and drive forward the opportunities it presents. Here, too, we must leave no-one behind. Again, research is the key to building a modern, sustainable and connected future.



Digitalization can serve as a multiplier for the mobility transformation. It helps enable us to develop intelligent, affordable and connected mobility, while at the same time making it efficient and climate-friendly – and also allowing us to offer services tailored to the users' specific situation.

We can also make freight transport and logistics much more advanced, faster and more sustainable by consistently using digital methods and solutions. Data is the foundation for our digital progress. If we provide, analyse, and link as much data of the highest possible quality, taking data privacy and cybersecurity into consideration, entirely new business models, processes, mobility and logistics services can emerge that fit the individual needs of people and companies. Research and rapid application of the findings are important in order to leverage new potential across virtually all sectors and to drive the necessary transformation processes towards a sustainable and climate-neutral way of living and doing business.

However, digitalization must not increase the vulnerability of the overall system, for example through networking and automation. Accordingly, research and innovation projects must increasingly focus on the security and protection of digital systems in the transport and infrastructure segments, as well on the protection of sensitive data.

The Federal Ministry for Digital and Transport wants to actively influence the digital transformation through innovation and thus enhance German and European technological sovereignty. Departmental research and other activities make a major contribution to this. Efficient digital developments are to be accelerated by means of targeted research and innovation projects, for instance by improving communication, creating new mobility services, and enhancing quality in other areas of life through networking and data use. These developments must focus on freedom, the precautionary principle, security, social participation and sustainable development.

Ultimately, the Ministry's research projects are intended to drive forward-looking technological developments in both the mobility and digitalization segments, to enable new developments and solutions, to leverage data potential, to harness data and ensure its security, and at the same time to put in place an inclusive process for shaping this transformation by involving society.

These diverse challenges give rise to the following strategic research framework with its priorities and action areas for the coming years in accordance with the guiding principle 'Challenges of the future – transforming mobility sustainably and driving digital performance.'



# 3. Research priorities

## and action areas

The primary purpose of departmental research is to obtain scientific findings and provide decision support tools for the direct fulfilment of sectoral functions and policy-making. For this reason, extensive analysis taking into account the new departmental portfolio and an intensive internal coordination process were conducted before defining the department's strategic research priorities and action areas for this parliamentary term.

As a result, the following research priorities and action areas in departmental research will be

addressed in a variety of ways over the next few years in order to develop the necessary technical and political activities based on the latest scientific findings. In this way, mobility can be sustainably transformed and digital capabilities enhanced.

The research priorities are not isolated, they are closely linked. This can result in synergies, which will advance the science-based transformation of the mobility system under the premise of sustainability and digital capabilities.

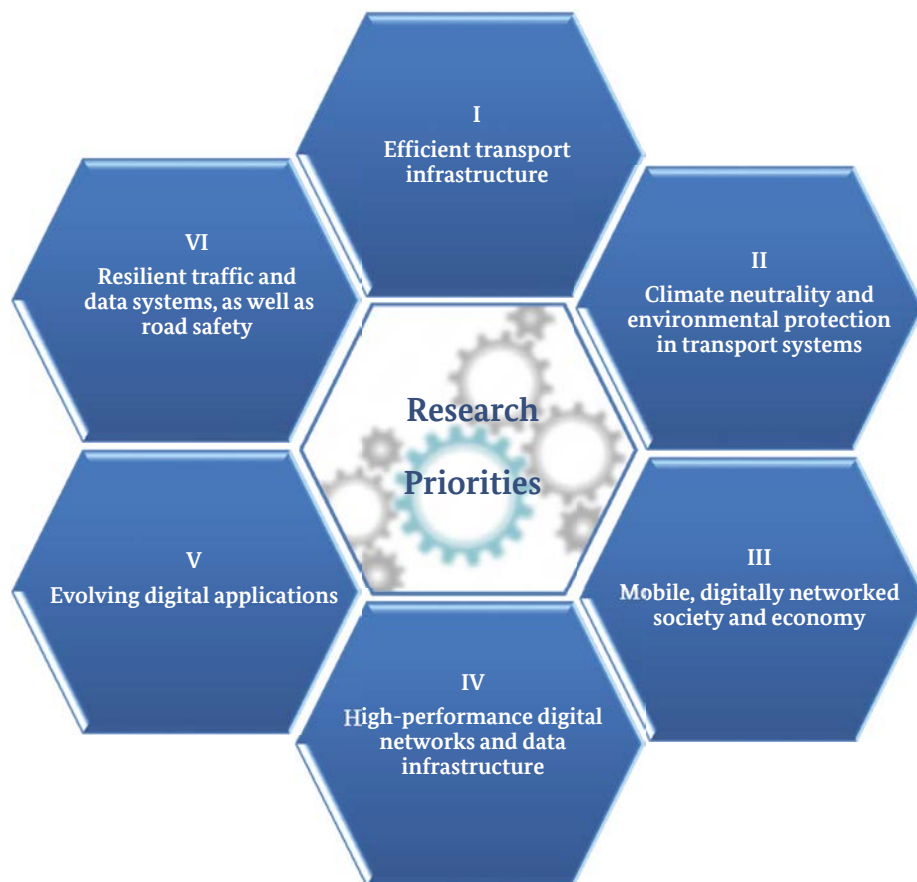


Figure 2: BMDV, © Jan Engel – stock.adobe.com (background image in honeycomb)

### 3.1. *Research priority I* *Efficient transport infrastructure*

Efficient infrastructure is the key prerequisite for mobility. Each year, considerable investment funds are dedicated to maintaining, upgrading and expanding the transport infrastructure as a dependable foundation for future mobility and a functioning national economy. The creation of new, science-based findings through research is the prerequisite for planning these investments in line with demand and deploying them efficiently, and for deriving additional policy measures based on state-of-the-art science and technology. Research is also responsible for constantly advancing the knowledge base for an efficient transport infrastructure of the future and, if necessary, identifying further research needs.

With regard to the research areas, the Ministry considers all areas of infrastructure within its portfolio. There is an urgent need for action on innovations in construction of transport infrastructure and maintenance of road, waterway, rail, cycling and pedestrian infrastructure, structures such as bridges and tunnels, as well as transport hubs. In order to meet known needs as efficiently as possible, research is correctly addressing innovations in transport infrastructure construction and maintenance as an action area.

What is more, forward-looking mobility is inconceivable without innovative technical infrastructure. In particular, this refers to research issues relating to the rollout of the charging and refuelling infrastructure. As a prerequisite for the market ramp-up of electromobility with batteries and fuel cells, the charging and refuelling infrastructure must grow





significantly faster in the coming years and enter the scaling phase.

If this rollout is to succeed, innovative solutions and objective scientific support for decision-making processes, which facilitate the design and management of this dynamic development, will be key. Charging and refuelling infrastructure must be considered in the context of an ecosystem that includes user needs, the entire grid-based energy supply system at the distribution network level, the distribution system for refuelling infrastructure, as well as the necessary data flows. However, other innovations in technical infrastructure are also driven by the department's research. For example, these include issues relating to evolving and evaluating digital signal boxes in the rail sector.

Other examples include the clear need for research in the area of predictive maintenance, the evolution of digital and (partially) automated construction and infrastructure monitoring for practical use, including innovations related to building materials and design.

For transport infrastructure planning and investment planning, there is also a need for research on science-based processes, concepts, methods, data, and forecasts to contribute

to the long-term evolution of the federal transport infrastructure. These plans provide the framework for significant decisions on federal investments totalling billions of euros. Against this background, and given the dynamic developments in the economic, transport and other relevant frameworks (e.g. environmental protection and climate action), an ongoing review and evolution of the processes, methods and underlying data on which the planning is based with regard to, among other things, international standards, increase in scientific knowledge and efficiency of application is not only advisable, it is essential and the key to departmental research work.

Transport demand modelling, for example, is an important tool in this context for federal transport infrastructure and mobility planning. It is used to estimate the effects of potential measures (such as infrastructure measures) and future developments (such as demographics, user costs, climate action requirements) on demand in freight and passenger transport. The model-based traffic demand calculation is used to create forecasts that realistically depict the present and future traffic situations both quantitatively (traffic volumes) and qualitatively (cause and effect relationships). The current state of science and engineering in knowledge

and manufacturing must always be taken into account. This research priority therefore includes the development of conceptual, methodological and procedural approaches, as well as leveraging and delivering existing and new mobility data in order to inform the federal government's transport infrastructure, mobility and investment plans on the basis of the latest scientific findings.

However, other mode-specific methods, processes and forecasts must also be advanced through research. This encompasses a very wide range of areas, from the automated validation of control and signalling technology plans, testing of implementation procedures for regional climate change signals, natural hazards and extreme weather events for infrastructure and investment planning, to the development of a methodology to show the macroeconomic benefits of investments in federal waterways that play a key role for tourism. Also addressed, for example, are the development of approaches to assess mode-specific developments in the update of methodological approaches and the evolution of federal transport infrastructure planning, as well as research into models to generate a multi-airport module to quantify congestion-dampening effects from neighbouring airports and other hubs.

Last but not least, the Ministry supports the ongoing development of legislation and regulations for the wide range of topics in the department's portfolio through its ongoing research work, thus helping to ensure that scientific findings are put into practice quickly.



**Due to these complex requirements, the Framework for Departmental Research identifies the following action areas (AA) in this priority:**

- AA 1: Innovations in transport infrastructure construction and maintenance of road, waterway, rail, cycling and pedestrian infrastructure, including transport hubs**
- AA 2: Innovations in technical infrastructure**
- AA 3: Evolution of procedures, strategies, methods, data and forecasts as a basis for transport infrastructure planning and investment planning**
- AA 4: Scientific support for legislation and regulations on transport infrastructure**

### 3.2. *Research priority II Climate neutrality and environmental protection in transport systems*

The Federal Government's energy and climate policy objectives call for a significant reduction in greenhouse gas (GHG) emissions. In its amendment to the Climate Change Act of 12 May 2021, the Federal Government once again raised the binding reduction targets for harmful greenhouse gases compared with the 1990 as a base year, and adopted a cross-sectoral reduction of at least 65% by 2030. A reduction target of at least 88% applies for 2040, and Germany is to achieve greenhouse gas neutrality across all sectors by 2045. Annual sector targets have already been set for the period to 2030. The transport sector must reduce its GHG emissions from 146 million tonnes of CO<sub>2</sub> equivalents in 2020 to 85 million tonnes of CO<sub>2</sub> equivalents in 2030. On the research side, the Ministry is also focusing on the period after 2030 and continues to drive climate neutrality in the transport sector.

Responsible, forward-looking transport policy needs support from an innovative and problem-oriented research environment. The 'Climate neutrality and environmental protection in transport systems' research priority is essentially dedicated to the question of how alternative drivetrains and fuels can be gradually implemented in transportation, taking into account the associated supply infrastructure, in order to achieve climate change targets in the transport sector. This includes research into a wide range of innovative vehicle technologies to achieve climate neutrality and improve environmental protection in order to meet future technical and operational requirements.

One of the key issues here is the market ramp-up for the electrification of the transport sector – this includes battery-electric vehicles as well as fuel cell-powered vehicles. The relevant electromobility use cases must be analysed for the various modes of transport and user-friendly, needs-based and practicable solutions must be found. To maximize the reduction in greenhouse gas emissions with electromobility will take technological innovations. Harnessing synergies with adjacent technology fields and efficiently integrating climate-neutral energy sources are key to this.

The Federal Government has also been providing high-level support for the development of hydrogen and fuel cell technology since 2007. Hydrogen and fuel cell-based mobility is essential for achieving climate change targets in the transport sector. Hydrogen and fuel cell technology is a practical complement to battery-electric vehicles, especially for large and heavy vehicles as well as in shipping and aviation.

There is a wide range of application-driven research in this area. In maritime shipping, for example, it spans the spectrum from propulsion technology to supply infrastructure, market ramp-up and economic matters. As part of the interdepartmental NIP II programme (National Hydrogen and Fuel Cell Technology Innovation Programme), the Ministry is promoting the development, market preparation and procurement of hydrogen and fuel cell technology for use in transportation, research into renewables-based hydrogen production and the integration of hydrogen into the fuel portfolio. The aim is to establish hydrogen and fuel cells as competitive technologies in the transport sector. The research aims to further reduce costs and continue application-oriented market activation.

In addition to alternative drivetrains, it is also important to gradually transition the sources of energy used in the transport sector toward climate-friendly renewable fuels by 2045 in order to meet climate change targets. Both electricity-based fuels (e-fuels) from renewable energies and advanced biofuels from waste and residues still require development work with regard to the overall chain, but also for individual process steps, so that they can make a relevant contribution to greenhouse gas reduction in the medium term. Specifically, innovative manufacturing processes must be developed to achieve the necessary technological maturity for market entry and ramp-up of these fuels. For processes with a higher level of technological maturity, there is still potential to leverage optimization and efficiency in order to reduce costs.

Another aspect of research in this research priority is sustainable construction and structures. Legal bases and the implementation of the German sustainability strategy result in increased requirements for the sustainability of construction measures in the context of modification, extension and new construction of transport infrastructure. For example, this includes CO<sub>2</sub>-absorbing building materials, the use of suitable plant species for slope protection, the evaluation of the recycling potential and the retention function of certain building materials. However, the Ministry's research also looks at the offshore sector, e.g. by investigating possible impacts of offshore structures on the environment in order to promote decision-making processes and provide insights into sustainable marine use.

A sustainable transport policy must meet both growing mobility needs and increasingly stringent environmental requirements.

Accordingly, from a transport policy perspective, there is still a considerable need for research into environmentally relevant topics such as noise mitigation, air quality and nature conservation on land and water.



Innovations in environmental protection and noise mitigation are therefore an important area for research, particularly in the planning, construction, approval and maintenance of infrastructure. Fundamental research areas include the environmental impact (construction-, plant- and operation-related), the effectiveness of measures and evolution of innovative measures as well as the development of methods and support in the preparation of technical regulations. This also means tapping further potential for reducing pollution and promoting environmental protection and nature conservation. The research areas are very diverse, encompassing all modes of transport, including maritime shipping and marine protection.

This includes specific issues, such as the establishment and implementation of an insect conservation programme at railway stations and appropriate measures against invasive species. Departmental research also makes substantial contributions to the targets set by the Federal Government in ecologically oriented research on and development of bodies of water, as well as

the development of an environmentally friendly, sustainable and resilient transport infrastructure. On a different topic, but also part of the portfolio is the standardized estimation of emissions and immissions from air traffic.

Climate-neutral mobility and enhanced climate action also require activities in other areas. The priorities of this research include, for example, the development of methods for improved accounting of road- and shipping-induced greenhouse gas emissions from transport and life cycle assessment as well as the evaluation of the transition to climate-neutral fuels.



In addition, the avoidance of greenhouse gases in the construction, maintenance and operation of transport infrastructure is also extremely important. For example, the expansion of renewable energy generation (especially photovoltaics) on transport modes and transport soft estate is to be investigated in greater depth in order to identify both its potential and limits. Similarly, the research will also consider the promotion of biomass on transport soft estate.



**This research priority serves the following action areas:**

**AA 1: Alternative drivetrain technologies and fuels**

**AA 2: Innovative vehicle technologies**

**AA 3: Sustainable construction methods and building materials as well as evaluation methods**

**AA 4: Innovations for environmental and noise protection**

**AA 5: Climate-neutral mobility and enhancing climate action**

### **3.3. *Research priority III Mobile, digitally networked society and economy***

Mobility must be sustainable, efficient, low-emission, barrier-free, digital, intelligent, innovative, safe, suitable for everyday use by all, affordable and resilient. In this research priority, the Federal Ministry for Digital and Transport examines the needs and the resulting demand behaviour of economy and society. The diversity of requirements profiles and the developments in



technologies require a systemic approach. At the same time, it is important to take into account the respective spatial circumstances in urban areas, in the urban hinterland and in rural areas of the different regions and how they interact. The functional space is particularly important.

Therefore, this research priority is dedicated to the diverse research questions in the context of ensuring a demand-driven, mobile, digitally connected society and economy. The transformation of the mobility sector requires, on the one hand, integrated sustainable concepts such as SUMP (Sustainable Urban Mobility Plans) for freight and passenger transport to support transport policy goals, and, on the other hand, studies on the development of mobility behaviour and on acceptance research to provide a sound scientific basis for policy measures. Demand for sustainable mobility and appropriate climate-conscious mobility behaviour call for

a new mobility culture that requires people to change the way they previously made decisions. If mobility behaviour is to change, attractive and appropriate services and alternatives must be available and sufficiently known. It must be taken into account that mobility behaviour is usually routine, deeply embedded in cultural and social contexts, and often dependent on economic and personal factors, so that behavioural changes and the use of modified services usually depend on many factors.

On the supply side, consistent networking of different modes of transport and using Intelligent Transport Systems (ITS) can make a major contribution to a transport system that is environmentally friendly and socially acceptable. This is only possible with innovative and integrated mobility concepts as well as their acceptance and implementation.







With its research funding in this action area, the Ministry aims to contribute to the development of nationwide mobility solutions and their networking in joint mobility strategies and to create the contractual, organizational and financial conditions for this. These solutions are intended to help improve mobility in rural areas while also supporting strategies for multimodal linking of urban and rural areas. This also involves the design and acceptance of mobility chains and their use.

Research initiatives in this area are primarily aimed at increasing the attractiveness – which includes not only objective safety but also the subjective perception of safety – of environmentally friendly modes of transport and primarily of public transport, e.g. in serving the first or last mile, or facilitating the digital networking of the various modes of transport, for example, through mobility platforms. Improved access to rail transport is also being examined in this context. In the area of transport infrastructure, the technical, operational and socio-economic prerequisites for successful reactivation of existing, disused railroad lines, including the regional effects, are being researched, among other things, in order to derive recommendations for action.

An essential prerequisite for the development of targeted, efficient and effective transport policy measures is that transport, economic and social interdependencies between infrastructure supply and mobility behaviour be analysed in a targeted, in-depth and highly topical manner. This requires empirical underpinning with current traffic and mobility data on the

causes of mobility, attitudes, constraints and degrees of freedom. For example, there is a need for more research on the acceptance and use of rail transport in order to derive framework conditions for increasing passenger transport services. In addition, departmental research addresses the question of how current circumstances change passenger behaviour in order to draw conclusions about political influence on mobility behaviour (for example: COVID-19 pandemic, temporary introduction of the nine euro ticket in the summer of 2022). The issues of affordability and accessibility play a key role in influencing mobility behaviour and reveal future research needs.



**Therefore, this research priority addresses the following action areas:**

- AA 1: Preparation of integrated freight transport concepts, promotion of logistics and multimodal freight transport**
- AA 2: Creation of integrated multimodal mobility approaches for passenger transport**
- AA 3: Improvement of mobility in the countryside (convergence of living standards) and accessibility of urban and rural areas**
- AA 4: Studying mobility behaviour, acceptance research, affordability and accessibility (social participation)**

### 3.4. *Research priority IV High-performance digital networks and data infrastructure*

The economic value of data and its processing in the context of digital applications is immense. This also involves systematically and continuously tapping the potential of new digital data in order to add informative value or make things easier for respondents. Overall, accessible, high-quality and usable data is an important foundation for research, innovation, planning, investment and other activities of the government department. At the same time, the data supports monitoring measures and making decisions for the benefit of society.

Improving data access, availability, networking, quality and interoperability, right up to creation of a data ecosystem – both in sector-specific contexts and across sectors – is therefore a key action and research area for the coming years. This also includes the standardization of data, its transfer into applications and business

models, and the exchange of data and services on platforms.

High-performance digital networks and a secure, trustworthy data infrastructure in line with demand are the basis for digital applications and innovative business models. Nearly all technological innovations and advances require secure and seamless data communication. More and more objects, sensors and machines are being interconnected. Mobile networks therefore play a key part in the gigabit networks of the future. However, in addition to innovations for the networks (e.g. 6G), it is also important to develop and test future application scenarios that make good use of these innovations and thus generate further demand. The mobility, logistics, industry and energy sectors are particularly suitable, as is the agricultural sector. The aim is to use resources efficiently and reduce harmful emissions. For example, the development and evaluation of technological innovations help automate maritime shipping and evolve autonomous navigation in maritime transport.



Digitalization and the use of new emerging technologies are continuously increasing the need for energy-efficient and high-capacity computing infrastructure for data processing. It is necessary to examine the required computing infrastructure design and how government can support national capacity enhancement so that companies can make the most of their growth opportunities and Germany's technological sovereignty in the area of data infrastructures is ensured.



**This research priority addresses the following action areas:**

**AA 1: Improving data access, availability, networking and business model development (data economy)**

**AA 2: High-capacity computing infrastructure (also for mobile edge, cloud, quantum computing, etc.) and platform economy**

**AA 3: Technological innovations and advances in application-oriented mobile communications (6G)**

### 3.5. *Research priority V* *Evolving digital applications*

Key digitalization technologies such as artificial intelligence (AI), distributed ledger technology (DLT), cloud and quantum technologies are crucial growth drivers for the coming years as cross-sectoral enablers for innovations and new business models.

In order to keep pace with global competition, it is necessary to build an even broader base in the application-oriented development and testing of emerging digital technologies, to activate and network as many companies as possible across sectors, and to accelerate the development of quality standards. In order to drive forward the green and digital transformation (known as the twin transition), extensive research is also required on what is termed green IT. This includes aspects of energy and resource efficiency, reducing greenhouse gas emissions, and making software and digital services sustainable.

Digitalization also supports a complete overhaul of mobility behaviour and changes the way mobility is implemented. The digitalization of the mobility sector holds great potential for making transportation safer, more environmentally friendly, more sustainable and more efficient through automation and digital connectivity. In addition, the use of autonomous (driverless) and networked means of transport will play a key role in future mobility. The corresponding need for research on the processing of large, complex, fast-moving data volumes (big data) is one of the department's future research areas.

Automation and digital networking of vehicles and infrastructure on roads, railways and waterways are key issues for more efficient freight and passenger transport in urban and rural areas.



They also contribute to environmental and climate protection as well as to increased competitiveness. In the rail sector, for example,

research is being conducted into the use of what are known as transport management systems (CTMS) to optimize capacity utilization.

Digitalization also helps to support and enable, for example, administrative processes in freight transport as well as communication and electronic data exchange between the logistics industry and the authorities through new digital applications – there is a continuous need for research in this area. Digitalization is also seen as a major accelerator in planning and approval processes. Digital models and virtual simulations are the tools of choice in these areas to support planning and approval. In addition, model-based simulations, forecasts and accounting can be used to obtain more precise information on the life cycle assessment and the environmental impact of construction projects or systems in advance or during operation.



Last but not least, the Federal Ministry for Digital and Transport conducts many meteorological, hydrographical, hydrological and environmental data surveys in its departmental research facilities and develops forecast models from them.

Forecasts are essential for smooth and safe traffic operations. For example, research to improve environmental data can help process planning and permission granting procedures more effectively. This data is also an important foundation for the development of infrastructure that is resilient to the impacts of climate change.



This research priority focuses on these challenges in the following action areas:

- AA 1: Digitalization/automation/connectivity in mobility
- AA 2: New emerging digital technologies
- AA 3: Enhancement of meteorological, hydrographical, hydrological and environmental data collection and forecasting

AA 4: Digitalization, digital models and virtual simulations for planning and approvals in civil engineering as well as in transport, operational and vehicle technologies

AA 5: Enhancement of digital connectivity in logistics/transport management systems/port logistics

AA 6: Digitalization of traffic management/B2A communication systems

### 3.6. *Research priority VI Resilient traffic and data systems, as well as road safety*

It is becoming increasingly important to study the relevant risks and evolve protection and adaptation measures. This includes modal and cross-modal vulnerability, criticality, extreme value and risk analyses.



These are used to identify consequences for transport infrastructures and to adapt the transport system to the consequences of climate change and extreme weather with regard to vehicles, operations and infrastructure as well as users. In this way, appropriate consolidation measures can be implemented to increase the resilience of critical transport nodes and transport infrastructure and ensure efficient mobility. Extensive research spanning all modes of transport is needed in this area.

Due to the long service life of infrastructure and the long lead times for planning investment measures, the future requirements for adaptation to climate change and weather extremes must already be taken into account as comprehensively and meaningfully as possible in the planning, maintenance and additional measures required to increase the reliability of the transport infrastructure. Research serves



to develop and implement climate adaptation measures based on in-depth knowledge of environmental conditions and forecasting methods. However, it is also important to evolve monitoring systems for climatic influences in this context in order to be able to develop even more targeted resilience measures.

The increasing connectivity and digitalization of systems create new opportunities for more aggressive and complex cyber-physical attacks on transportation systems, so cyber security must be fortified. This research action area focuses on the development of defence software, the research and development of interference-free devices and systems, as well as system networks for navigation and communication. This applies equally to the maritime and terrestrial sectors.

Security of the transport sector and protection of critical infrastructure is another action area. Research is needed in this area to study the relevant risks and the existing protection approach in the transport sector in order to develop and implement suitable measures for the Ministry's portfolio to improve the existing protection strategies in line with the threat and to boost resilience. In this context, the Ministry's research focuses in particular on evolving forecast and warning systems and improving forecast quality and products, e.g. through increasing automation. Establishment of an early warning system for natural hazards that covers as many modes of transport as possible is also planned.





This research priority also addresses traffic safety, because sustainable mobility must be safe. Safe mobility is characterized by accident prevention and mitigation of the consequences of accidents. Targeted research serves to develop new measures to improve road safety. The research needs relate to the three road safety action areas: people, vehicle technology and evolution of infrastructure to maintain and improve the level of safety. Research will also be conducted in the maritime sector to improve shipping safety, for example through automated identification of extreme waves along shipping routes in the North Sea.



**This research priority focuses on these challenges described in the following action areas:**

- AA 1: Adaptation of transport systems to the consequences of climate change**
- AA 2: Reliability and resilience of the transport infrastructure**
- AA 3: Strengthening cybersecurity in the transport sector**
- AA 4: Security in the transport sector and protecting critical infrastructure (CRITIS)**
- AA 5: Improving transport safety**
- AA 6: Developing/evolving warning systems**



## 4. Organization of departmental research

### 4.1. Departmental research in the Federal Ministry for Digital and Transport and its executive agencies

The purpose of departmental research is to obtain scientific findings and provide decision support tools for the direct fulfilment of sectoral functions and policy-making. In most cases, it has a direct practical relevance and can

therefore essentially be classified as applied research. Departmental research at the Federal Ministry for Digital and Transport is carried out by six institutions with departmental research responsibilities and by awarding R&D projects. Other higher executive agencies of the Ministry are also involved in performing the research. In addition, the Ministry also funds third party research projects to a large extent by way of grant-funded research (funding legislation) if it is in the interest of the Federal Government.

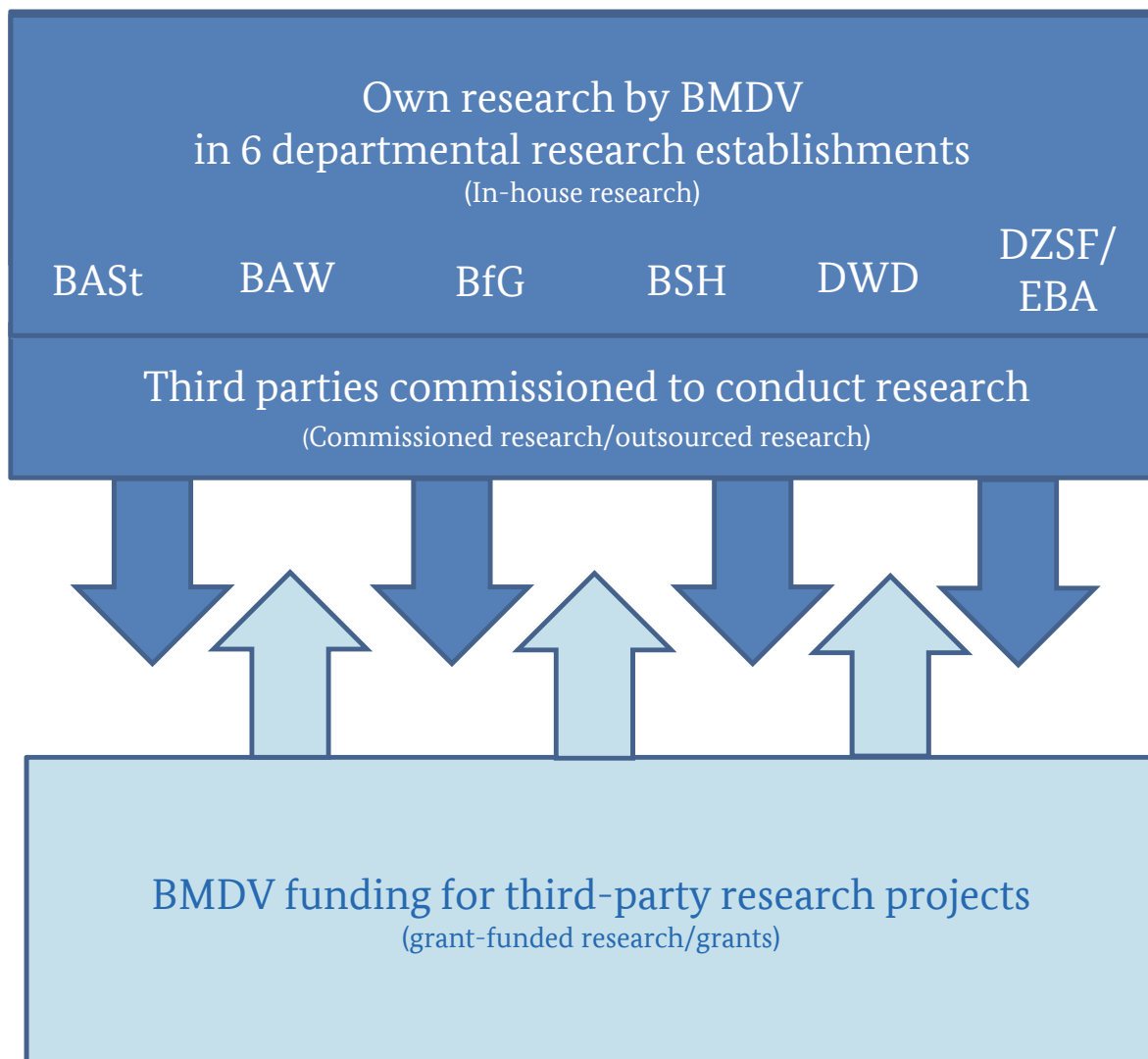


Figure 3: Federal Ministry for Digital and Transport

Furthermore, departmental research also provides impetus for third parties (e.g. commercial companies, universities, colleges and non-university research establishments, federal and federal state institutions, local government bodies, consulting engineers and consortia/alliances). Through their research and the resulting measures, these in turn help achieve the goals of the respective research priorities of the departmental research framework.

Departmental research is innovative and constantly evolving. For example, there is a growing interest in microdata from official statistics and other public sector bodies. Since the turn of the millennium, a research data infrastructure has been established in the form of research data centres to allow data that is originally personal or requires protection to be analysed. Suitable anonymization procedures and technical/organizational measures ensure compliance with data protection requirements.

In 2019, for example, the Federal Motor Transport Authority (KBA) became the first executive agency of the Federal Ministry of Transport and Digital Infrastructure (now the Federal Ministry for Digital and Transport) to set up a research data centre, thus gradually opening up access to information in the KBA's data areas for independent scientific research in compliance with data protection regulations. This information is highly specific in terms of subject matter and location. With its data, the KBA represents one of the most important data sources both for transport policy and infrastructure planning as well as for research on the transformation process in the motor vehicle transport sector. Since spring 2022, anonymized microdata sets on the structure and development of the vehicle population of more than 66 million motor vehicles and motor vehicle trailers have been available for scientific analyses.

Since the R&D projects are in the immediate technical context of the department's work, the research projects and the evaluation of the scientific results and their operational usability are determined within the government department. The thematic range of R&D projects is very broad in view of the Ministry's diverse responsibilities. At the same time, prioritization is necessary simply because budgetary resources are limited. Research coordination serves to avoid redundant research, develop synergies, and generate multiple benefits. This Strategic Framework for Departmental Research, with its broadly coordinated definition of research priorities and action areas that apply for the entire government department, i.e. the Ministry and executive departmental research agencies, also serves this purpose.

#### 4.2. *The Federal Ministry for Digital and Transport's departmental research establishments*

With its departmental research, the Ministry covers a wide range of specific scientific responsibilities. To this end, the departmental research establishments also perform departmental research tasks with their own staff and material resources in addition to their actual technical functions. They also award research contracts and, in some cases, issue research funding on behalf of the Federal Ministry for Digital and Transport. All planned research projects form part of the annual departmental research plan. In addition, most institutions provide important research-based services, some of which are legally defined (e.g., section 4(2) of the Deutscher Wetterdienst Act: "To perform its duties, the Deutscher Wetterdienst shall undertake scientific research in the fields of meteorology and related sciences and shall participate in the development of corresponding standards.") Fundamental questions concerning departmental research are coordinated with the Research Commissioner of the Federal Ministry for Digital and Transport in joint meetings of the departmental research establishments.

**Who are we?**

**Federal Maritime and Hydrographic Agency (BSH)**

**Where are we?** Hamburg/Rostock

**Our responsibilities:**

The BSH fulfils responsibilities in the fields of maritime navigation, hydrography, oceanography, marine uses and marine environmental protection. Maritime tasks include surveying, wreck search, marine environmental monitoring, testing of communications and navigation equipment, as well as research. The BSH uses five of its own special purpose ships for this work. The BSH operates forecasting and warning services, prepares the spatial plans for the German Exclusive Economic Zone of the North Sea and Baltic Sea, approves offshore wind farms and monitors their operation. The BSH also provides financial support for German merchant shipping and German seafarers as part of the German flag state administration. Data and digital information products play a key role in all of these responsibilities.

**Our current research topics:**

With its research, the BSH supports maritime shipping and the maritime economy, enhances safety and environmental protection in shipping, promotes sustainable marine use and ensures the continuity of quality-assured monitoring of marine conditions. Current research areas include marine climate issues, marine environmental protection, forecasting and warning systems, issues related to offshore wind energy, the development of forward-looking technologies for safe and sustainable shipping operations, including cyber security, for communication, navigation and oceanographic surveying, as well as digitalization and automation. The BSH works closely with partners from research, industry and technical agencies.

**More information:**

[https://www.bsh.de/EN/TOPICS/Research\\_and\\_development/research\\_and\\_development\\_node.htm](https://www.bsh.de/EN/TOPICS/Research_and_development/research_and_development_node.htm)



Automatic monitoring station in the North Sea (© BSH)

**Who are we?****Federal Institute of Hydrology (BfG)**

**Where are we?** Koblenz

**Our responsibilities:**

The Federal Institute of Hydrology is the Federal Government's scientific institute for research, assessment and advice in the fields of hydrology, water use, water quality, ecology and water protection. As an interdisciplinary departmental research establishment, the BfG supports the government departments and executive agencies in the implementation of Federal Government's transport and environmental policy goals. The goal of BfG research is to promote and support the sustainable development of federal waterways.

**Our current research topics:**

The BfG lays the scientific foundations for safe and efficient navigation with special regard to the ecological functionality of federal waterways. It also monitors and evaluates biodiversity and studies controlling mechanisms and, on the research side, provides support for the development of targeted measures to keep habitats in a near-natural state and restore them to a near-natural state in and along federal waterways. The institute also develops adaptation measures in light of the impact of global change and climate change on inland and coastal waters (e.g. water level rise and extreme events).

**More information (German only):**

[https://www.bafg.de/DE/04\\_FuE/fue\\_node.html](https://www.bafg.de/DE/04_FuE/fue_node.html)



Ahr estuary at Sinzig, Rhine km 629 © E. Nilson/BfG

**Who are we?****Federal Highway Research Institute (BAST)**

**Where are we?** Bergisch Gladbach

**Our responsibilities:**

As a technical-scientific institution of the Federal Ministry for Digital and Transport, the Federal Highway Research Institute works on more than 550 research projects annually and links topics such as road, bridge and tunnel construction, road furniture, traffic management, safety of road users and vehicles, electric mobility and environmental protection. In addition, the Institute provides support for the introduction of national and international legislative and harmonization procedures and plays a major role in the preparation of technical regulations. It plays an essential role as a mediator between science, policy and practice, federal and state governments, and at the European and international levels.

**Our current research priorities:**

Road infrastructure will continue to play a prominent role in freight transport and mobility in the future. The demands of sustainability, climate protection and climate change adaptation must be met, and new functions must be established in road and transport systems taking digitalization into account in particular. The Federal Highway Research Institute plays a key role in shaping innovations and research for sustainable, robust roads, the development of the digital transformation, immission control, decarbonization and resource conservation, the use of renewable energy generation, infrastructure management, autonomous and connected driving, as well as cycling and walking. Its excellent research infrastructure, such as the duraBAST real-world laboratory at the Cologne/East interchange, enables the Institute to translate forward-looking impetus into new technologies.

**More information:**

<https://www.bast.de/EN/Home/>



Demonstration and test site (duraBAST) © Tilke/BAST

**Who are we?**

**German Federal Waterways Engineering and Research Institute (BAW)**

**Where are we?** Karlsruhe and Hamburg

**Our responsibilities:**

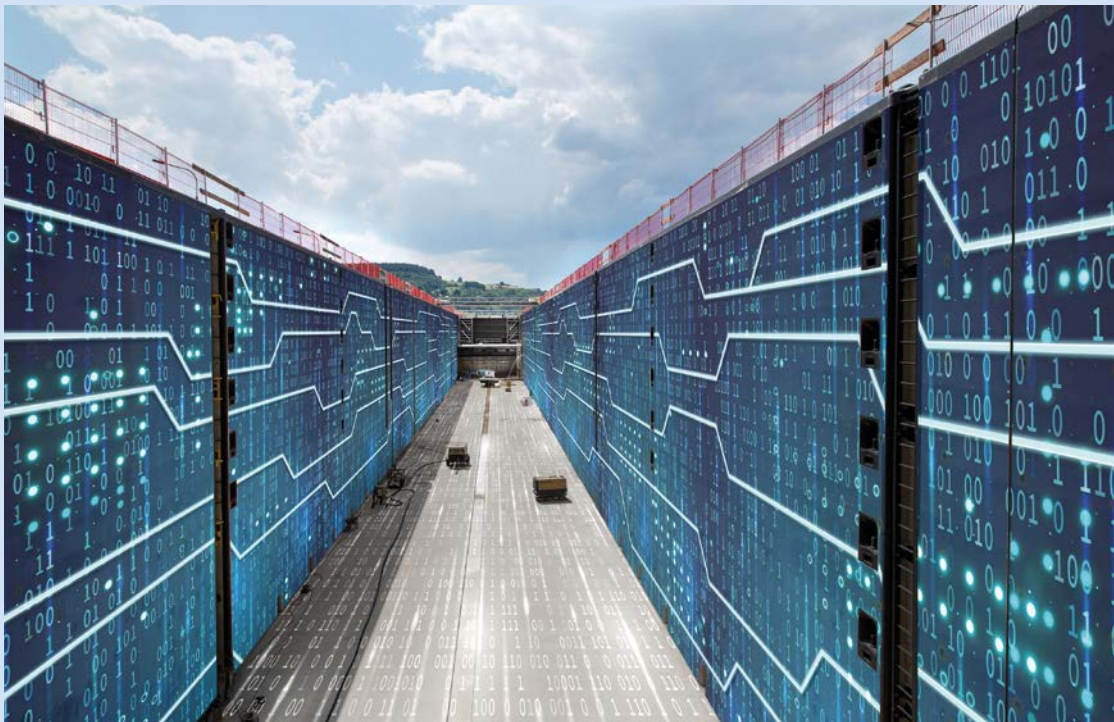
As a technical and scientific higher-level federal authority, the Federal Waterways Engineering and Research Institute conducts research and development work on civil engineering, geotechnics and hydraulic engineering in inland and coastal areas. The Institute's responsibilities include advisory activities and assessment for issues related to federal waterways, the development of methods and standards, as well as the provision of data. Interdisciplinary research and development form an important foundation for the fulfilment of these tasks.

**Our current research topics:**

The Federal Waterways Engineering and Research Institute's research focuses on innovations in the operation, maintenance and upgrading of waterways to provide an efficient infrastructure for this mode of transport. The development and evaluation of sustainable construction methods and materials helps make the waterways environmentally friendly and climate-sensitive. Other research priorities include adaptation of waterways to the impact of climate change and optimizing the transport safety and resilience of waterways. Its ongoing development of digital applications focuses on automation in mobility and digitalization for planning and operation in the construction industry.

**More information:**

[https://www.baw.de/en/die\\_baw/wie\\_wir\\_arbeiten/forschung\\_entwicklung/forschung\\_entwicklung.html](https://www.baw.de/en/die_baw/wie_wir_arbeiten/forschung_entwicklung/forschung_entwicklung.html)



Digitalization of river and canal structures – visualization using Trier lock as an example (Source: BAW)

**Who are we?**

**National Meteorological Service of Germany (DWD)**

**Where are we?** Headquarters in Offenbach and other locations

**Our responsibilities:**

As the national meteorological and climate service of the Federal Republic of Germany, we provide meteorological services for purposes of general interest, including civil protection and disaster preparedness, for the safeguarding of air and sea navigation and for the provision of basic public services to the population.

The Meteorological Service's research activities serve to improve the informative value,

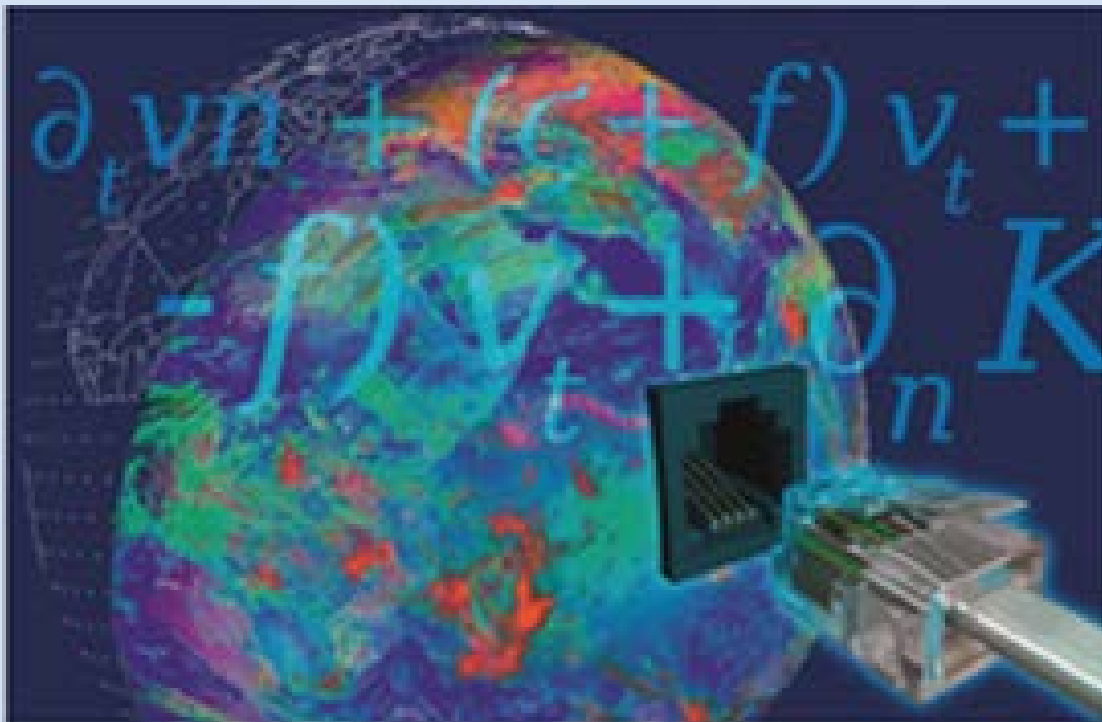
relevance, usability and acceptance of meteorological and climatological information and services.

**Our current research topics:**

Improving the observation, analysis, and modelling of weather, climate and the chemical composition of the atmosphere on various space and time scales; studying weather- and climate-relevant processes and interdisciplinary issues; development of specialized procedures and causal models to support weather forecasting and warning services and user-demand-driven climate change adaptation.

**More information:**

[https://www.dwd.de/EN/research/research\\_node.html](https://www.dwd.de/EN/research/research_node.html)



Earth-Climate Data Network (© DWD)



**Who are we?****German Centre for Rail Transport Research (DZSF) at the Federal Railway Authority**

**Where are we?** Dresden/Bonn

**Our responsibilities:**

The Research Centre is the Federal Government's establishment for researching the rail mode and the overall rail system under the aspects of economic efficiency, environment and sustainable mobility as well as safety and security. In evolving the complex rail system, the interfaces and relationships between infrastructure, rolling stock, operations, and the interaction between people and technology are taken into account. The Centre's responsibilities include the planning, coordination and implementation of multi-year research projects as commissioned and in-house research as well as establishing its own research infrastructure. In addition, it supports not only the sovereign tasks of the Federal Railway Authority, but also the Ministry's work with scientific expertise. The research findings are processed appropriately for practical use in

the sector and support the updating of national and European regulations.

**Our current research topics:**

Against the backdrop of climate change, the Centre is researching, among other things, the technical and socio-economic prerequisites for reactivating rail lines, the resilience of rail transport to natural hazards, increasing the capacities of existing infrastructure through technical and operational innovations, and the further development of rail transport safety, especially in view of increasing digitalization (cyber security). The advantage of rail as the most environmentally friendly mode of transport is also to be consolidated and enhanced. In the area of research infrastructure, work for the coming years will focus on establishing the Open Digital Test Bed for the rail mode.

**More information:**

[https://www.dzsf.bund.de/DZSF/EN/home\\_node.html](https://www.dzsf.bund.de/DZSF/EN/home_node.html)



Test drive with refrigerated container in the Open Digital Test Bed, © DZSF/Angermann

### 4.3. Federal Ministry for Digital and Transport Network of Experts

The Ministry's Network of Experts is a cross-modal research format in its departmental research. In 2016, seven higher executive agencies in the BMDV's portfolio joined forces to form a research network with 'Knowledge – Ability – Action' as its leitmotif. The authorities participating in the Ministry's Network of Experts include the six departmental research establishments described in section 4.2 and the Federal Office for Goods Transport (BAG), which will be renamed the Federal Logistics and Mobility Office (BALM) in 2023.

The aim is to establish a broader, shared foundation on which to build the expertise of the authorities involved, and to network them more closely. By doing so, practical research findings are to be generated for real-world use. The Network of Experts addresses topical pressing transport issues from an interdisciplinary and multimodal perspective.

Its cross-agency and cross-modal research is broken down into six subject areas at an operational level:

- Subject area 1: Adapting transport and infrastructure to climate change and extreme weather events
- Subject area 2: Designing environmentally friendly transport and infrastructure
- Subject area 3: Making the transport infrastructure more reliable
- Subject area 4: Unlocking and leveraging digital potential
- Subject area 5: Stepping up efforts to harness the potential in renewable energy sources for use in transport and infrastructure
- Subject area 6: Transport industry-related analyses

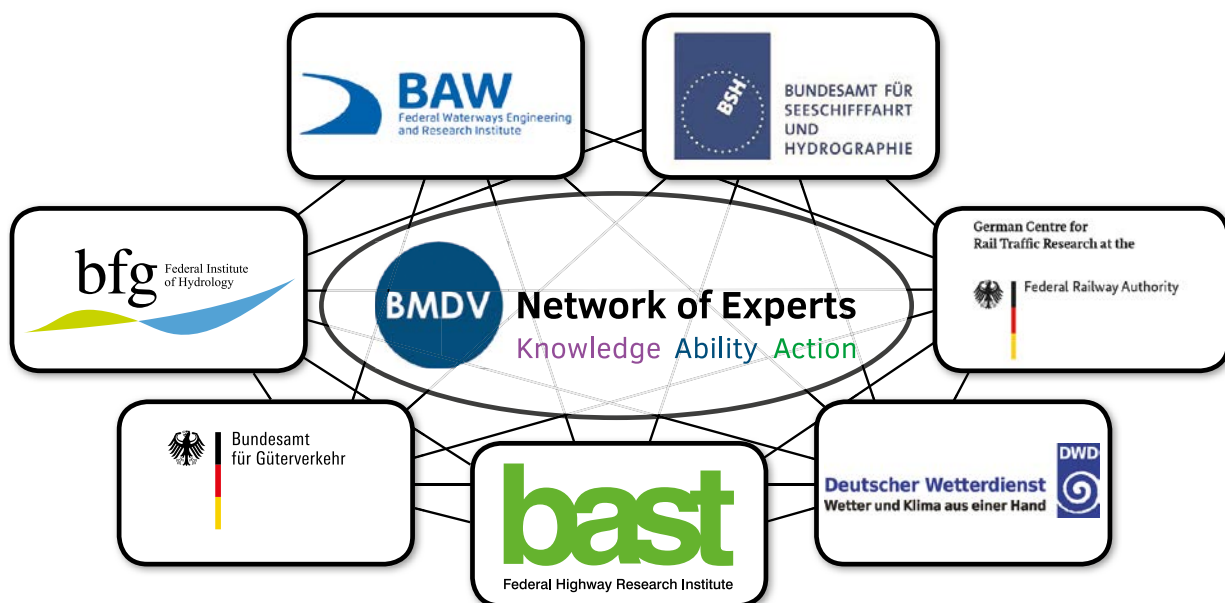


Figure 4: BMDV

#### 4.4. *Annual departmental research plan*

All research-relevant directorates-general of the Ministry as well as the departmental research establishments are involved in the departmental research plan to be drawn up annually by the Research Commissioner of the Federal Ministry for Digital and Transport. The basis for applications is the strategic departmental research framework with its research priorities and action areas.

The departmental research plan compiles the respective research projects planned,

- which are to be commissioned on behalf of the Ministry or its departmental research establishments (contract research/commissions); and
- the designated research funding/funding guidelines that can be used to support third parties through grants,

including a breakdown of the budgetary resources per financial year.

The departmental research plan is approved at the State Secretary level. It serves as a basis for internal planning and political consultation. Implementation of individual measures is coordinated via the federal coordination database. Funding guidelines/calls for applications for funding are announced in good time in the Federal Gazette and are updated in the grants database. Research contracts are generally put out to tender via the Federal Government's eVergabe platform.

#### 4.5. *Board of Academic Advisers to the Federal Ministry for Digital and Transport and the academic advisory boards of the departmental research establishments*

The Board of Academic Advisers to the Federal Minister for Digital and Transport was established in 1949 as a panel of independent experts to advise the Federal Minister on all transport-related matters and contribute to leveraging scientific findings in both transport policy and technical work. It comprises up to 18 leading academics – all university professors with their own chair – from a range of disciplines. They work together to draw up expert opinions on specific technical policy issues as well as recommendations on transport policy on their own initiative, which the academic experts draw up in complete independence on an interdisciplinary basis.

The work of the Board of Academic Advisers focuses on the mobility sector, and it also addresses digitalization-related issues in this context. The independent expertise is highly valued, and the science-based comments provide valuable input for the Ministry's policy and technical issues. The academics' assessment of modern transport policy is also informed by topical cross-cutting issues.

The Ministry's departmental research establishments are usually supported by the expertise of an independent (academic) advisory board. These advisory boards also make recommendations, particularly on fundamental, strategic matters, and advise the authorities from an independent position. The appointment and composition of advisory boards are handled differently in each authority: As a rule, the advisory boards are either composed exclusively

of professors from relevant disciplines (academic advisory boards) or they are a body of leading scientists, experts and users.

#### 4.6. *Departmental research at the Ministry in the national and international context*

The Ministry's departmental research is involved in a wide range of national, European and international activities and committees. This results in a diverse, mutually beneficial network that is in part complementary, in part synergetic and in part hybrid. What makes it so special is that research, development and innovation all dovetail with one another and with policy and application.



In this respect, departmental research plays a key role at the Ministry by bridging research and innovation (including fundamental research) on the one hand and application (including policy, legislation, sets of rules and further regulations, e.g. in the harmonization area, investment, approval, system integration) on

the other. It takes a two-pronged approach, combining holistic, interdisciplinary exploration of important topics with specific detailed exploration of specific issues.

This special status of application-oriented research results in a growing need for funding and personnel, since the technological and societal upheavals taking place globally at an ever-increasing pace and the resulting changes in the markets and in competition make it necessary to accelerate the implementation of important innovations in Germany, too. Otherwise, Germany will face considerable disadvantages not only in terms of global competition and loss of capitalization opportunities for key innovations, but also in terms of international influence.

Interdisciplinarity and sector coupling are increasingly important, especially in the field of digitalization and mobility. The Ministry is therefore coordinating closely with all government departments and actively shaping the Federal Government's strategies for research and innovation with its contributions, for example, to the department-wide presentation of the Federal Government's measures and goals. The Federal Ministry for Digital and Transport's specialist expertise, especially with regard to complex application-related issues and requirements or in relation to the regulatory environment or infrastructures, is also an important inspiration for strategies at other government departments in relevant cutting-edge fields.

How digitalization and future mobility are implemented plays a key role in influencing the transformation of society as a whole and achieving the overarching goal of climate neutrality by 2045. In line with the growing need for innovation and the specific challenges for the rapid implementation of pioneering, future-proof technologies and their integration into the system, the aim is to further enhance departmental research in the coming years.



In doing so, it should also be noted that the creative forces shaping tomorrow's world of transport and digital in Germany will increasingly come from areas outside the transport sector. Therefore, it is essential that research and innovation policy takes an interdepartmental approach to sustainably transform the mobility sector and improve digital performance. Key drivers are trend-setting leaps forward in technology and innovation such as AI applications, IT-based complex system developments, electronics, automation and autonomization, robotics and space technologies as well as developments in the energy sector and quantum technologies. This also applies to the resilience of transport and data systems, securing critical infrastructure, and ensuring national sovereignty in the mobility sector, which includes protecting supply chains.

The overarching mobility framework is also increasingly being determined outside the

mobility sector, for example by stakeholders in climate, energy and environmental policy, defence policy, health policy, global missions, competition policy and geostrategic policy. The transitions between the government departments to the individual research areas are fluid, even within the mobility and digital research subjects. As a result, interdepartmental coordination of issues and design of major funding programmes will remain essential in the future. For this purpose, there are well-established instruments that are adapted and evolved in an interdepartmental process due to the dynamic nature of the research subjects. For example, the Ministry is working on the implementation of the interdepartmental digital strategy, which was adopted in mid-2022 and sets out the Federal Government's major digital policy guidelines for the next few years. The Ministry is also involved in the development and content design of a new funding programme on quantum technologies by the Federal Ministry of Education and Research (BMBWF).

The new AI technologies also form the basis for numerous research initiatives in the transport sector. They are intended to help companies better harness the potential of AI technologies derived from research in order to compete successfully in the international arena.

In order to research and prepare the use of automated and connected driving functions in rural and urban areas taking public transport and freight traffic into consideration, several digital test beds have been set up in recent years for the various modes of transport or technologies to be tested, such as drones. The Ministry also promotes the cross-border testing of technologies for automated and connected driving at the Franco-German-Luxembourg Digital Test Bed.



Hydrogen and fuel cell technology is one of the cutting-edge fields of sustainable mobility. The Ministry will therefore step up its activities in these areas, complementing the activities of the European Hydrogen Partnership and international initiatives such as the UN Hydrogen Mission, which was launched at the World Climate Conference a few years ago.

Departmental research also inspires the work of international organizations and European and international committees. The Ministry's departmental research establishments are actively involved in European and international networks and innovation partnerships. The Ministry plays a key role in shaping European and international research and innovation as well as the European research strategy in the mobility sector. There is a particular focus in this area on cluster 5 (climate, energy, mobility) and cluster 4 (digital and competitiveness).

Through the national process accompanying EU missions, the Ministry is involved in implementing missions of particular relevance to it within the framework of interdepartmental bodies. The Federal Government is to support the '100 Climate-Neutral and Smart Cities'

mission, the 'Adaptation to Climate Change' mission and the 'Healthy Oceans, Seas, Coastal and Inland Waters' mission in their ambitious goals for 2030. The Federal Ministry for Digital and Transport contributes to this. At the same time, the Ministry is involved in the 'New European Bauhaus', an initiative of the European Commission. Internationally, the Ministry plays a key role in shaping mobility policy and research through the International Transport Forum (ITF). The Ministry currently chairs the TRC research committee there, which also serves as a think tank for the ITF's annual ministerial summits. The Ministry actively shapes the work programmes in it. In addition, the Ministry and the departmental research establishments are involved in ITF working groups and round tables in which recommendations are developed on key future issues in the mobility sector.

In conclusion, it should be noted that the Federal Government's goal is to work with the federal states and industry to increase investment in research and innovation to 3.5 percent of gross domestic product. The Ministry's departmental research makes an important contribution to this with its diverse research programmes and activities.



As applied research, the results of the R&D projects directly inform the Ministry's work, as they play a key role in shaping policy and fulfilling specialist responsibilities.

The aim of the Ministry's research is also to disseminate research results as widely as possible in order to share the added value of research findings and to use them in a variety of ways, e.g. in politics, administration, business, planning firms and the scientific community, as well as among other stakeholders for the preparation and implementation of decisions and for further scientific research. Knowledge sharing is also crucial for transitioning innovations

into practical application, which is particularly important politically. The research findings are also of interest to citizens.

Given the diversity of research findings, decisions will be made about the appropriate format and platform for publication in order to target and efficiently reach all those who will benefit most from the findings. Depending on the subject, research findings are presented at specialist conferences or information is provided to the general media. In addition, the results are made available to the public and users via various media (internet and document series/specialist publications/support platforms).

To publish research findings, the Ministry provides the approved reports from commissioned research as downloads on its homepage at <https://www.bmvi.de/SharedDocs/DE/Artikel/G/forschungsergebnisse.html> (German only) and also links to publication platforms or the homepages of the departmental research establishments. In addition, the findings from research projects supported through the Ministry's funding programmes by way of grant-funded research, which are compiled and made available on a website/platform, are also published via a link.

In addition, the Ministry has set up a comprehensive research information system as an Internet-based knowledge platform on the website [www.forschungsinformationssystem.de](http://www.forschungsinformationssystem.de) (German only) for its departmental remit. The research information system continuously prepares and presents topical research results from the Federal Ministry for Digital and Transport's departmental research with a focus on problem-solving. The research information system is the scientifically based information platform covering mobility and transport. As a source of advice for policymakers, it is intended to establish the transfer of knowledge from science and research to policy and planning.

## Research Findings

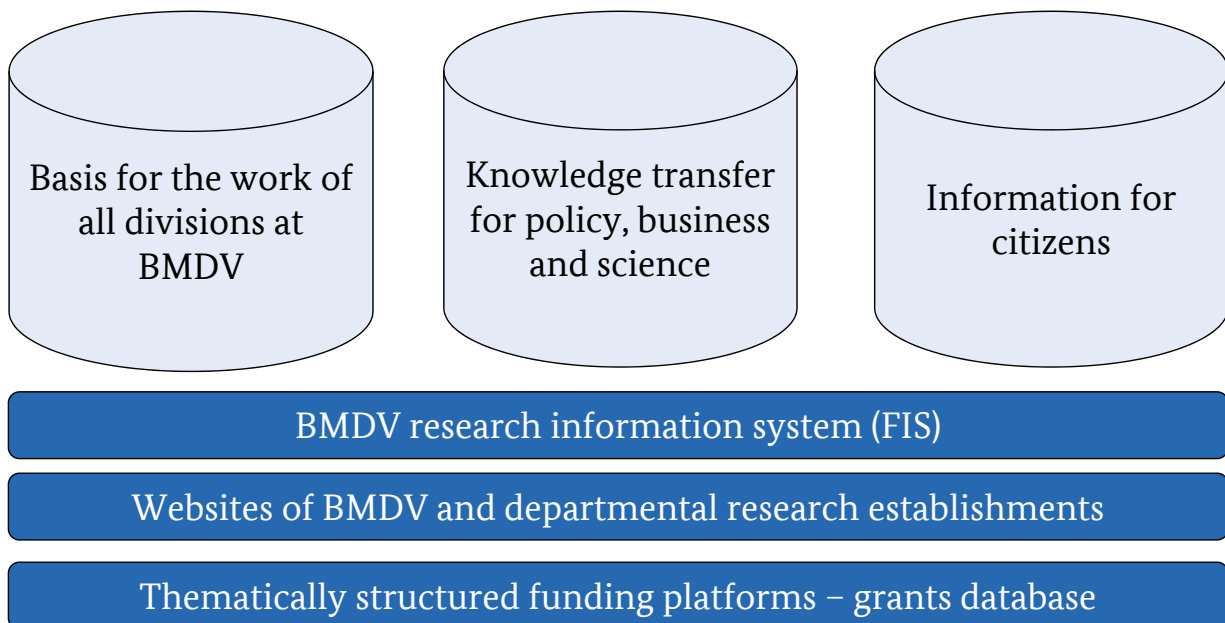


Figure 5: BMDV



## Ministerial research activities

- **Federal Ministry for Digital and Transport homepage 'Departmental Research' (German only):**  
<https://www.bmvi.de/DE/Themen/Ressortforschung/ressortforschung.html>
- **Research sites of the departmental research establishments:**
  - **Federal Maritime and Hydrographic Agency (BSH):**  
[https://www.bsh.de/EN/TOPICS/Research\\_and\\_development/research\\_and\\_development\\_node.html](https://www.bsh.de/EN/TOPICS/Research_and_development/research_and_development_node.html)
  - **Federal Institute of Hydrology (BfG):**  
[https://www.bafg.de/DE/04\\_FuE/fue\\_node.html](https://www.bafg.de/DE/04_FuE/fue_node.html) (German only)
  - **Federal Highway Research Institute (BAST):**  
[https://www.bast.de/EN/BAST/research/research\\_node.html](https://www.bast.de/EN/BAST/research/research_node.html)
  - **Federal Waterways Engineering and Research Institute (BAW):**  
[https://www.baw.de/en/die\\_baw/wie\\_wir\\_arbeiten/forschung\\_entwicklung/forschung\\_entwicklung.html](https://www.baw.de/en/die_baw/wie_wir_arbeiten/forschung_entwicklung/forschung_entwicklung.html)
  - **German Centre for Rail Traffic Research (DZSF) at the Federal Railway Authority:**  
[https://www.dzsf.bund.de/DZSF/EN/home\\_node.html](https://www.dzsf.bund.de/DZSF/EN/home_node.html)
  - **German Meteorological Service (DWD):** [https://www.dwd.de/EN/research/research\\_node.html](https://www.dwd.de/EN/research/research_node.html)
- **Federal Ministry for Digital and Transport Network of Experts:**  
[www.bmdv-expertennetzwerk.de](http://www.bmdv-expertennetzwerk.de)
- **Federal Government Railway Research Programme (German only):**  
[https://www.bmdv.bund.de/SharedDocs/DE/Publikationen/E/bundesforschungsprogramm-schiene.pdf?\\_\\_blob=publicationFile](https://www.bmdv.bund.de/SharedDocs/DE/Publikationen/E/bundesforschungsprogramm-schiene.pdf?__blob=publicationFile)
- **Urban Transportation Research Programme (FoPS, German only):**  
[www.fops.de](http://www.fops.de)
- **Microdata from mobility surveys and traffic forecasts:**  
[https://www.dlr.de/cs/en/desktopdefault.aspx/tabid-669/1177\\_read-2160/](https://www.dlr.de/cs/en/desktopdefault.aspx/tabid-669/1177_read-2160/)
- **Research Data Centre at the Federal Motor Transport Authority (KBA, German only):**  
[https://www.kba.de/DE/Statistik/Forschungsdatenzentrum/forschungsdatenzentrum\\_node.html](https://www.kba.de/DE/Statistik/Forschungsdatenzentrum/forschungsdatenzentrum_node.html)

# Links

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## Ministerial research funding (as of August 2022)

- **Financial assistance programme for innovative seaport technologies (German only):**  
<https://www.innovativehafentechnologien.de/>
- **Research Programme on Automation and Connectivity in Road Transport (German only):**  
<https://www.bmvi.de/DE/Themen/Digitales/Automatisiertes-und-vernetztes-Fahren/AVF-Forschungsprogramm/Ueberblick/avf-ueberblick.html>
- **5G Innovation Programme:**  
<https://bmdv.bund.de/EN/Topics/Digital-Matters/5G-Innovation-Programme/5g.html>
- **National Hydrogen and Fuel Cell Technology Innovation Programme (NIP):**  
<https://www.now-gmbh.de/en/funding/funding-programmes/hydrogen-and-fuel-cell/>
- **Electric mobility research financial assistance programmes:**  
<https://www.now-gmbh.de/en/funding/funding-programmes/electric-mobility/>
- **Renewable fuels financial assistance programme (German only):**  
<https://www.bmvi.de/SharedDocs/DE/Artikel/G/Klimaschutz-im-Verkehr/neues-foerderkonzept-er-neuerbare-kraftstoffe.html>
- **Cycling research financial assistance programme (German only):**  
[https://www.bag.bund.de/DE/Foerderprogramme/Radverkehr/NichInvestiveMassnahmen/nichtinvestivemassnahmen\\_inhalt.html?nn=3295018](https://www.bag.bund.de/DE/Foerderprogramme/Radverkehr/NichInvestiveMassnahmen/nichtinvestivemassnahmen_inhalt.html?nn=3295018)
- **mFUND (Modernity Fund) initiative (German only):**  
<https://www.bmdv.bund.de/DE/Themen/Digitales/mFund/Ueberblick/ueberblick.html>
- **Open RAN research funding (German only):**  
<https://www.bmvi.de/SharedDocs/DE/Artikel/DG/startschuss-foerderung-open-ran.html>
- **Satellite navigation area research (GALILEO, German only):**  
<https://www.bmvi.de/DE/Themen/Digitales/Satellitennavigation/GALILEO-Public-Regulated-Service/galileo-public-regulated-service.html>

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