Logistics 2030 Innovation Programme
Foreword

The logistics sector is booming – across the world, and especially in Germany. Over three million people are employed in the logistics industry, which generated a turnover of around 268 billion euros in 2018. After the automotive industry and commerce, it is the third strongest economic sector in our country. The foundations of our logistics are around 60,000 enterprises, including major corporations that are among the top ten in the world. But it is first and foremost our small and medium-sized enterprises that strengthen Germany’s position as a diverse centre for logistics that is the envy of the whole world. We have taken top spot time and again, for instance in the World Bank’s Logistics Performance Index, which studies 160 countries. All this benefits our citizens, society, economy – in fact the whole of Germany.

However, it is also true that we must not rest on our laurels as far as this success is concerned. The reason that Germany is an economic powerhouse and logistics world champion is that people here have, over several centuries, demonstrated a spirit of innovation, inventiveness and a willingness to change. For this reason, we must now take the steps necessary to ensure that we stay at the top in the future.

Freight transport and logistics currently face major challenges, for instance the common task of making it possible to transport more goods and ensure mobility while reducing the volume of traffic. Although this might appear at first glance to be an intractable conflict, it is actually a huge opportunity – and we already have one instrument in our toolkit that will help us, namely the rapid spread of digital technology. Digitalized processes, artificial intelligence and optimized transport routes will enable us to reduce unnecessary movements in the future. We want to progress intelligent infrastructure, create even more efficient connectivity between the individual modes of transport, shift even more goods from the roads to the railways – and at the same time, of course, reduce emissions from freight transport. It is also imperative that we evolve the occupations in logistics and allied sectors. It will not be possible to participate in the increasingly globalized economy and safeguard jobs or even create new ones unless logistical processes continue to be well managed using the most modern technologies.

For all this, we need guidance that shows us the way ahead for the next decade. For this reason, I tasked my Parliamentary State Secretary and Federal Government Coordinator for Freight Transport and Logistics, Steffen Bilger, with developing the Logistics 2030 Innovation Programme – and it has now been published. I hope you enjoy reading it and that it provides you with a lot of new insights.

Andreas Scheuer, Member of the German Bundestag

Federal Minister of Transport and Digital Infrastructure
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Introduction
Logistics 2030 Innovation Programme

We are living in a period in which there is a paradigm shift towards a digital society. In the future, data will play a crucial role in determining whether national economies are successful. Major developments are currently underway in the spheres of artificial intelligence, robotics and the digital transformation.

This affects many sectors in Germany, and in particular the logistics sector. 2030 sounds a long way away, but in reality it is very close. Thus, the Logistics 2030 Innovation Programme is not about science fiction but about giving the system a concrete shape.

In the future, self-learning systems will optimize logistics processes. Innovation cycles for freight transport and logistics operators are becoming increasingly shorter. The digital transformation of the logistics industry has begun. Freight movements will be interlinked and transparent, and operators will know at any time where their goods are located. These are just examples of the changes that we have to help to shape and for which we have to assume responsibility. Here, I am deliberately using the plural. Undoubtedly, it is first and foremost the enterprises in the logistics sector themselves that are called on to master the rapid developments. However, as the Federal Government Coordinator for Freight Transport and Logistics, it is important to me that this be done with government assistance wherever this is appropriate and necessary.

I am therefore delighted to be able to present to you the Logistics 2030 Innovation Programme. In the Coalition Agreement for the 19th parliamentary term, the coalition parties agreed that such a programme should be developed at the Federal Ministry of Transport and Digital Infrastructure. Many experts from various fields of industry and academia contributed to and were involved in this process. I would like to thank all the parties involved for their dedication, the constructive discussions and the contributions that helped us flesh out the innovation programme in its current shape.

It became apparent in the process that all the experts involved are aware of the importance of developing Germany as a competitive business location and are also working on the implementation of strategies. And I was very taken by the numerous proposals that we received for the Innovation Programme, many of which we have included. In the Innovation Programme, we have also covered activities by the Federal Ministry of Transport and Digital Infrastructure that had already been started and that we consider important in order to future-proof Germany as a logistics hub, but for which modifications are necessary.
With the Innovation Programme, we are focusing on the future of the freight transport and logistics industry and on new developments that we have to include and process. Here, it is imperative that we address everyone and not support only the pioneers and major corporations. The freight transport and logistics industry is dominated to a large extent by small and medium-sized enterprises, which have to be supported and, occasionally, encouraged to embrace the opportunities arising from the aforementioned processes of transformation.

The Innovation Programme contains 10 fields of action, each of which starts with a scenario description. Why a scenario description for 2030 when we all know that the world in 2030 will look different than in any description available today? I consider it important that each field of action be prefaced by a positive vision that is to guide us in developing the right measures and taking bold steps towards the future. It would not be advisable to describe only the present. Let us join forces in courageously shaping the future.

This Innovation Programme is a work in progress that is designed to provide us with guidance for the future of freight transport and logistics. As I have already said, the world of logistics is changing rapidly. What is seen today as a strategy for the future can already have been rejected by tomorrow. Take climate change mitigation, for example. At the time of publication of the Innovation Programme, the Federal Government is working intensively on a package of measures that will ensure that we meet our climate change targets and that will confront all of us with new challenges. I want such developments to inform this Innovation Programme. Thus, shortly after this Programme has been published, I will appoint an Innovation Commission, to be chaired by me, in which I want to join forces with experts from industry and academia to evolve the Innovation Programme at relatively short intervals. And we will be receptive to new topics. Continue to get involved in our work by contributing proposals, examples of good practice and initiatives for projects.

Steffen Bilger, Member of the German Bundestag
Parliamentary State Secretary at the Federal Ministry of Transport and Digital Infrastructure and Federal Government Coordinator for Freight Transport and Logistics
FIELD OF ACTION 1

Digital infrastructure, data processing and platform solutions
FIELD OF ACTION 1

Digital infrastructure, data processing and platform solutions

The 2030 scenario

The digital transformation in the mobility sector is based on high performing digital infrastructure. Gigabit networks with a high level of availability and providing universal coverage are the basis for new possibilities in the fields of automation and connectivity. The coverage obligations of the 2019 spectrum auction have provided a strong boost to the rollout of mobile communications along the federal trunk roads and the railway infrastructure. The processes in logistics, mostly based on algorithms, have resulted in logistics leading the way for other sectors of the economy in the digital revolution. New applications in the Fourth Industrial Revolution and in autonomous driving have been made possible by 5G technology. In the process, data protection and IT/cyber security have been taken into account.

The deployment of digital infrastructure and the rapid spread of digital and data-based applications have enabled the logistics industry to appreciably enhance its efficiency and safety and significantly reduce its emissions.

In addition, the systematic link-up of the means and modes of transport has contributed to environmentally sustainable transport in both urban and rural areas. The evolution of cooperative intelligent transport systems into cooperative, interlinked and automated mobility systems has been set in motion.

Thanks to increasingly accurate forecasts with the help of predictive analytics, it is possible to significantly optimize the load factors of journeys, including with the aid of external parameters.

The Federal Ministry of Transport and Digital Infrastructure and all its executive agencies have translated open data into everyday practice. Many private sector enterprises, too, are committed to the principle of maximum openness and interoperability and have created, for mobility-relevant but non-sensitive data, open digital interfaces and simple access for potential users.

In recent years, the Federal Ministry of Transport and Digital Infrastructure has already kick-started numerous business ideas and made Germany an even more attractive location for innovative businesses in the transport sector.
Location data plus information on the nature of the goods can be forwarded in real time to every member of the logistics chain by tracking and tracing. Automated, seamless and paperless documentation processes cut costs and, as a result of the digital traceability of the transport documents, ensure better tamper-proofness than in the past.

The use of blockchain technology is improving the transparency, documentation and predictability of delivery flows, thereby strengthening trust between the numerous and widely dispersed trading partners and making entirely new trading relations possible.

One of the most important development trends of the processes implemented via blockchain is smart contracts, i.e. digital applications that embed and verify the terms and conditions of a contract and provide technical support to the implementation and execution of a contract, or perform them entirely, and for which there are numerous fields of application, especially in logistics. Smart contracts can also trigger transactions or monitor leasing agreements.
Our objectives

→ Develop Germany into a lead market for 5G.
→ Ensure high-performing mobile communications coverage that makes mobile telephony and data usage possible throughout the country.
→ Enshrine the open data principle at the Federal Ministry of Transport and Digital Infrastructure and all its executive agencies and make available all data from the Ministry and its agencies on which there are no restrictions, for instance because of data protection provisions.
→ Create a future-proof and flexibly scalable data exchange infrastructure via which innovative new ranges of information in the fields of mobility and logistics can be simply supplied with the ranges of data on offer.
→ Make Germany a more attractive location for innovative businesses by establishing a start-up culture.
→ Create systematic digital connectivity of the means of transport across all modes of transport.
→ Use distributed ledger technologies (blockchain et al.) to evolve Germany into a driving force for these basic technologies.
→ Use artificial intelligence (AI) as part of innovative applications in logistics.

Implementation steps

1. The rollout of gigabit networks will be progressed in a targeted manner. Alongside the continuation of the existing financial assistance programme, a new programme is envisaged for the provision of coverage in “grey spots” in regions in which the deployment of gigabit-capable networks is not commercially viable.
2. On the basis of the 5x5G strategy developed by the Federal Ministry of Transport and Digital Infrastructure, which will be used to fund the development of 5G mobile communications networks, six upstream pilot projects are to be implemented by research establishments and universities and test beds are to be created for trialling 5G applications.
3. The mFUND financial assistance programme is to be institutionalized beyond 2020.
4. The mobility, spatial and meteorological data from the Federal Ministry of Transport and Digital Infrastructure and its executive...
agencies should be made available, wherever possible, as open data via a national access point, while complying with data protection legislation. This will meet the requirements set out in Directive 2010/40/EU and the delegated acts adopted on this basis.

5. On the basis of the findings of the Basic Report on Blockchain (DLT), which was commissioned by the Federal Ministry of Transport and Digital Infrastructure, the Ministry will play an active role in shaping the Federal Government’s blockchain strategy and develop projects for trialling and funding the technology.

6. The equipping of vehicles and road transport infrastructure with cooperative intelligent transport systems is to be intensified.

7. Greater support is to be provided to the deployment of artificial intelligence within the scope of research and development programmes commissioned by the Federal Ministry of Transport and Digital Infrastructure.

Addressees

→ Federal Ministry of Transport and Digital Infrastructure for items 2, 4, 5, 6 and 7

→ Federal Ministry of Transport and Digital Infrastructure, local authorities and industry for items 1, 3 and 6
FIELD OF ACTION 2

Digital freight transport management across all modes of transport – digital supply chain
FIELD OF ACTION 2

Digital freight transport management across all modes of transport – digital supply chain

The 2030 scenario

With the onward march of globalization and the volume of freight lifted growing worldwide, there is an increase in production in a highly automated and digitalized form. Connectivity between modes of transport has become more important, numerous government and industry activities have helped to improve flows of freight transport and ensure enhanced transparency of the supply chains.

By means of intelligent control, reserves of efficiency in freight transport are being increasingly leveraged. Connected vehicles collect and process information, and freight transport flows can be optimized. Artificial intelligence supports digital freight transport management. In this way, vehicles and infrastructure can largely manage the transport routes themselves, because the location and pattern can be recognized and features and criteria derived. In addition, with its help, targeted requirements, such as climate-friendly freight transport management, can be implemented. Freight transport planning is synchronodal and makes use of intelligent software that suggests a choice of transport mode(s), including dynamic adjustments, to ensure rapid, efficient, reliable and resource-conserving freight transport operations.

Digital economies are organized in platforms. The freight transport sector has adapted accordingly to this global megatrend. Most of the logistics chain can now be digitally represented. Multimodal platforms enable interactive connectivity of all stakeholders across the different modes of transport and across enterprises as well as the exchange of data, services and experience in conformity with data protection legislation. Goods are sold and comprehensive logistics services organized on digital platforms. Multimodal platforms make it possible to interlink all the players involved in logistics services, customers, producers and logistics service providers. The platforms are able to depict ranges of logistics services across all modes of transport and organize freight transport services optimized on the basis of various criteria. With the increasing degree of digitalization, new business models have arisen on the freight transport market.
The evaluation of comprehensive (real-time) information using artificial intelligence models supports the logistics industry in the proactive reorientation of its processes in order to work more effectively, with lower costs and without disruption.

Statutorily required freight transport information for transport operations within the European Union by all modes of transport is provided by businesses to the public authorities predominantly in electronic form and processed digitally by the latter. All business-to-business communication and international standards for transport operations have been evolved to simplify and accelerate the flow of goods. Freight transport information is presented electronically not only during checks. Thanks to distributed ledger technology\(^1\) and artificial intelligence, a digital transport management system across all modes of transport and enterprises that enables contract execution, approvals, monitoring of processes and the recording and implementation of scope for improvements is available.

The digital revolution has enhanced overall efficiency and flexibility and has contributed to the simplification of processes and transport choices and to the reduction of emissions and empty running in all modes of transport. Thanks to low-threshold offers, it is also possible for small and medium-sized enterprises to participate.

By means of big data analytics, the data collected are analysed and used to forecast arrival and departure times. Data on markets, customers, transactions, etc. have evolved into major assets. At the same time, the necessary protection of business data and data that can be traced to an individual is ensured.

Digital infrastructure that provides universal coverage enables intermodal connectivity and is an essential prerequisite for digital transport management. All modes of transport are digitally equipped.

The modernization and digitalization of the licensing and permit granting procedure for movements of large or heavy loads have made the process swift and efficient. In addition, the modal shares of the rail and waterway modes have been significantly increased.

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\(^1\) Gabler Wirtschaftslexikon: Distributed ledger technology (DLT) is a special form of electronic data processing and storage. The term “distributed ledger” refers to a decentralized database that gives subscribers to a network common read and write access. New datasets can be added at any time by the subscribers themselves. A subsequent updating process ensures that all subscribers always have access to the latest update of the database. One special form of DLT is the blockchain. (English translation by the Federal Ministry of Transport and Digital Infrastructure)
A digital positioning system enables all customers to find out where their goods are currently located and make appropriate arrangements. Remotely controlled sensor technology makes it possible to check and, if necessary, correct the condition of the products being carried.

Our objectives

- Improve the digitalization of the rail, road, waterway and air modes.
- Develop digital business models and open, user-oriented platform economies with common standards and incorporating small and medium-sized enterprises.
- Create suitable data interfaces to enable communication and – in conformity with data protection legislation – the exchange of information between public authorities and businesses in electronic form.
- Fund neutral platforms and blockchain solutions that enable transparent and secure flows of information over a global supply chain.
- Rollout distributed ledger technologies.
- Provide comprehensive information to all parties involved in the supply chain on the availability of modes of transport, terminals and conveyances.
- Develop sensors for digital communication from the goods themselves to the parties involved in the freight transport chain (terminals, modes of transport, etc.) or develop artificial intelligence systems that can digitally identify goods and forward the corresponding information to the parties involved in the freight transport chain.
- Evolve platforms for mobility data, such as mCLOUD or the Mobility Data Marketplace (MDM).
- Pursue a systematic policy of open data focusing on real-time data and complying with privacy and cyber security laws.
Implementation steps

1. The Federal Ministry of Transport and Digital Infrastructure will support the development of platforms and common standards by, among other things, providing financial assistance to the “Silicon Economy” for the development of a neutral platform for forward-looking logistics.

2. In the context of electronic freight transport information, the Federal Ministry of Transport and Digital Infrastructure will lobby at EU level for the creation of the legal conditions for digital transmission and the necessary interfaces between businesses and public authorities. The Federal Ministry of Transport and Digital Infrastructure will encourage greater use to be made of the electronic consignment note to improve and simplify logistics processes and enforcement activities.

3. The Federal Ministry of Transport and Digital Infrastructure will join forces with the federal states to evolve the electronic VEMAGS process management system (process management system for movements of large or heavy loads). They will progressively work towards the complete digitalization and thus the acceleration of the process. In parallel with the programming of the route input, the digital network map will be programmed as the basis for automatic routing, which will also take into account performing the operation on the railways or inland waterways. To this end, the Federal Ministry of Transport and Digital Infrastructure has already made available the Digital Waterway Network.

4. Develop and apply digital maps for freight transport planning and drive assist systems. This will facilitate the carriage of abnormal loads, improve road safety and modernize the occupational field.

5. The Federal Ministry of Transport and Digital Infrastructure will evolve the mCLOUD and MDM data platforms, taking into account the requirements to be met by a national access point set out in Directive 2010/40/EU and the delegated acts adopted on this basis.

6. Implement the department’s position on open data, which involves providing all data collected on behalf of the Federal Ministry of Transport as part of the discharge of public functions and that comply with the principle of open data (for instance no personal data), especially real-time data with a greater depth of information and a higher frequency than in the past.
Addressees

→ Federal Ministry of Transport and Digital Infrastructure for items 1, 2, 5 and 6
→ Federal Ministry of Transport and Digital Infrastructure and federal states for item 3
→ Industry for item 4
FIELD OF ACTION 3

The world of work of the future
The world of work of the future

The 2030 scenario

Alongside the Fourth Industrial Revolution and the attendant digital revolution, other major trends have transformed the world of work in logistics and its occupations. Globalization, demographic change, education and migration have been driving forces behind this transformation, as has a change in values and ambitions. The spread of digital technology, the new direction in energy policy and the need for economic management that conserves resources and is energy efficient have progressively transformed not just logistics and the freight transport industry but all sectors and occupations.

People are seeking an appropriate work-life balance, working models that are independent of time and place, and the feeling that they are creating something significant. Logistics and road haulage companies have adapted to this and have shaped new and innovative possibilities in the world of work, which have resulted in attractive jobs. One of the outcomes of this is that women are now employed in many logistics occupations that were previously dominated by men. The digital revolution has supported this trend but has not made people superfluous. On the contrary, it has made work easier and more efficient. People have to deploy their “working capacity” less and are assuming control functions more frequently than in the past. With the help of working and lifting aids, exoskeletons, etc., routine procedures and physically demanding activities have migrated from humans to machines.

Working is now characterised by human-technology cooperation. For most people in employment, handling human-machine interfaces is an essential requirement. As the digital revolution has progressed, basic digital skills have become a prerequisite for employability. Increasing levels of automation have created new and more highly skilled jobs. For instance, the occupational profile of the professional driver has changed to that of a freight transport manager. Within the context of platooning, mobile workers also perform functions such as writing invoices, arranging meetings or planning routes – the driving task has evolved into a significantly more demanding occupational profile. There has been a continuous improvement in the conditions of work. There is an adequate number of well equipped parking areas on motorways, and the waiting times at loading docks and at combined transport terminals have been significantly reduced by the digital revolution. Where these waiting times still occur, there are pleasant recreation areas and dispassionate
communication between the parties involved, who endeavour to reach a mutual understanding.

More than ever before, human expertise is becoming a scarce asset. Alongside technological capabilities, characteristics such as self-management and creativity are the qualifications that will be most important in the future. Accordingly, initial training and continuing professional development have asserted the role they play in the provision of skills on the labour market. Around one half of those leaving school in any given year continue to go on to higher education. However, the “twin track” system has proved its worth compared with higher education as an alternative of equivalent quality and with great future potential. Vocational qualifications have been harmonized within the EU to a very large extent.
Our objectives

→ Systematically improve working conditions in all logistics occupations.
→ Increase the share of women working in the logistics occupations.
→ Provide political support to schemes to improve the image of logistics and enhance the attractiveness of occupations in the logistics industry.
→ Improve training and skills development and adapt to modern requirements.
→ Ensure recruitment by systematically implementing the measures set out in the Rail Freight and Inland Waterway Transport Masterplans.
→ Seek to facilitate conditions of access, for instance in the language regime for international rail freight in Europe.
→ Reduce waiting times and improve the general social conditions for the crews of goods vehicles at loading docks and handling facilities.
→ Evolve the financial assistance programme for periodic training in road haulage companies that operate heavy goods vehicles, focusing on IT or digital tools.
→ Implement projects concerning HGV platoons in regular operations.

Implementation steps

1. It is incumbent upon the logistics sector to shape jobs wherever possible such that they meet people’s requirements for a healthy work-life balance. Particular attention is to be paid to the employment of women.

2. The Federal Ministry of Transport and Digital Infrastructure will support the endeavours made by the industry to improve the image of logistics, make occupations in logistics more attractive and recruit skilled labour. Particular attention will be paid to the measures addressed in the Rail Freight and Inland Waterway Transport Masterplans and the “Five-Point Plan to Counter Logistics Bottlenecks and the Lack of Drivers in the Road Haulage Sector”.

3. The Federal Ministry of Transport and Digital Infrastructure will continue to task the Federal Office of Goods Transport with evaluating the working conditions in the freight transport and logistics sector in order to ensure that trade unions and employers have resilient information and enjoy fair conditions of competition.
4. High-quality initial training and lifelong continuing professional development will continue to be major elements of employment in logistics occupations. The course curricula will be continuously reviewed to check whether they meet the current and future requirements of the workforce in the logistics sector and of the digital society. Should it be necessary to amend the existing legislation, the Federal Ministry of Transport and Digital Infrastructure will lobby to ensure that it is amended.

5. To ensure recruitment in the logistics industry, the Federal Ministry of Transport and Digital Infrastructure will get involved by assuming high-publicity and non-material patronages as well as through the participation of the Minister and State Secretaries at events staged by the associations.

6. To support the recruitment of graduates to the logistics sector, the Federal Ministry of Transport and Digital Infrastructure will continue to award the annual Freight Transport and Logistics Higher Education Prize.

7. To ensure the recruitment of workers in the inland waterway transport sector and of train drivers in the rail freight sector, implementation of the measures set out in the Rail Freight and Inland Waterway Transport Masterplans will be progressed.

8. The Federal Ministry of Transport and Digital Infrastructure will continue to play its role of facilitator in the Ramp Working Party together with the major trade associations representing the road haulage sector, the industry, trade and the ver.di union in order to develop possible improvements. The focus will be on the use of modern time management systems to reserve time windows and on the improvement of the conditions for the crews of goods vehicles during waiting times and their communication with the warehouse operatives.

9. The Federal Ministry of Transport and Digital Infrastructure will, in compliance with EU state aid law, lobby for the evolution of the financial assistance programme for continuing professional development in road haulage companies that operate heavy goods vehicles, focusing on digital tools and information technology.

10. The Federal Ministry of Transport and Digital Infrastructure will provide financial assistance to projects trialling the practical suitability and system safety of HGV platoons in regular operations and additionally studying the potential effects that the new technologies may have on the occupation of HGV driver.
Addressees

- Federal Ministry of Transport and Digital Infrastructure for items 3, 5, 6, 9 and 10
- Industry for item 1
- Both parties for items 2, 4, 7 and 8
FIELD OF ACTION 4:
Climate change mitigation through innovative freight transport
FIELD OF ACTION 4

Climate change mitigation through innovative freight transport

The 2030 scenario

In 2030, the German economy is on course for growth, and freight transport reflects this trend. As a lead market for mobility solutions, Germany has succeeded in decoupling the growth in the level of freight traffic from final energy consumption and greenhouse gas emissions. This has been implemented with the help of a comprehensive strategy that has supported not only the deployment of low-emission technologies plus automation and connectivity but also the extensive exploitation of the scope for modal shift to the environmentally friendly rail mode. It has been possible to significantly reduce emissions of noise, pollutants and greenhouse gases. Freight transport is thus making a major contribution towards achieving the Federal Government targets for reducing greenhouse gas emissions and final energy consumption in the transport sector.

The especially environment-friendly rail freight sector has significantly increased its market share by providing new and better ranges of services and a high degree of reliability and is relieving the pressure on the roads. All production systems – block trains, combined transport and wagonload services – are contributing to this. The capacity and availability of the infrastructure have been significantly increased and major bottlenecks have been removed. By performing minor and medium-sized works, it has been possible to achieve a high level of robustness of the network. Trains are marshalled at train formation yards with a high level of automation. Private sidings provide a convenient rail link to and from business parks, industrial plants and distribution facilities.

Innovative drivetrains with significantly lower whole life costs than at the start of the last decade have been developed and have entered the market. With its high energy efficiency, the growing volume of rail freight has made a major contribution to the success of Germany’s new direction in energy policy. On the last few non-electrified sections of railway line, climate-friendly rolling stock is in use that is powered by, for instance, fuel cell technology or batteries.

Vehicles with alternative drivetrains and fuels are becoming increasingly widespread in the road haulage sector. Encouraged by the EU fleet-wide CO₂ emissions reduction targets for 2025 and 2030, electrically powered commercial vehicles are in a significant majority among new vehicle...
registrations. Battery and fuel cell powered zero-emission models are now widespread. In addition, hybrid models in combination with an overhead contact line have long been a familiar sight on German roads, operating shuttle services on selected routes. With these configurations, it is easy to comply with the access restrictions and emission limit values that apply in many regions and cities of Europe. In addition, the alternative charging and refuelling infrastructure in Germany and Europe has been significantly expanded in order to make cross-border transport operations by vehicles with zero-emission drivetrains possible. Thus, along the major European transport arteries, there are a large number of charging stations suitable for HGVs, hydrogen refuelling points and also, along the major trunk routes, overhead contact wire infrastructure. Nevertheless, the diesel engine continues to be a major drivetrain option in Germany and Europe. Since the prices of synthetic diesel fuel from renewable energy started to fall at the pump, there has been a demand for relevant quantities. In the case of commercial vehicles powered by natural gas (CNG and LNG), the use of renewable gas, for instance synthetic methane from biomass or renewable electricity, makes the scope for a reduction in emissions equivalent to that of the other drivetrain options.

As a growing transport sector, the aviation industry is of major importance to the national economy. For air transport, various measures are being pursued in the sphere of climate change mitigation, including the deployment of innovative technologies, efficient procedures and the funding and use of sustainable alternative fuels. Since 2012, aviation has been included in the European Emissions Trading System (EU-ETS). Starting in 2020, international aviation was to grow in a carbon neutral manner through the global CORSIA compensation scheme (Carbon Offsetting and Reduction Scheme for International Aviation). The aviation industry is heading in the right direction towards achieving a reduction in greenhouse gas emissions of 50 % by 2050 (against 2005 levels) alongside the carbon neutral growth. The advances made in the development of battery and fuel cell propulsion systems have not yet resulted in fleet penetration and are not yet an option for long-haul flights, even in the long run.

International maritime transport, too, continues to rely on the use of liquid fuels and achieves its emission reductions by using sustainably generated biogenic and electricity-based fuels. The purpose of a technology mix that takes account of the efficiency of the propulsion system and the energy carrier used is to meet the environmental and climate change requirements in maritime transport. The Federal Government has systematically lobbied at the International Maritime

2 CNG = Compressed Natural Gas, LNG = Liquefied Natural Gas
Organization for the evolution and harmonized implementation of international climate change, environmental protection and nature conservation standards and has achieved the adoption of the initial strategy on the reduction of greenhouse gas emissions from international maritime shipping.

There has been a significant increase in the volume of goods transported by inland waterway vessel. Timely financial assistance programmes have made it possible to comprehensively modernize the inland waterway transport fleet, inter alia through the use of alternative propulsion systems. This has made a major contribution towards reducing emissions of pollutants, noise and greenhouse gases. The capacity of the infrastructure has been significantly increased and major bottlenecks have been removed.

In intralogistics, from the forklift truck in the warehouse to the baggage tug at the airport, alternative drivetrains present a good opportunity for reducing emissions of pollutants and CO₂ as well as cutting noise levels.

In those places where biogenic fuels are used, the potential inherent in advanced biofuels is being harnessed. The sustainability criteria are being complied with.
Our objectives

- Boost the environmentally friendly rail mode and increase its share of the modal split, its performance, its financial viability and its social acceptance.
- Increase the rate of electrification of the rail network and rollout new drivetrain systems for rolling stock with battery and fuel cell for non-electrified lines.
- Boost the climate-friendly inland waterway mode.
- Enhance the energy efficiency of the road haulage sector and significantly reduce emissions without imposing constraints on mobility.
- Speed up the technologically neutral development, demonstration and rollout of vehicles with alternative drivetrains and provide the corresponding infrastructure.
- Support low-cost processes for the manufacture of bio- and electricity-based renewable fuels in Europe and throughout the world, thereby enabling carbon neutral growth in the aviation and maritime sectors.

Implementation steps

1. Over the years ahead, investment in the renewal and upgrading of the railway infrastructure will be progressively and significantly increased.
2. The measures agreed in the Rail Freight Masterplan will be implemented on a permanent basis using the necessary funding and will boost the environmentally friendly rail mode.
3. The measures agreed in the Inland Waterway Transport Masterplan will be implemented on a permanent basis and will boost the environmentally friendly inland waterway mode.
4. The Federal Ministry of Transport and Digital Infrastructure will lobby to ensure that the support measures for alternative drivetrains and fuels in the transport sector are widened and sustained. To this end, the provision of financial assistance to hydrogen/fuel cell drive trains from the National Hydrogen and Fuel Cell Technology Innovation Programme and the programmes for funding electric mobility are to be continued and the funding envelope extended.
5. Targeted financial assistance is to be provided for the rollout of charging infrastructure that meets current and future needs.
6. The financial assistance programme for energy efficient and/or low carbon goods vehicles will be sustained and, if necessary, receive an additional injection of funds to the extent that this is possible within the budget. The shape of the tolling system is to create significant incentives for the purchase of environmentally friendly and low-emission goods vehicles. The Federal Ministry of Transport and Digital Infrastructure will thus lobby at EU level for an HGV tolling system based on CO₂ emissions.

7. The Federal Ministry of Transport and Digital Infrastructure will support extending the funding provided by the Federal Ministry for Economic Affairs and Energy within the scope of the 5th Aeronautical Research Programme beyond 2023.

8. Innovative pilot projects for the real-world trialling and evolution of funding schemes to support the technology ramp-up of innovative drivetrain technologies with the aim of enhancing energy efficiency and reducing emissions, for instance within the scope of the Federal Government’s Mobility and Fuels Strategy, are to be systematically implemented. In the maritime shipping sector, the provision of financial assistance for the use of LNG as a fuel will be continued. The provision of such assistance to the use of LNG in the inland waterway transport sector is also possible.

9. The industrial market ramp-up for the production of bio- and electricity-based renewable fuels is to be initiated, for instance by inviting tenders for large plants with pro rata funding.

Addressees

- Federal Ministry of Transport and Digital Infrastructure for items 4 to 8
- Federal Ministry of Transport and Digital Infrastructure and industry for items 1 to 3 and 9
FIELD OF ACTION 5

The connected world of freight transport
FIELD OF ACTION 5

The connected world of freight transport

The 2030 scenario

In comparison with other countries of the world, Germany has an exemplary multimodal transport system for national and international freight transport. Here, there is a very highly developed network of roads, railways and waterways that are interconnected and on which logistics operations are organized using modern information technology. Depending on the type and quantity of goods, the time required and the route, freight can be moved on the most efficient transport infrastructure in any given case. All the stakeholders have at their disposal a wide range of up-to-date information relating to their freight movements. It is true that the HGV continues to be the most important conveyance. Over long distances, however, it is predominantly environmentally friendly freight trains and inland waterway vessels that are now being used. In recent years, they have continuously increased their share of the modal split. In addition, high-volume industrial, trading and logistics locations have their own private sidings.

Combined transport (CT), as an indispensable component of German logistics chains, is firmly integrated and has, moreover, established itself as a sustainable form of freight transport not just in Germany, but throughout Europe. CT and private sidings are considerably relieving the pressure on our roads and make major contributions towards reducing emissions of air pollutants and greenhouse gases.

The railway undertakings have developed and introduced new ranges of services that make it possible to also provide high-capacity rail freight services away from the conurbation-to-conurbation routes. In many places, goods vehicles with alternative drivetrains on the initial and terminal hauls have made a seamlessly electric freight transport chain possible. The number of cranable trailers has been significantly increased.

In recent years, a tightly meshed network of CT and multimodal handling facilities and private sidings has been established in Germany – likewise with Federal Government funding – that serves as an example of good practice throughout Europe and whose operation is integrated into the nationwide integrated regular interval timetable. CT hubs have been created at which rail or waterway movements can be rearranged without a change of mode. Multimodal terminals make it possible to provide services down to the last mile by rail, irrespective of the size of the consignment. In addition to conventional loading systems that use cranes,
other cargo handling technologies are now in operation at the CT terminals.

Automation is now standard at rail freight and cargo handling facilities. AGVs (automated guided vehicles), autonomously operating cranes and rapid handling facilities have transformed rail freight and the CT landscape and are increasingly being deployed at industrial enterprises for the movement of goods. For smaller quantities of goods, smaller transport units are being used, especially in wagonload traffic and on the last mile. With the help of digital processes, the organization of supplier-independent transport operations is becoming increasingly widespread throughout the world and optimum load factors for freight transport vehicles are being achieved (“Physical Internet”). With modern information technology, all players involved in the logistics chains are provided with up-to-date information on available rail freight facilities and the arrival and departure times of trains and inland waterway vessels. This minimizes the amount of time spent by goods vehicle drivers at terminals.
Our objectives

- Enhance the attractiveness of the railways and inland waterways.
- Improve the conditions for more multimodality.
- Construct/upgrade a sufficient number of CT terminals to ensure that the growth in CT forecast for the period to 2030 can be managed. Deploy digital technology at CT terminals and increasingly automate their operation in order to perform cargo handling as quickly as possible and reduce the time spent by all conveyances at the terminals.
- Construct/upgrade multimodal access points to the railways at places close to customers and in the immediate vicinity of transport hubs.
- Ensure comprehensive information on the availability of terminals and conveyances is provided to all parties involved in the supply chain.
- New types of efficient freight transport and cargo handling systems that can complement the existing ones will be implemented.

Implementation steps

1. The measures set out in the Rail Freight and Inland Waterway Transport Masterplans to boost multimodality will be systematically implemented.
2. Targeted research will be conducted to identify possibilities for a further improvement of multimodality. This includes exploring even greater connectivity and linkage between the individual modes of transport and taking particular account of the demand for transport. In addition, ways of improving the use of rail freight and CT away from the major conurbations and the provision of support to the establishment of the Physical Internet are to be examined.
3. The Federal Ministry of Transport and Digital Infrastructure will lobby to ensure that the funding of CT and private sidings is secured in the longer term and will constantly improve it and make it investment-friendly.
4. In the provision of financial assistance, particular consideration is to be given to ways of providing targeted funding to the spread of digital technology and automation.
5. The Federal Ministry of Transport and Digital Infrastructure will lobby to ensure that areas for handling facilities are considered in the federal states’ spatial plans. It will also advocate a systematic review to
determine whether freight transport sites are to be equipped with rail links and ensure that such links are delivered if the outcome is positive.

6. Relevant freight transport information is to be provided to all parties involved in rail freight and beyond.

7. The deployment of AGVs at logistics facilities is to be supported and not hampered by unnecessary bureaucratic obstacles.

**Addressees**

- Federal Ministry of Transport and Digital Infrastructure for items 2 to 5 and 7
- All parties for items 1 and 6
FIELD OF ACTION 6

| Smart railways, intelligent trains |
FIELD OF ACTION 6

Smart railways, intelligent trains

The 2030 scenario

Germany is in the vanguard of climate-friendly and sustainable mobility. Action to extend the railway infrastructure is being taken on a significant scale. Funding the extended upgrade of the railway infrastructure represents a major challenge in terms of the funding needs and gaining the acceptance of the public in the planning process. In addition, the competitiveness and innovative capacity of the railways have been continuously enhanced by the Federal Government's Research Programme and the Federal Government Programme on the Future of Rail Freight. This was the only way that a significant shift in the modal split towards rail freight (increase from 18.6 % in 2017 to 25 %) was feasible. The railways have further consolidated their position as a reliable, fast, low-cost and flexible means of freight transport. They are a major means of transport for freight movements of 300 km or more and, thanks to innovative logistics strategies, the railways also offer freight transport solutions for shorter distances. They are thus an integral component of the electric vehicle supply chain.

Because of its system properties – it is guided and can be controlled as an overall system – rail freight is at the forefront of the digital transformation and automation of freight transport. Throughout Europe, the screw coupling has been superseded by the digital automatic coupling. With a standardised interface that makes it possible not only to couple the rolling stock and air pipe but also to establish the power and data link between the traction unit and the freight wagons, the groundwork has been laid for the digital transformation and automation of rail freight. Thanks to the digital automatic coupling, automatic brake testing and digital monitoring of operational safety, trains can marshalled and split quickly and deployed more efficiently. Preventive maintenance using digital methods, both directly on the rolling stock as well as along the tracks, has improved the productivity of the rolling stock. Logistics processes between the roads and the railways have been standardized and, to a very large extent, automated. Goods are loaded quickly, reliably, punctually and safely.

The European Train Control System (ETCS) and digital signal boxes have already been introduced on many lines. They form the basis for automated train operations. For the automation of rail freight services, the appropriate standards and regulations have been adapted after consultation with the EU.
Fully automatic driverless locomotives are in use in shunting operations. Real-time control and monitoring make quick and safe operational processes possible. The use of intelligent software for planning and scheduling makes it possible to optimize track occupancy and the capacity utilization of marshalling yards. There has also been a digital transformation and automation of the management of marshalling and stabling, resulting in its optimization and, at the same time, it has been intelligently linked to repair work on the wagons and locomotives. This was a basic condition that had to be met in order to operate wagonload services economically and acquire new groups of customers.

On the infrastructure side, sufficient capacity is provided. The increase in the electrified share of the network and the extensive use of electricity from renewable sources plus the use of alternative electric drivetrains mean that the operation of the railways is largely climate-neutral. On the few non-electrified lines, especially on the first and last mile, the railways use alternative, climate-friendly drivetrains. In this way, the numerous private sidings to and from large and medium-sizes production sites are connected to the rail network in a climate-friendly manner.

Lightweight, energy-efficient, high-mileage and quiet freight wagons and freight locomotives with significantly lower whole life costs than at the start of the last decade have been developed and have entered the market. Modular design makes it possible to flexibly adapt freight wagons, for instance to the freight being transported in any given case or to the loading sites, and to upgrade them with new technologies. The intelligent train is part of the Internet of Things and, by providing continuous information on its location and status to parties with authorized access, enables the effective deployment of available resources.

Easy-to-use platform services and improved customer service have also simplified access to the railways for enterprises that have not previously used them.
Our objectives

→ Significantly increase the market share of the railways.
→ Improve the financial viability of rail freight and improve the attractiveness and competitiveness of the railways compared with the roads.
→ Upgrade the railway infrastructure in a targeted manner.
→ Increase the electrification rate of the rail network.
→ Enhance the digital transformation and automation of rail freight.
→ Improve the efficiency and logistics capabilities of rail freight services.
→ Construct more and maintain existing private sidings.
→ Increase the capacity utilization and effectiveness of marshalling yards.
→ Introduce the digital automatic coupling throughout Europe.
→ Progress the development of innovative freight wagons and an intelligent freight train.
→ Accelerate targeted railway research.
→ Speed up the establishment of innovations on the rail freight market.
→ Enhance acceptance among the general public by preventing and reducing noise.
→ Further improve the energy efficiency and environmental friendliness of rail freight.

Implementation steps

1. The measures agreed in the Rail Freight Masterplan will be implemented on a permanent basis using the necessary funding.
2. The Federal Government Programme on the Future of Rail Freight will be provided with the necessary funding and implemented in order to trial innovations in rail freight in the fields of digital transformation, automation and innovative rolling stock technology and establish them as a market standard.
3. Measures that boost and increase the number of wagonload services and make them financially viable will be developed and implemented.
4. ETCS in combination with digital signal boxes will be progressively introduced as uniform European command, control and signalling equipment to create a digital platform on which further innovations, such as automated train operations and the provision of real-time information, can be based.

5. A test bed for the digital transformation and automation of the marshalling of freight trains is to be established.

6. The Federal Ministry of Transport and Digital Infrastructure will implement the Federal Government’s Railway Research Programme as a strategic “research timetable” with the German Centre for Railway Research, a Federal Government departmental research establishment.

7. The Federal Ministry of Transport and Digital Infrastructure will develop a migration strategy for the Europe-wide introduction of a digital automated coupling and systematically implement it.

8. The intelligent freight train project is to build on findings delivered by the Innovative Freight Wagon project and, alongside the modular design of future freight wagons, is also to create the technological and legal conditions for the digital transformation and automation of rail freight. The intelligent freight train is to be equipped with a digital automated coupling as a basic requirement and is not to exceed the stipulated noise and energy values of the Innovative Freight Wagon. In this project, problem-solving approaches for the safe, accurate and highly available positioning of single wagons can also be developed.

9. The Federal Ministry of Transport and Digital Infrastructure will lobby to ensure that the funding for railway infrastructure is permanently increased. The renewal of the existing network within the scope of the service level and funding agreement will be further intensified by the Federal Government and DB. More extensive measures will be taken to deliver the nationwide integrated regular interval timetable and for a robust network.

10. The projects from the Federal Transport Infrastructure Plan for the federal railway infrastructure will be systematically implemented to ensure sufficient capacity for rail freight.

11. The Federal Ministry of Transport and Digital Infrastructure will champion the development of Europe-wide rules and standards for safe automated and digitalized train operations.

12. The target timetable for the nationwide integrated regular interval timetable will include sufficient capacity for rail freight services. At the same time, flexibility for freight services will be ensured.
13. The Federal Ministry of Transport and Digital Infrastructure will also lobby to ensure that funding is created for investment in rolling stock in the ETCS.

Addressees

➔ Federal Ministry of Transport and Digital Infrastructure for items 2, 5 to 11 and 13
➔ Federal Ministry of Transport and Digital Infrastructure and industry for items 1, 3, 4, 8 and 12.
Smart ports and waterways
FIELD OF ACTION 7

Smart ports and waterways

The 2030 scenario

The German sea and inland ports are among the best terminals in the world. They face fiercer international competition but they are able to assert themselves because they guarantee a very high degree of reliability and speed plus the smooth initial and terminal haulage of goods. Maintaining the high level of competitiveness of Germans ports continues to require maximum innovation and evolution of the port technologies and procedures.

The sea and inland ports are locations at the cutting edge of technology and port operations are increasingly being performed in an automated manner. Digital infrastructures at the ports ensure that traffic is controlled intelligently, that it is possible to monitor the infrastructures and their environmental impact and that the operation of drones can be monitored. For many years, digital test beds at the ports have made it possible to trial Logistics 4.0 innovations in real-world conditions. It has been possible to achieve, for instance, the optimum use of the modes of transport, greater digital connectivity between the maritime supply chains, a reduction of congestion, an improvement in environmental performance and an optimization of the existing infrastructures and resources. The use of IT at the ports and in the logistics chains is very well developed, as are the IT systems and cyber security.

Cargo handling at the ports and initial and terminal hauls have been optimized and the volume of cargo handled by the port terminals is high. Traffic flows to, from and at the ports are largely smooth, which means that there are no longer any congestion and bottlenecks on and between the port terminals and at the ports themselves. The ports are thus in a position to perform their key functions for the entire national economy despite the continuing sharp growth in the volume of cargo handled.

The digital transformation of the ports makes it possible to optimize the exchange of data along the logistics chains and to automate processes. The shorter turnaround times at the ports help to reduce CO₂ emissions. The sea and inland ports have a well developed network of LNG refuelling points and shore-side electricity systems.

New jobs have been created at many ports and the preservation of existing jobs has been supported as new technological developments have been introduced. At the same time, the development of innovative port technologies, with financial assistance from the Federal Ministry of
Transport and Digital Infrastructure, has helped to improve environmental protection and climate change mitigation.

The seaward approaches, inland connections and inland waterways have been upgraded to a standard that meets current and future requirements, as set out in the current National Ports Strategy, and are being maintained. Optimum use is being made of the strengths inherent in each mode of transport. Tailor-made connectivity between the modes of transport, the sea and inland ports and the logistics hubs means that optimum use is made of the existing transport infrastructure.

The ports are testing new transport systems such as the hyperloop or heavy lift drones and are deploying them where this makes commercial sense.

Inland waterway transport’s share of the modal split has increased in recent years because it has been integrated into the freight transport chain in an optimum manner via digital platforms and multimodal route planners. This high share of the modal split has created new jobs. The deployment of partially automated inland waterway vessels facilitates the work of the inland waterway transport operator. The inland waterway vessels deployed are largely climate-neutral and comply with the EU’s stringent environmental conditions with regard to their emissions. Enhanced environmentally friendly inland waterway vessels, for example those with alternative propulsion systems, receive additional concessions when using public infrastructures. Power is supplied to ships in port by shore-side electricity systems, which means that the ships do not create any emissions or noise.

The first autonomous vessels, i.e. without a boatmaster on board, are in operation. This is reducing the number of accidents and resulting in fuel-efficient operation. Automated navigation also makes it possible for smaller units of vessels to operate profitably, for instance as suppliers in city centres. They can be used flexibly in the redistribution of containers at ports. The first electronically connected convoys of vessels are also being operated on the water – leader vessel with follower vessels, remotely monitored and with a reduced crew (platooning).

It has been possible to significantly reduce the investment backlog in waterway infrastructure. Locks are remotely operated and are available to inland waterway vessel operators around the clock. Waiting times have been minimized through the digital allocation of slots. Digital berthing systems are in operation at all ports. The use of port-wide cargo handling planning systems has made it possible to drastically reduce the waiting
times experienced by inland waterway vessels at the sea and inland ports. Inland waterway vessel operators have up-to-date route-specific static data on, inter alia, waterway and port infrastructure, hydrological conditions and route-specific incidents, etc. at their disposal at all times. Various infrastructure measures, such as the optimization of laden draughts on the Middle Rhine, have resulted in a situation where, even in the case of climate-induced disruption such as lengthy periods of low water, it remains possible to use inland waterway transport.

In addition, ships are in operation that are equipped with highly automated functionalities such as electronically controlled main engines, automated engine plants and power generation and intelligent track control systems. The charting of complex traffic situations, special vessels such as those for the movement of abnormally heavy loads and passenger shipping, and special navigational conditions necessitate operation by highly skilled personnel. Some cargo vessels and vessels with a two-point terminal call are operating in autonomous mode.
Our objectives

→ Enhance the competitiveness of the ports, maritime shipping and inland waterway transport by upgrading and maintaining seaward approaches, inland connections and inland waterways.
→ Evolve the ports into locations at the cutting edge of technology.
→ Promote innovation and evolve port technologies and procedures.
→ Deploy a technical digital infrastructure.
→ Explore the possibility of deploying new freight transport systems.
→ Reduce GHG emissions and emissions of air pollutants and noise at the point of use.
→ Enhance the attractiveness and competitiveness of inland waterway transport.
→ Continuously further improve the safety and efficiency of national and European inland waterway transport.
→ Autonomous operation of vessels.
→ Provide active support and funding to the development and trialling of assistance systems for (partially) automated navigation.

Implementation steps

1. The Federal Ministry of Transport and Digital Infrastructure (BMVI) will lobby to ensure that public funds required for the upgrading of port-related infrastructures are included in the budget. The measures set out in the Federal Transport Infrastructure Plan in the sphere of inland waterway transport will be systematically implemented.
2. The industry will conduct feasibility studies and operational tests of new freight transport systems such as hyperloop and heavy lift drones.
3. The BMVI will fund the creation of a network of LNG refuelling points and shore-side electricity systems.
4. The BMVI will develop new funding guidelines for innovative port technologies (IHATEC II).
5. The BMVI will develop funding guidelines for digital test beds and have measures relating to Logistics 4.0 trialled in real world conditions.
6. The BMVI will join forces with the industry to develop, in a timely manner, a new 2025 National Ports Strategy for Sea and Inland Ports as strategic guidance for the Federal Government’s port policy.
7. The BMVI and the industry will implement the measures set out in the Inland Waterway Transport Masterplan.

8. The BMVI, in cooperation with the Federal Ministry for Economic Affairs and Energy, will explore the possibility of a research programme specifically for inland waterway transport.

9. The BMVI will fund the implementation of the “Binntelligent” project as a prerequisite for the coordination of inland and seaports, the optimization of the waterborne and land-based modes of transport and synchronomodal transport planning.

10. The BMVI and the Federal Waterways and Shipping Agency will implement the measures contained in the EU’s COMEX project for the sustainable provision of selected River Information Services via a central European portal.

11. The BMVI will arrange for up-to-date depth information to be provided on the Inland Electronic Navigational Chart to enable boatmasters to make better use of the existing fairway depths.

12. The BMVI will support the effective use and upgrading of the skills required for automated navigation, communication and integration at the Federal Maritime and Hydrographic Agency and the Federal Waterways and Shipping Agency.

13. Systems for partially automated navigation are to be developed and tested in practical applications. To this end, research and development projects are to be launched and financial assistance is to be provided for the development of automation equipment and the operation of vessels fitted with this equipment. Legal obstacles are to be dismantled.

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**Addressees**

- Federal Ministry of Transport and Digital Infrastructure for items 1, 3 to 6 and 8 to 11
- Industry for item 2
- All parties for items 7, 12 and 13
FIELD OF ACTION 8

Innovative air cargo

The 2030 scenario

Thanks to its close interconnectedness with the major economies of the world, Germany, as a supplier of capital goods such as machines and equipment, high-value consumer goods such as cars and technologies in the environmental and energy spheres, continues to be a leading exporting nation. A sizeable proportion of the goods to be exported are carried by air. Since 2018, the volume of air cargo loaded in Germany has risen from just under 2.5 million tonnes to 3.8 million tonnes.

Implementation of the Single European Sky has made it possible to optimize international traffic flows and enhance the efficiency of airspace use. A Single European Sky is to fulfil the future requirements to be met by aviation and comply with the environmental criteria. By means of digital services, a safe, seamless, flexible and resilient network for all airspace users (both civil and military) as well as for passengers has been created. The Digital European Sky is introducing the new technologies in a manner that is beneficial to all parties involved in aviation, which has resulted in particular in a facilitation of the air traffic control activity, thereby significantly enhancing capacity.

The opportunities presented by the digital transformation have resulted in higher expectations with regard to the availability of products and services. Innovation and production cycles have become significantly shorter and are impacting on air cargo. In addition to accelerated customs clearance and autonomous ground processes, the deployment of robots and unmanned aircraft for AI-controlled cargo handling at airports helps to reduce delays and makes a quicker and efficient exchange of goods possible, which satisfies the demand on the consumers' side. Germany has succeeded in exploiting the opportunities presented by globalization for Germany as an air cargo hub without losing sight of climate change mitigation, environmental sustainability or noise reduction.

All airspace users can avail themselves of the airspace service without any difficulties despite the continuous rise in the volume of traffic. Following intensive research, the airspace structure was adapted such that the integration of “new” airspace users became possible in an area that was for a long time used exclusively by civil and military aviation.

Unmanned aircraft systems (UAS) are making a valuable contribution towards reducing ground-based distribution operations. UAS that deliver parcels or transport medicines are making certain vehicle journeys
superfluous. The flexible framework created by European regulations on unmanned aviation is opening up lucrative business and application fields from which society also benefits. Given their good safety record and appropriate safety requirements, UAS are accepted by society and make a contribution towards improving air quality and relieving the road infrastructure. UAS also perform important functions in rural and difficult-to-access areas. The supply of the population is faster and less expensive than with conventional conveyances. In addition, unmanned aircraft are playing an increasingly important role in long-haul logistics. This is made possible by “sectorless control”, which involves unmanned cargo aircraft being controlled over long distances by pilots on the ground and monitored by air traffic controllers. This makes a significant contribution towards reducing the number of personnel required compared with conventional cargo aircraft.
Our objectives

→ Maintain and strengthen Germany as an air transport hub and safeguard the air cargo value chain.

→ Guarantee the protection of acquired rights for hours of operation that meet current and future demand, also including 24-hour operation at certain locations to preserve international connectivity in air cargo transport.

→ Further progress the digital transformation and automation of air cargo.

→ Reconcile environmental friendliness and noise reduction with rising numbers of tonne kilometres.

→ Safely and efficiently integrate unmanned aircraft into the airspace structure.

Implementation steps

1. The Federal Ministry of Transport and Digital Infrastructure will continue to implement the Aviation Strategy. This will involve, among other things, optimizing surface links to airports within the scope of future federal transport infrastructure planning and monitoring the protection of acquired rights for hours of operation that meet current and future demand, also including 24-hour operation at certain locations.

2. The Federal Aviation Office will join forces with air carriers, airports and associations to examine and develop proposals for action to reduce the time required for granting permission to cargo charter flights to enter and exit German airspace.

3. The Federal Ministry of Transport and Digital Infrastructure will examine whether digital test beds can be established for certain aviation sectors, modelled on the “Seaport of Hamburg” digital test bed. In this way, parties involved in the air cargo logistics chain are also to be given an opportunity to extensively test new and innovative approaches in a real-world setting.

4. The Federal Ministry of Transport and Digital Infrastructure will develop and implement an “Action Plan for Unmanned Aerial Systems and Innovative Aviation Strategies”, which will pave the way for the deployment of automated and remotely piloted UAS.

5. The Federal Government will join forces with the stakeholders to create without delay the conditions for application of the new EU
Drone Regulations, which will establish a flexible regulatory framework for operation of most UAS. In addition, the Federal Ministry of Transport and Digital Infrastructure will lobby to ensure that rules and guidelines for the necessary operating, licensing and technical requirements of heavy UAS for the carriage of cargo are developed without delay so that these UAS can also be integrated into the existing airspace organization. The approval procedure for commercial drone flights in Germany will be harmonized and accelerated.

Addressees

- Federal Ministry of Transport and Digital Infrastructure for items 1 to 4
- Ministry and industry for item 5
FIELD OF ACTION 9

| The road of the future
FIELD OF ACTION 9

The road of the future

The 2030 scenario

Germany has developed into the European lead provider in the field of automated and connected driving. Automated and connected goods vehicles and other freight transport vehicles are deployed in regular operations on digital roads. In comparison with other countries of the world, the German road network boasts an exemplary cooperative, intelligent and digital infrastructure. The legal and infrastructure conditions for automated and connected driving have been internationally harmonized and also enable cross-border automated transport. Routing systems are designed to be intermodal and are also compatible with rail and inland waterway transport.

To be able to continue to handle the rising volumes of freight safely and reliably, there has been a massive expansion of the telematics-based control of traffic on federal trunk roads, and adaptive traffic control has been widened into strategic network management. Intelligent active traffic management systems are making a contribution towards enhancing road safety and improving the situation on the roads. Congestion is minimized by making intelligent use of the existing infrastructure. Public sector telematics-based network management is augmented by cooperation with and the provision of information by private sector service providers, resulting in appropriate individual routing on the roads. Meteorological information is used both for strategic planning and real-time tactical planning.

Private sector services supply movement data of road users (floating car data – FCD) from which distance-related journey times and speeds are derived at defined intervals and which make both a good description of the current traffic situation and real time-based recommended routes possible. Cooperation between traffic management centres that offer real-time data from stationary detection cross-sections via an open platform for the exchange of mobility data to private sector third parties for use makes it possible not only to describe the current traffic situation but also to reliably forecast congestion in order to achieve improved cost and time savings in goods vehicle traffic with more reliable delivery times. Stationary traffic detection is a major building block for reducing traffic jams because it supports both collective adaptive traffic control and individual routing. The network quality and the capacity of the transport infrastructure are continuously assessed using a Federal Government key performance indicator (KPI) system.
There is complete interconnectivity between the traffic management centres and between the vehicles. This enables optimum route management and an immediate response to traffic disruption. In particular, new systems for the detection of parking spaces and the display of parking space availability as well as the deployment of telematics-based parking methods within existing areas have resulted in a situation where there is sufficient information about parking spaces so that the crews of goods vehicles have no problems planning their rest periods. In addition, at parking areas on federal motorways, systematic anti-theft measures are in place, among other things by means of clearly laid out and sufficiently illuminated facilities.

Road works constitute a traffic disruption but are being reduced in terms of both number and duration. There is now a rapid response to any structural maintenance and construction needs identified and the action required is implemented speedily. By means of suitable and possibly intelligent indicators (for instance monitoring) in the road superstructures and civil engineering structures, which provide supplementary information on the condition, it is possible, taking account of whole life cycle analyses and at least for especially sensitive sections of road, to develop time-optimized tailor-made blueprints for necessary structural maintenance works and implement them in pilot projects. From these, it is possible to develop new approaches to the identification of structural maintenance cycles that make preventive maintenance possible. Here, special importance also attaches to the quality of the construction materials used and the on-site execution of the work. High-quality construction materials and methods of construction that are less prone to defects help to further increase the quality of execution of the work, thereby laying the foundations for more permanent road superstructures and bridge constructions. By considering structural maintenance cycles, structural maintenance work can be better synchronized with the use cycles of road construction and civil engineering structures. As a result, the number of structural interventions can be reduced in a best-case scenario.

The lanes used for moving traffic are themselves widened during the road works through the automation of the construction processes. As a result of automation, work is done in off-peak time windows, because activities are increasingly being shifted to machines, and these are subject to different constraints in terms of, for instance, workplace exposure, working time rules, etc., than human workers. Roadworks management, too, uses telematics to control the flow of traffic approaching the roadworks site, transmits site-specific information to road users and provides comprehensive information on ongoing activities at the site.
There has since been a significant increase in road safety and the efficiency of road traffic. As part of the establishment of digital connectivity between the road infrastructure and vehicles, automatic early warning systems have been installed across the entire network which, in the event of road traffic hazards, automatically reduce the speed of vehicles and adapt it to the flow of traffic. All road haulage vehicles are fitted with early warning systems as standard, which warn drivers of aquaplaning and ice. The vehicles, frequently fitted with alternative drivetrains, produce fewer emissions thanks to intelligent freight transport management. Turn assist systems have been made mandatory for goods vehicles.
Our objectives

→ Unlock further potential for the digital transformation of the roads.
→ Provide the infrastructure with digital equipment, among other things with the necessary cooperative intelligent transport systems to support cooperative, connected and automated driving.
→ Implement the blueprint for a goods vehicle parking guidance and information system. Make optimum use of the parking spaces at rest areas by deploying telematics-based parking methods (parking in columns and compact parking).
→ Establish a nationwide real-time traffic situation report for the federal motorways and interconnect the traffic management centres.
→ Improve the counting accuracy of the road traffic census by reducing the number of manual counts and introducing automatic counting procedures.
→ Improve the data bases for traffic management, including the provision of real-time daily time variation curves on the mobility platforms for use by third party providers in the Mobility Data Marketplace.
→ Evolve the adaptive traffic control strategies in network management.
→ Improve the quality of forecasts through the traffic analysis system for the traffic impact of road works sites on federal motorways.
→ Establish a key performance indicator system for Federal Government applications, combining traffic volumes and speed/journey time data.
→ Extend the structural cycles and lengthen the useful life of the road pavement.
→ Develop a digital outline map showing the network available to longer goods vehicles.

Implementation steps

1. The Federal Ministry of Transport and Digital Infrastructure will develop a regulatory framework for autonomous driving in specific use cases and will at the same time get involved in European and international bodies for the development of uniform international rules and standards for automated and connected driving in connection with Intelligent Transport Systems.
2. It will continue to support trialling on digital test beds.

3. The Federal Ministry of Transport and Digital Infrastructure will update the Intelligent Transport Systems (ITS) Action Plan for the Roads and implement the ITS services going beyond the “day 1 applications” on federal motorways. This will involve equipping daytime work sites, major road works sites and subsequently conurbations and the areas around junctions with intelligent transport systems road side stations.

4. The first cooperative, connected and automated mobility (CCAM) services are to be introduced.

5. The Federal Ministry of Transport and Digital Infrastructure will fund research projects for the evolution of automated and connected driving and trials on digital test beds. Standard drawings will have to be developed and harmonized for the deployment of telematics in temporary traffic management arrangements. Provision is to be made for such research projects in departmental research.

6. The Federal Ministry of Transport and Digital Infrastructure will develop connectivity between meteorological analyses, model forecasts and data on traffic disruption and logistics planning with the help of artificial intelligence.

7. The Federal Ministry of Transport and Digital Infrastructure will press ahead with establishing technological and organizational connectivity between the federal motorway traffic management centres.

8. To optimize parking areas for goods vehicles, the Federal Ministry of Transport and Digital Infrastructure will deploy telematics-based parking methods for parking in columns and compact parking.

9. The Federal Ministry of Transport and Digital Infrastructure will progressively expand the network of permanent count sites on federal motorways to develop new network control strategies. The data from the permanent count sites will be provided in real time via a mobility data platform and integrated, along with the data from manual road traffic censuses (whose methodology has been adapted to the widened data collective), into the time variation curve library of the traffic analysis system.

10. The Federal Ministry of Transport and Digital Infrastructure will develop a key performance indicator system for the federal motorway network. On the basis of key performance indicators, this is to further improve the capacity and safety of the road network, optimize operational and control processes and expedite planning and investment decisions.
11. The Federal Ministry of Transport and Digital Infrastructure will incentivize the development and trialling of partially automated construction machinery and continue measures to enhance the quality of installation in road construction.

12. There will be a categorization of the federal motorway network sections in terms of their sensitivity to losses of availability and measures to enable optimized responses to influences hindering the flow of traffic.

13. Germany will consider concluding bilateral agreements to make cross-border operations by longer goods vehicles possible if necessary. The requirements set out in the Longer Goods Vehicles Exemption Regulations must also apply here. The Federal Ministry of Transport and Digital Infrastructure will commission the preparation of a digital outline map making it easier for the industry to identify which motorways and federal highways can be used by longer goods vehicles.

**Addressees**

→ Federal Ministry of Transport and Digital Infrastructure for items 1 to 13
FIELD OF ACTION 10

| Solutions for the last mile |
FIELD OF ACTION 10

Solutions for the last mile

The 2030 scenario

People are increasingly shopping online – for clothes, furniture, food and drink and much more besides. Their orders are frequently delivered on the same day or even within a few hours. Despite the massive increase in distribution operations, levels of noise and pollutants in towns and cities have fallen, thanks to electric and alternative drivetrains among other things. In addition, significantly more goods are being moved by rail, and in some cases by inland waterway, right into city centres. There, they are consolidated at low-noise freight villages and delivered by commercial vehicles with alternative drivetrains. In many places, micro depots owned by more than one supplier are increasingly making it possible to use cargo cycles for the final delivery of parcels.

In towns and cities, the pressure on the last mile is being reduced by a broad network of points owned by one or more suppliers for small-scale freight consignments at railway stations and local public transport hubs and by parcel shops. Here, consignments can be collected and handed in by consumers. Businesses and private individuals can use digital means to not only track and trace the status of their consignments but also to actively influence their course. Thanks to this real-time communication, the use of private parcel boxes and other innovative approaches such as car boot delivery, it has been possible to significantly reduce the number of abortive delivery attempts. Thanks to a large number of designated loading zones on parking areas away from the public road environment, delivery vehicles no longer double park. This has resulted in a significant improvement in the flow of traffic and there has been a drop in the number of accidents.

In addition, in towns and cities many freight transport operations have become “invisible” to the population and a large number of new delivery models have been developed. Some towns and cities have joined forces with the private sector to construct underground pipes in which small electrically powered autonomously operating vehicles carry goods into the city centre. In many towns and cities, night-time logistics on the roads plays an important role. In many places, railway rolling stock and stations are used for freight transport at night and in off-peak periods. In more sparsely populated regions, in particular, local public transport buses also carry goods.

The digital transformation and automation of the entire logistics chain, infrastructure and vehicles plus new data-based real-time applications for...
optimizing the last mile ensure efficient cross-modal route planning and a smooth flow of traffic. Numerous autonomously operating delivery vehicles and unaccompanied delivery robots are in operation on the streets. In more sparsely populated regions, in particular, drones are frequently used to transport goods. For urgent deliveries such as medicines, drones are also already in operation in towns and cities.

In the federal states, districts and municipalities, the needs of logistics are taken into account proactively as early as the regional planning and municipal development stages. In this way, multimodal logistics areas and areas for rail connections are secured in the land use plans at an early stage and the local authorities have coordinating points of contact for logistics issues.

The basis for decisions on the optimization of the last mile is formed by comprehensive logistics strategies, which have by now been drawn up by all large districts and municipalities with the involvement of the relevant stakeholders. These strategies draw on, among other things, standardized procedures that are used to calculate the effects of individual measures, for instance on emissions from distribution operations. Consumers and, as a consequence, also businesses attach great importance to low-emission distribution operations, and transparent information on the carbon footprint of a delivery has become standard.
Our objectives

- Boost the deployment of electric and less noisy commercial and delivery vehicles on the last mile.
- Develop digital applications for route optimization and connectivity between modes of transport in towns and cities.
- Fund connectivity between the urban transport infrastructure and delivery vehicles, the deployment of tele-operated delivery robots on the last mile and automated/autonomous driving in towns and cities.
- Develop logistics strategies in municipalities and districts for the last mile.
- Improve the flow of traffic and reduce emissions in towns and cities by means of innovative delivery strategies, for instance by making greater use of cargo cycles.
- Incorporate rail freight and inland waterway transport into the supply of goods at the local level to a greater extent and establish connectivity between distribution operations and rail hubs and ports.
- Use local public transport vehicles and railway stations for freight transport.
- Make logistics services in rural areas more efficient while ensuring the provision of goods and services.
- Create the conditions for the operation of drones on the last mile.
- Take account of the needs of multimodal logistics in regional and land use planning and ensure that the necessary areas are included in the plans.

Implementation steps

1. The Federal Ministry of Transport and Digital Infrastructure will fund – without favouring a specific technology – the procurement of electric commercial and delivery vehicles including the related charging infrastructure for the last mile and will support research and development in these segments.
2. The Federal Ministry of Transport and Digital Infrastructure will fund data-based digital applications, for instance for route optimization on the last mile.
3. The Federal Ministry of Transport and Digital Infrastructure will fund research projects to find answers to unresolved issues for the operation of autonomous vehicles in real world traffic conditions in towns and cities, also focusing on freight traffic. Operating scenarios
for freight transport on the last mile will be taken into account in new legal rules governing autonomous driving.

4. The Federal Ministry of Transport and Digital Infrastructure will support the evaluation of pilot projects, to be approved at the local level, on the use of tele-operated delivery robots on public roads. On the basis of the findings, it will then progress the creation of the regulatory framework for regular operation.

5. The Federal Ministry of Transport and Digital Infrastructure will also support, among other things, innovative drone applications on the last mile with a coordination unit for drone test beds, a “Drones and Air Taxis Action Plan” and a call for applications for funding.

6. The Federal Ministry of Transport and Digital Infrastructure will fund the preparation of logistics strategies, feasibility studies and the implementation of innovative freight transport and delivery strategies on the last mile. This will also include funding micro depots, from which goods are delivered on the last mile, especially by cargo cycle.

7. Within the scope of the implementation of the Rail Freight Masterplan, the Federal Ministry of Transport and Digital Infrastructure will set up a sub-working group with industry representatives to examine how, in the future, more goods can be moved by rail into large cities and will identify pilot projects in major cities. The integration of inland waterway transport into pilot projects is also to be examined.

8. The Federal Ministry of Transport and Digital Infrastructure will lobby to ensure that the federal states and local authorities implement innovative pilot schemes, for instance for the use of local public transport, night-time logistics or underground pipes for the movement of goods.

9. To simplify the approval procedure, certificates for night-time logistics are to be developed.

10. The Federal Ministry of Transport and Digital Infrastructure will lobby to ensure that spatial planning and land use planning tools are adapted to cater for the needs of the last mile.

11. The Federal Ministry of Transport and Digital Infrastructure will appreciate it if the local authorities make available central points of contact for freight transport issues.
Addressees

→ Federal Ministry of Transport and Digital Infrastructure for items 1 to 5, 6
→ Federal Ministry of Transport and Digital Infrastructure, federal states and local authorities for items 8, 10
→ Local authorities for item 11
→ Federal Ministry of Transport and Digital Infrastructure and industry for item 7
→ Industry for item 9