DIE BAHNINDUSTRIE.

VDB VERBAND DER BAHNINDUSTRIE IN DEUTSCHLAND E.V.

THE END OF MOBILITY AS WE KNOW IT

NEW PARTNERSHIPS FOR FUTURE MOBILITY

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It all begins with a mission. Zero emissions while maximising the travelling experience as well as achieving sustainable economic growth. This mission is what directs our efforts. Our industry aims to set global standards to benefit people, protect the climate and promote prosperity.

In many respects certainly, mobility today works very well; but to be honest, in many ways it does not. The same situation can be seen all over the world - endless crawling columns of trucks on the motorway, breathtakingly overcrowded metros in megacities during rush hour and miserable cross-border connections. But we can do better – much better.

We intend to create the most climate-friendly and most fascinating means of transportation that has ever existed in people's everyday lives. This calls for nothing less than a mobility revolution: The End of Mobility As We Know It. This mobility revolution is creating new high-tech solutions that are flexible, digital, sustainable, and attractive. New solutions that are making the rail network resilient and more robust. Innovative solutions that create sophisticated, intermodal mobility concepts, tailored to the needs of individual passengers. In short: progress that serves people.

Together with our partners around the world, we aim to push the boundaries of what is possible, time and time again. For people today and for future generations. To put it in a nutshell - in partnership, we aim to reinvent mobility.

Andre Rodenbeck
President

Dr. Ben Möbius
Managing Director

Axel Schuppe
General Manager

CLIMATE PROTECTION FOR THE PLANET **RAIL 4.0**

Blue skies over our cities? Green logistics for sustainable economic growth? Unhindered travel across borders? One hundred percent travelling experience with zero percent emissions? How does the future of mobility look? The climate goals dictate nothing less than a mobility revolution. Mobility that inspires, connects, and unites, while protecting the climate sustainably – this is the mission of the railway industry in Germany. The approach we need to take? Provide options, rather than imposing prohibitions. Climate protection and individual freedom of choice should not be mutually exclusive. Green Mobility is quite simply very compelling. The railway industry in Germany has a clear mandate – to provide solutions for intelligent, emission-free mobility for the well-being of present and future generations, all over the planet. Future mobility is one of the greatest challenges of our time.

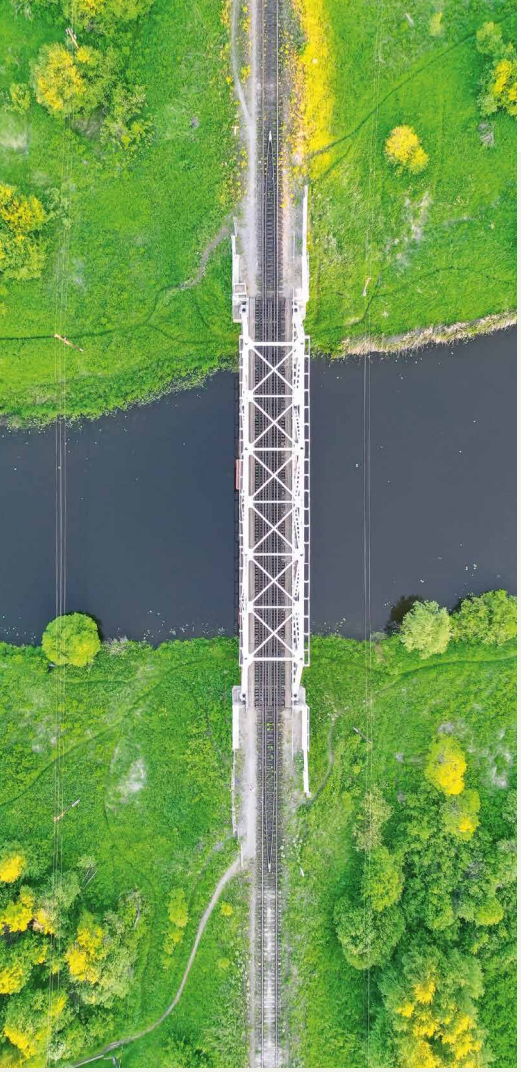
The rail industry is already well on track to achieving zero emissions. Electromobility? This has been a reality for over 140 years; 90 percent of the mileage travelled on German rail networks today is powered by electricity. When using green electricity, this results in emission-free mobility. Rail transport today already accounts for less than one percent of GHG emissions in the transport sector. One thing is clear: Future Mobility calls for the intermodal integration of all means of transport. That is why the future needs to be networked.

Forest fires, heat records, floods – the climate crisis is tangible and real. Everyone can take action, in the transport industry, too. Today for example, this sector is responsible for 25 percent of GHG emissions in the EU.

Transport is the only major sector in the EU that has not yet reduced its carbon footprint. This is because substantial, considerable efficiency gains counteract the increase in traffic. The bottom line is that very little climate progress has been made. For example, to meet the Paris climate targets, GHG emissions in the EU must be cut by 40 percent by 2030, and by 80 to 95 percent overall by 2050 (compared to the 1990 baseline).

Climate change must be dramatically slowed if people and nature are to adapt. This will require a striking acceleration of new, zero-emission mobility. Or as António Guterres, UN Secretary-General put it: “Delay means death”.

Where electrification by means of overhead lines has not been implemented or is not economical, alternative drive concepts “Made in Germany” can provide systematic decarbonisation. The potential is unique and available today as proven technology. The railway industry in Germany is the global leader in the development of hydrogen, battery and hybrid drives. Trains based on the new drive technologies have been in our portfolio since 2016, enabling gaps in electrification infrastructure to be elegantly bridged.



Energy efficiency is a central pillar of the mobility revolution, since even electricity produced by recuperation is not inexhaustible. Besides, it is needed more and more in other sectors. The more mobility consumes, the less is available for other industries. At the same time, the demand for mobility is increasing. The rail system today is already highly energy-efficient; for example, routine recuperation of braking energy is already well advanced. The amount of energy recovered and returned to the network is 7 percent in rail freight transport, 10 to 15 percent in long-distance passenger rail transport and 20 to 40 percent in local passenger rail transport, depending upon the route profile. Automation reduces the energy requirement of a metro system by almost a third, lightweight construction and intelligent, adaptive components are radically more energy-efficient and the use of overhead lines means that the input energy is utilised on an almost one-to-one basis. But there is still much more to be done. Our mission: more mobility with zero emissions and maximum energy efficiency.

Future Mobility is climate neutral. The railway industry in Germany is the figurehead, the icon of a new era. The century of rail has only just begun.

Alternative Drives “Made in Germany”

Battery-driven trains are already operating on journeys of around 200 km without overhead lines. They consume 33 percent less energy than internal combustion multiple units and 50 percent less energy than electric diesel multiple units, at a distance of 5 km between stops. If a battery-driven train is powered by green electricity, around 90 percent of CO_2 emissions are eliminated.

Hydrogen trains operate electrically, emission-free, powered by fuel cells, completely independent of overhead lines, with a range of up to 1,000 kilometres. They save around 260 t of carbon dioxide p.a. compared to diesel locomotives (LNVG, under practical conditions).

Hybrid locomotives with dual drive, diesel and overhead line, save 950t CO_2 p.a. in the rail freight sector when the overhead line is used 80 percent of the time.

Energy-efficient components such as intelligent air conditioning systems, save up to 30 percent of the energy required.

Weight reduction achieved through lightweight construction saves up to 5 percent of the energy required.

Recuperative braking allows up to 40 percent of the braking energy to be fed back into the overhead line.

GET YOURSELF CONNECTED
FUTURE HIGHSPEED MOBILITY

Just imagine: jumping on the train in Berlin in the morning, getting off in Rome the same evening, just in time for some tagliatelle or lasagne. And while "on the road", reading while enjoying a good cappuccino, engaging in conversation, playing with the children, listening to your favourite music, and working effectively. That is precisely the vision of the EU. Rail 4.0 "Made in Germany" can contribute to this goal. Faster, increasingly digital, greener – this is how the train can become the first choice throughout the world.

Limitless? Today, there are still more than 20 different national train control systems within the European railway network. Consequently, locomotives still have to be changed at borders, multiple train control systems have to be installed on board and there are even language barriers – anachronisms such as these are holding Europe back.

Just in time? In Europe, around 21 percent of all long-distance trains were delayed in 2018[1]. In July 2022, only 59.9 percent of all long-distance trains in Germany reached their destination on time[2]. Motorists in Germany were stuck in traffic jams for about 40 hours in 2021, in London the figure was as high as 148 hours; Parisians lost 140 hours and travellers in Brussels 134 hours on congested roads[3].

Sustainable? In Europe, only eight out of every 100 journeys are made by rail[4]. If the top 250 short-haul flights in Europe, which account for around 85 percent of European air passengers were replaced by train journeys, around 23.5 million tonnes of CO_2 could be saved every year[5].

Ultra-modern high-speed trains will deliver the best quality of travel in the future with interoperable systems, digital driver assistance, optimised energy efficiency, broadband on-board infotainment and precisely scheduled, punctual journeys. New interior designs featuring a high degree of spatial flexibility improve not just the passenger ambience but also the cost-effectiveness of operation. At the station, passenger information systems guide passengers in real time to lifts, and thus also provide support for people with disabilities or travellers with baby buggies. Rail 4.0 is all about service, accessibility, reliability – and imparting a captivating experience.

Enabling families in future to arrive by train at their holiday destination in a more relaxed state of mind. Allowing friends to explore the world together, without having to worry about borders. To make the journey for the elderly easier. Enabling travellers to reach megacities internationally, directly from city centre to city centre, as quickly as by plane – with a significantly lower CO_2 footprint. Connecting airports intermodally, in a carefully thought-through fashion – allowing aircraft in future to primarily service the global long-haul routes, for which they are predestined.

Twice as many passengers on high-speed trains in Europe by 2030 – that is the goal of the EU Green Deal and quite rightly so. Germany's 2021 coalition agreement also sets a target of doubling rail passenger numbers by 2030. Consequently, the European rail network needs both increased capacity and greater interoperability. Digitalisation is the game changer for delivering both. The European Train Control System (ETCS) enables up to 25 percent more traffic on existing lines and blends over 20 different national rail systems into a single European standard.

Digital train control systems enable trains to operate at shorter intervals, which in turn allows more trains to travel the same section of track in any given time. For passengers, this results in shorter journey and waiting times while enjoying maximum on-schedule performance. Germany, Europe and many other countries around the world are therefore vigorously promoting the digitalisation of the railways. As the global leader, the railway industry in Germany has been exporting digital rail technology for many years, for example to Norway, Sweden, Spain and Switzerland.

Future mobility depends upon digital infrastructure and digital trains. More capacity, increased on-time performance, greater energy efficiency – these goals can only be met within a digital framework. This is how Green Mobility can be achieved – and only in this way. The railway industry in Germany is ready and willing to be a global partner in this new era of mobility.

Even today, it is apparent that customer demand is attracted to the best option available. More and more travellers are quite simply drawn to digitised trains, running on a digital rail network:

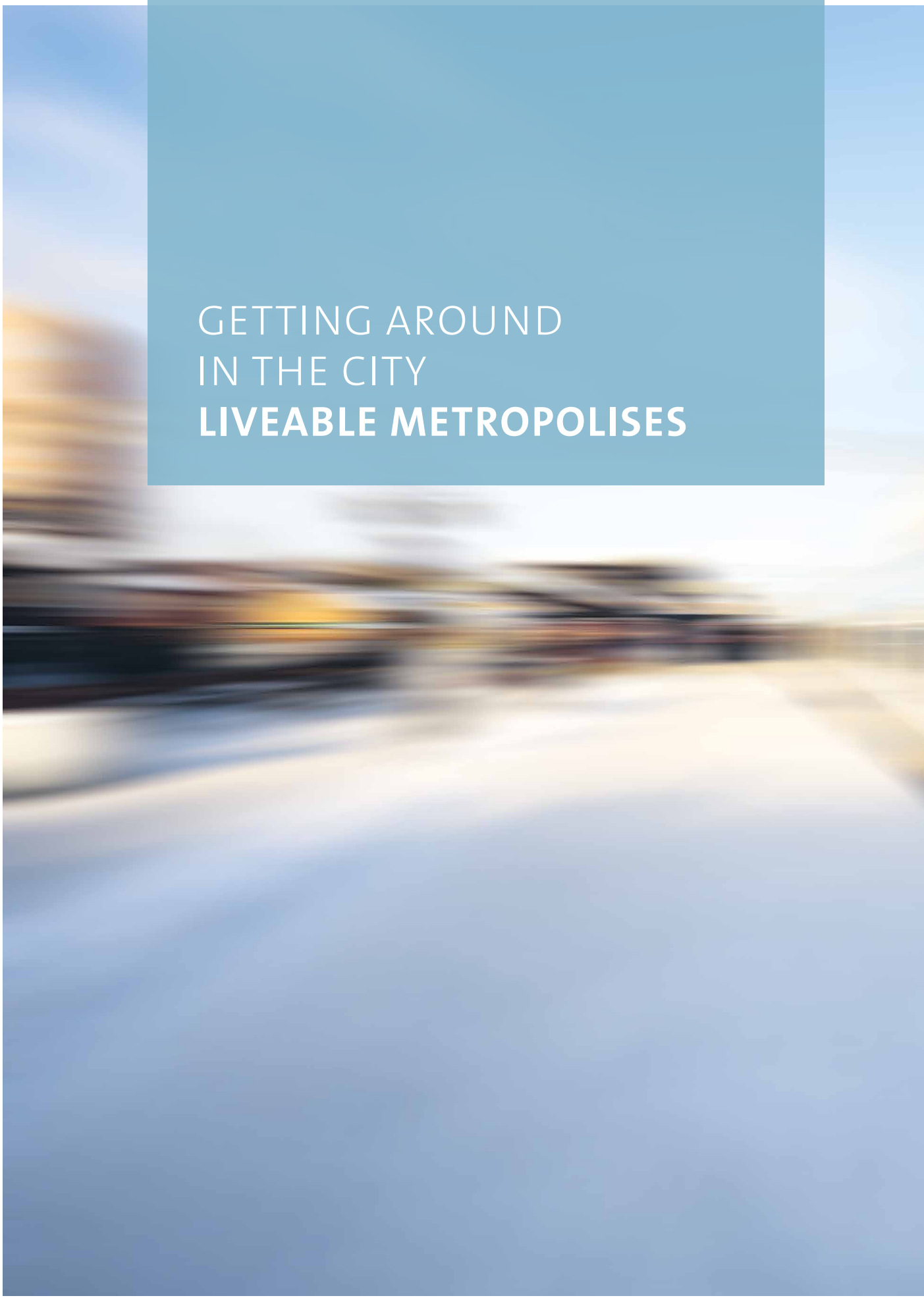
In **Germany** over one million people switched from road and air travel to the ICE high speed train for the journey from Berlin to Munich in 2018.

In **Italy** the market share of rail travel between Milan and Rome rose to 73 percent in 2016, up from 36 percent in 2008. Between Milan and Naples, the absolute number of air passengers fell by 40 percent between 2011 and 2016.

In **France**, rail travel commands a 90 percent share of the market on routes of less than two hours.

In **Spain**, around 63 percent of travellers on the Madrid-Barcelona route use the train; back in 2008 the connection was still one of the busiest air links in the world.

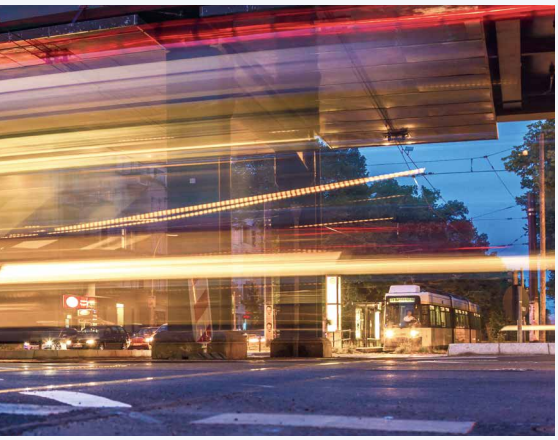
In the **US**, for many years the plane was the preferred mode of transport on the routes from New York to Washington and Boston. While at one time only about 30 percent of travellers between New York and Washington took the train, ten years later, in 2012, three quarters were already using the train connection, taking only about three hours, that links the two cities on the Northeast Corridor.



GETTING AROUND IN THE CITY **LIVEABLE METROPOLISES**

So is everything better by train? Let us be honest, squeezing into a packed metro during rush hour is anything but a pleasure. Rail 4.0 is completely rethinking urban living environments. Autonomous metros (ATO) beat congestion – they run on intelligent infrastructure on a tight schedule that adapts to the volume of passengers in real time. Thanks to precisely calculated acceleration and braking actions, autonomous trains require significantly less traction energy. The smoother acceleration and gentler braking is also noticed and appreciated by the passengers. The bottom line: greater flexibility, more capacity, increased satisfaction, even more customers – and all this with fewer emissions. What is the big difference that this makes to people in all walks of life? They will never again feel like sardines packed into a can, but are assured of a free seat with no wait.

As gateways to mobility, railway stations are becoming intermodal travel hubs. The station of the future will feature corridors of fresh air and use rainwater effectively; roof areas covered with greenery will further improve the quality of the air. The railway station of the 21st century is a meeting place as well as an intermodal nerve centre for different means of transport. The objective is the basic human need for mobility.



According to estimates, the **global urban population** is growing by two people every second; in other words, 172,800 new city dwellers every day. 80 percent of the world's population will live in cities in 2030. By 2030, there will be 40 megacities on earth, home to more than 10 million inhabitants.

Cities are responsible for around 70 percent of the energy-related **greenhouse gas emissions** worldwide. Rapidly growing cities across the globe are facing similar challenges: pollution darkens the sky, space is becoming scarce, ludicrous traffic jams rob people of time they would rather spend on more important things, with friends and family.

Mobility in many population centres today is already at the limit – or has exceeded it. All too often, smog and clouds of fine particulates reach levels that are hazardous to health. All over the world, people want better ways to get to work, to visit the doctor and to travel to university or school.

Quiet, lightweight, space-saving, trams provide services for mid-range journeys. In the station building, data-driven light guidance systems navigate travellers to the free seats in the carriages of regional trains. From the city centres to the residential areas in the suburbs, or to recreational areas in the countryside – the connections between the regions and the cities are a benchmark for the quality of life. The more attractive regional rail transport becomes, the easier it is for people to choose their preferred place of residence freely, for example to the benefit of their family. Digital monitoring ensures a greater degree of safety in trains and on the track. Real-time data provides information on the fastest connections and integrates the different modes of transport into a personalised travel package. Mobility on Demand provides a seamless travel experience from door to door.

The urban environment also offers a number of intriguing opportunities for innovative logistics. Intermodal, highly automated terminals in urban locations can serve as smart city hubs and revolutionise the distribution of goods in urban areas. Trams, metros and commuter trains, converted to carry freight, make the Last Mile green and boost economic development.

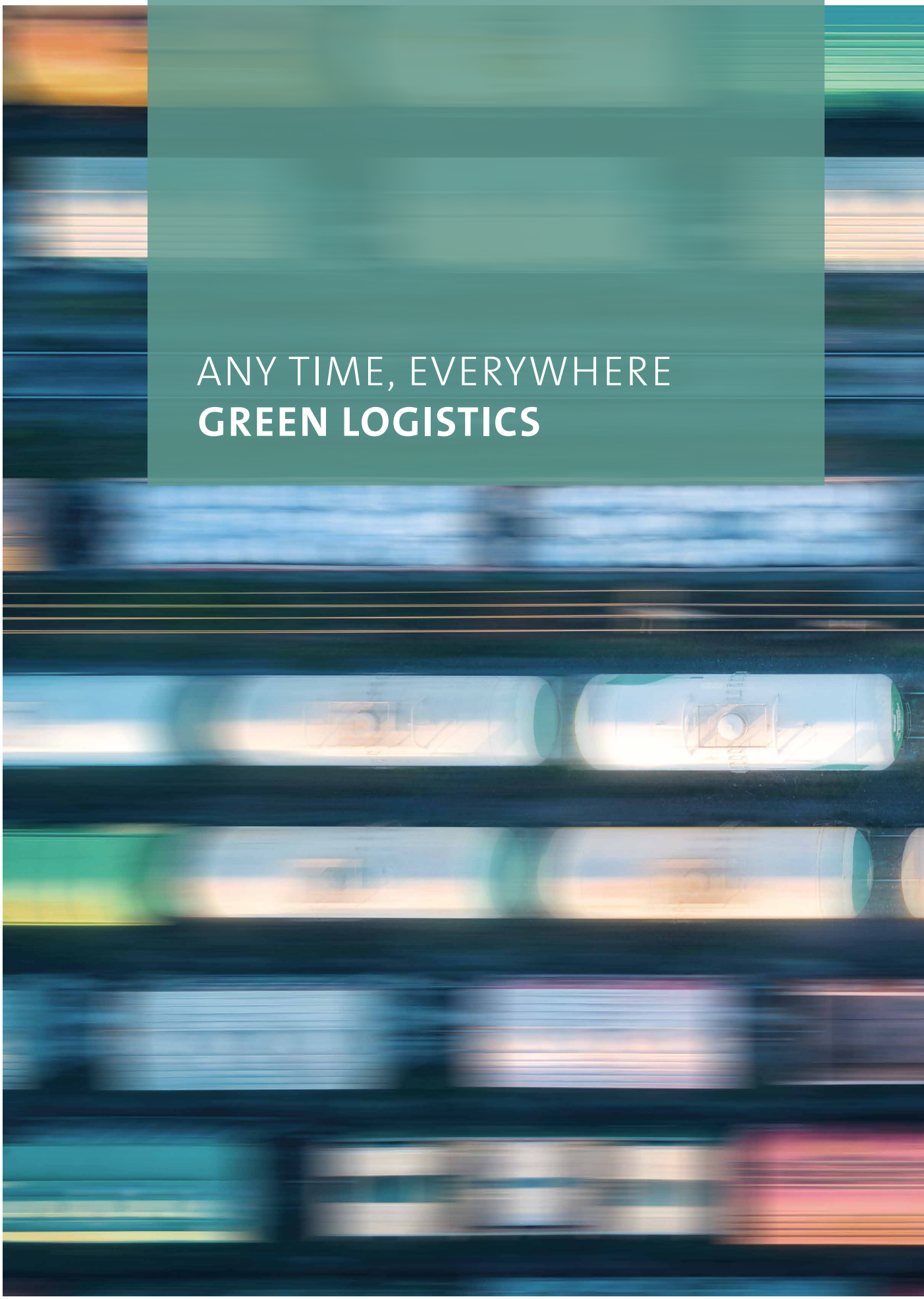
Future Mobility creates people-friendly metropolises. Rail 4.0 defeats traffic jams, air pollution and creates clean mobility, with the promise of a better quality of life!

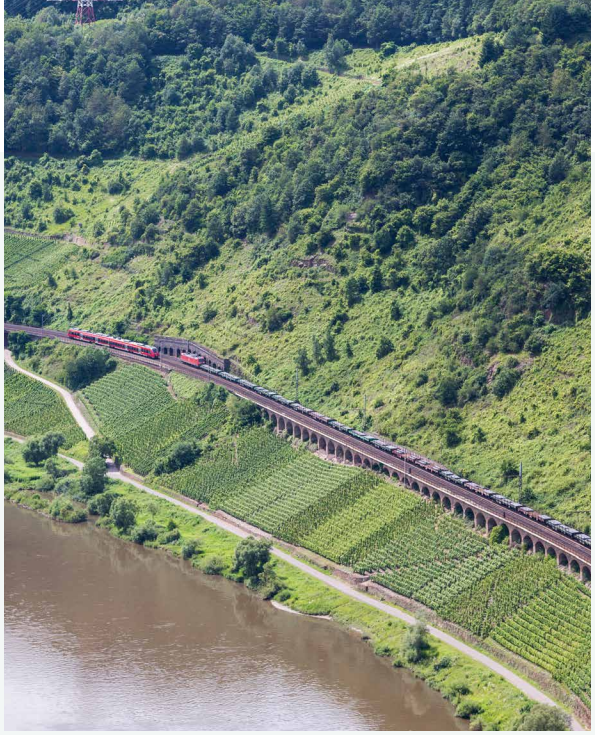
Automatic Train Operation (ATO): Today, whether in Vancouver, London, Sao Paulo or Singapore, millions of passengers already travel on fully automated trains on a daily basis. ATO technology:

30%
Energy saving

Punctuality
99%

- enables more trains on the same line through safer, tighter scheduling intervals
- increases ride comfort by automating starting, accelerating, driving, coasting, braking and stopping
- optimises speed profiles with less braking manoeuvres
- paves the way for predictive driving in combination with capacity and traffic management systems and the Future Railway Mobile Communication System, FRMCS


ANY TIME, EVERYWHERE
GREEN LOGISTICS

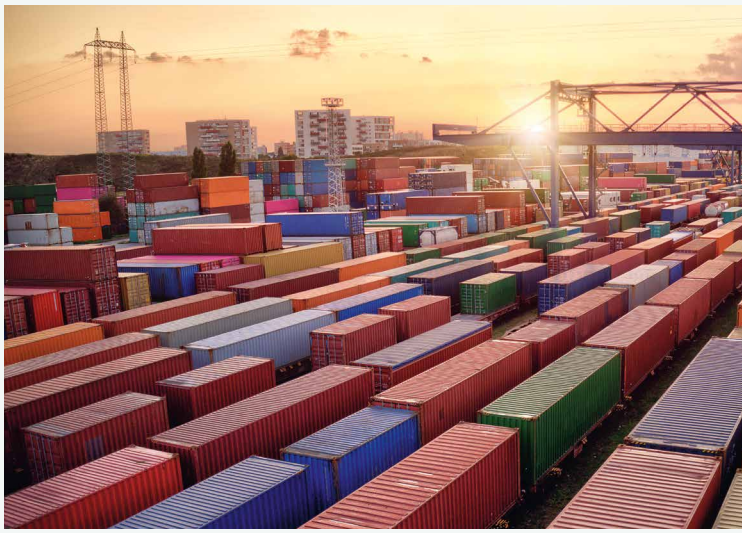


Roads and motorways throughout the world are already **reaching the limits** of their capacity. Huge traffic jams disrupt supply chains, hinder individual transport and adversely affect the climate. The volume of freight transport will continue to grow, in Germany for example, by 38 percent in 2030, compared to the figures for 2010[6].

Under the **European Green Deal**, approx. 30 percent of goods in Europe are to be transported by rail by 2030. In Germany, the market share of rail freight transport has stagnated at around 19 percent; in the EU, it fell recently to approx. 17 percent[7].

The use of **outdated technologies** – such as the old manual screw couplings for wagons – makes for time-consuming, cost-intensive and in some cases risk-intensive operations in urban rail transport, hampers intermodal networking and consequently slows down growth.

Frankly, the endless convoys of trucks on motorways have very few fans. Motorists, if nothing else, agree that first and foremost, freight transport is a task for the railways. But in order to become the backbone of an intermodal logistics system, the railways must up their game. The rail freight system of the 21st century needs to be emission-free, intelligent, interoperable, affordable, disruptively efficient – and intermodal. The sustainable logistics system of the future needs to be a team sport. No single mode of transport will be able to cope with the projected growth in global freight transport alone and simultaneously decarbonise. An integrated logistics system can optimise the performance of the individual modes of transport and exploit their interaction. In order to relieve the pressure on the motorways, the main mode of transport needs primarily to be rail, while trucks are predestined for the shorter distances in the feeder and final distribution stages. Digitally and intermodally upgraded, freight rail transport will unleash its full potential in networked logistics.



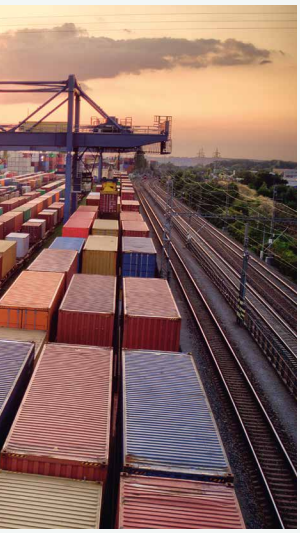
Digitization is bringing about a quantum leap: Who arrives where and when, and what free capacities do they have? Information on position, capacity utilization and journey duration forecasts are available in real time. This is how, for example, port terminals and freight trains communicate in the Port of Hamburg. Transported goods, such as containers, are continuously localized. Sensors permanently monitor the condition of the cargo (temperature, mechanical shocks, weight, etc.). The precise weight is measured digitally and any excess weight or an uneven distribution of the load is detected.

Tracking and tracing freight wagons also facilitates the exact determination of the mileage covered. This is a key factor when calculating return on investment. Digital technologies measurably reduce operating costs. Automated processes also unlock great potential for optimisation in expensive shunting operations. Infrastructure 4.0 and Vehicles 4.0 – the two must work smoothly, hand in hand. Perfectly synchronized timing, automated train formation, virtually coupled trains, computer-aided instructions to the driver supporting semi-automated energy-saving vehicle movements – all of these areas harbour enormous potential.

At its heart is a revolutionary innovation "Made in Europe" – the Digital Automatic Coupling (DAC). Its design ensures a continuous data connection throughout the entire train and thereby acts as a facilitator and catalyst for automation, data-based monitoring, predictive maintenance, interoperable European solutions, end-to-end smart, intermodally networked freight trains and efficient single-wagon transport.

People living near the tracks also have every right to expect low-noise rail freight transport – it is precisely this combination of different technologies that can drastically reduce noise emissions even further.

Future Mobility needs Green Logistics – and Green Logistics needs Rail Freight 4.0. This is the only way to secure prosperity through trade – and protect the climate!



The Digital Automatic Coupling (DAC) is not just another coupling. It provides the key to sustainable, intelligent logistics in the 21st century:

It increases capacity in (automated) shunting operations by up to 40 percent, significantly reduces process costs and reduces the workload for employees, improving safety in the workplace.

+ 40 %

It holds the promise of a permanent annual benefit potential of approx. 760 million euros in the EU states as well as the UK, Switzerland and Norway[8].

760 Mio. €

It upgrades and readies freight rail transport for both ETCS Level 3 (the signalling system of the future) and electro-pneumatic braking. As a result, longer, heavier and faster goods trains will be able to run on the existing rail infrastructure. This represents a gain in capacity of between 10 percent and 15 percent without the need to build new lines.

10–15

BIG DATA
NEXT GENERATION

The mobility of the future is geared towards its customers – and not the other way around. That is what data is for. Easily accessible, universally valid tickets from door to door on the smartphone. Intermodal, non-discriminatory and cross-operator real-time information on connections and current capacity levels. On-demand mobility between the doorstep and the bus stop. Mobility-as-a-Service platforms that integrate mobility services through an intermodal solution tailored to the customer's needs. Data increases both journey comfort and convenience.

As well as reliability and punctuality. Disruptively. How about trains that can detect faults before they occur? And no more breakdowns as a result. Delays and detours resulting from faults and failures, can be consigned to history. Data allows precise forecasts. Digital diagnosis and data analysis are revolutionising maintenance procedures. It is no coincidence that the technical services sector is one of the most vigorously growing business areas in the railway industry globally.

"The train has been cancelled due to a **breakdown**". Announcements like these exasperate passengers, and rightly so. Faulty vehicles are usually taken out of service so that the problem can be rectified in a maintenance depot. This, or some similar procedure, is all too often the way maintenance still looks like today.

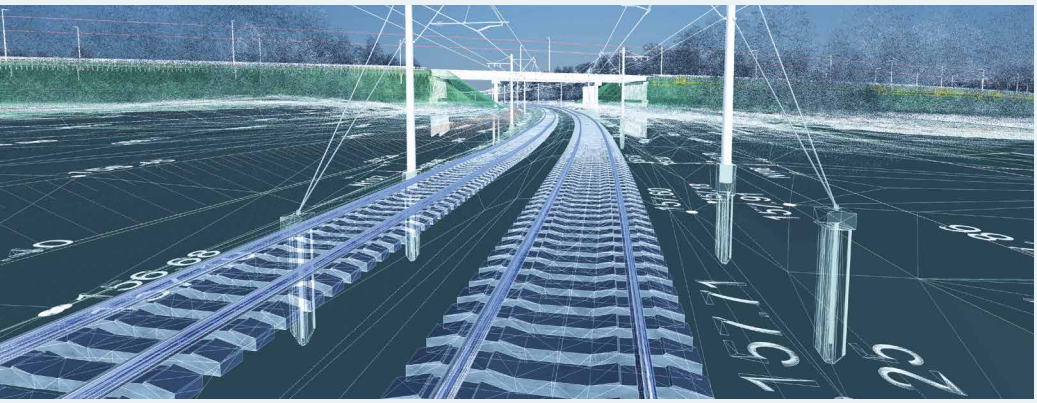
Real-time information on the status of operations and components is available, but it does not always reach the right person.

Experience gained with the 9-Euro-Ticket, which was introduced in Germany for a limited period, shows that for 34 percent of passengers, the fact that it was valid for travel throughout the entire country was the decisive factor for their purchase[9]. Fragmented **booking and information systems** that require a multitude of different apps and tickets for a journey on public transport, even within national borders, are not particularly customer-friendly.

Predictive maintenance anticipates when failures are likely to occur so that preventive action can be taken in good time. On-board systems seamlessly monitor mileage, operating, temperature and other condition data from sources such as wheels and brakes, measure weights and loading, locate wagons precisely via GPS and transmit data via mobile radio for live monitoring. Trackside systems precisely register the condition of a passing vehicle visually, acoustically and thermally. High-performance cameras and laser technology are deployed for this purpose. Intelligent points and components raise the alarm before they break down, failures are avoided and train traffic continues to run reliably. Furthermore, the optimised utilisation of components saves resources and energy, as unnecessary replacements are reduced, no longer slavishly following fixed intervals.

Intelligent maintenance also includes systematically exploiting existing product expertise wherever possible. It does not make sense for manufacturers to (be forced to) lose sight of their products after the warranty period. After all, products can be sustainably optimised, through a deeper understanding of their life cycles. One way forward could be availability models. The approach: The manufacturer not only sells the trains, but also guarantees, by taking over the maintenance, that the trains will continue to be in good working order for many years to come. The analysis of the enormous amounts of data is of central importance. In this process, human experience will remain indispensable.

Future mobility requires both using data intelligently and adequately protecting it. Only if the full potential of the operational and mobility data generated is exploited, can the optimum transport service be delivered – customisable, intermodal and intelligent.



Building Information Modeling (BIM)

Building Information Modeling – BIM for short – is a digital method that holds great potential for the planning, construction and operation of infrastructure projects. Different building trades and project participants can work together in sync on one and the same digital model, instead of sending drawings back and forth, which costs time and introduces the potential for errors.

It also allows the regulatory authorities to continuously monitor the planning status and streamline testing procedures.

The models allow errors which might only have been noticed on the construction site using traditional planning methods, to be detected and corrected at an early stage.

All this saves time and money. Digital planning methods such as BIM disruptively accelerate processes and reduce the sources of error. Successful implementations in track construction, for example, show that BIM can be used to optimise construction methods, construction logistics and the track possession concept for trades working in parallel, as early as during the planning stage.

STRONG CYBERSECURITY
FOR SAFE RAIL MOBILITY 4.0

Digital networking of mobility has created entirely new open flanks for cyberattacks and data misuse. Cyberattacks by hackers, organised crime, or other adversaries target data integrity, aim to paralyse parts of the network, undermine security systems or even seize control remotely.

In the event of a **crisis**, loss of control of the critical infrastructure (CRITIS) rail could result in supply disruption and jeopardize public safety. Cyber manipulation could affect the economy and, in the worst case, endanger human lives. Those who no longer fully comprehend their own CRITIS will potentially become vulnerable and relinquish digital sovereignty. Broadband infrastructure (5G), cloud data services and apps also need to be trustworthy.

Modern CCTV systems generate high-resolution video material on board public transport vehicles day after day, supplemented by data from WIFI, sensor technology and personal information from mobility apps. In the EU, for example, the data is anonymised and deleted within tight statutory deadlines. But could equipment manufacturers from third countries access video material to archive it? Could this result in violations of the protection of travellers' personal rights? These sensitive civil rights issues need to be addressed.

It sounds like the plot of a Hollywood thriller: manufacturers hide malware in the surveillance camera system of an underground rail carriage, which records the movement profiles of officials relevant to the security services. Sensors on the train secretly tape confidential conversations. A weak point in the software that controls the train allows it to be hacked by foreign agents or terrorists. Today, rail transport is characterised by an extremely high level of cyber security. However, the digital networking of rail creates new attack surfaces for cyberattacks and data misuse. To keep the storyline confined to films, cybersecurity is absolutely essential.

In the future, the Internet of Things will be woven into the rail transport system. As a result, in the 2020s, cybersecurity will become infinitely more complex. It is crucial to recognise and seize the opportunity to build a secure Rail 4.0 "Made in Europe". Potential security threats arising from digital connectivity are tackled by the rail industry in Germany in a three-tiered approach: prevention, detection and response.

Cybersecurity must be raised to a high level of political priority. The cybersecurity of the strategic rail sector is an essential component of economic and political sovereignty. Passengers too, have a right to safe mobility and the untroubled access to digital services. Cyber data protection must also be considered in public tenders. All of the bidders should be required to verifiably guarantee the same standards of data protection. Policymakers should not sidestep legitimate questions on the protection of passengers' personal privacy rights when using digital rail transport. In the US, data protection and cybersecurity in the context of public rail procurement have been publicly discussed for years now. On a Democratic Party initiative, a procurement reform, the Transit Infrastructure Vehicle Security Act, was passed in December 2019, which prevents public funds from being disbursed to Metro projects in the US awarded to state-controlled or subsidised bidders.

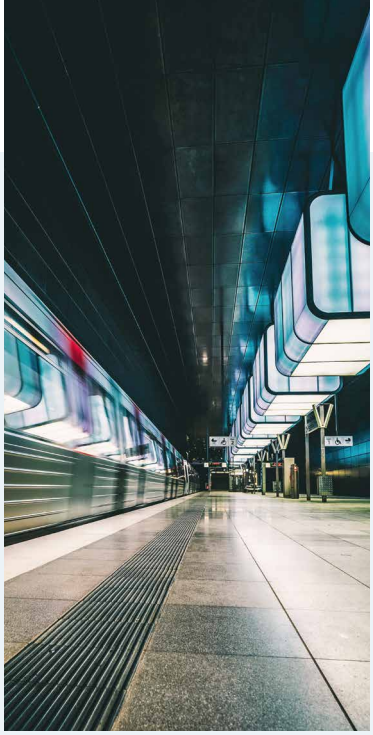
Future Mobility demands robust cybersecurity. Since railways are the lifelines of a modern society, protecting them against cyberattacks and data manipulation in the future is of utmost political relevance. Rail 4.0 without strong cybersecurity "Made in Europe" may result in security-critical dependencies. Digital rail must also conform to data protection legislation. The protection of personal rights is the foundation of public confidence in Rail 4.0.

1. **Prevention**
While security-by-design focuses on security aspects that are already at the core of a product's development process, security-by-default is concerned with embedded security settings. In other words, the default settings of a product should be the most secure settings possible. Effective prevention relies not only on technical remedies, but also on a clear definition of processes and responsibilities, along with a broad awareness of cyber security threats among staff and customers.

2. **Detection**
Effective detection systems identify and isolate threats before they spread.

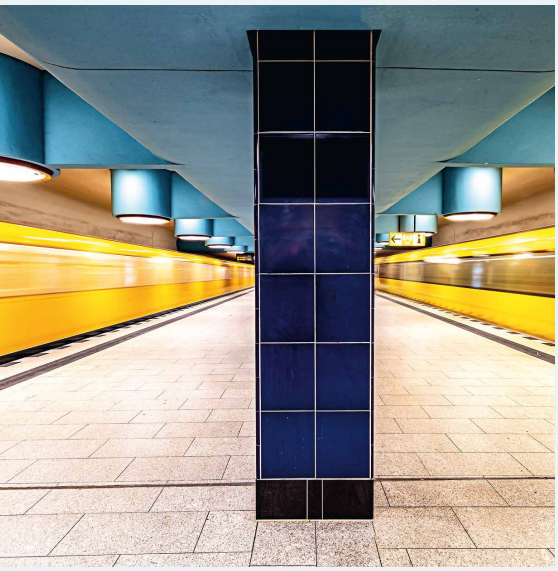
3. **Response**
An adequate response must be guaranteed by closing security vulnerabilities and delivering software updates where necessary.

NEW PROCUREMENT
FOR NEW MOBILITY



Trains have always been a symbol of pioneering spirit. And at the same time, they were always considered, in Saint-Exupéry's words, to be "a modest friend who comes by every evening at six". Basically, that's still what it's all about today – as we stand at the threshold of the next mobility revolution. Procurement plays a very decisive role in this. Will the train be on time – because the contracts awarded stipulate intelligent maintenance that prevents almost 100 percent of breakdowns? Does the metro run more frequently during rush hours – because the tenders placed value on automated driving? Does the new tram embody a grandiose design language – because this criterium was rated in the awards? Is the station still safe late at night – because digital monitoring supports the security staff? – Award criteria determine the daily quality of life and the commercial success of the project.

Only if the entire life cycle is evaluated can we achieve climate efficiency that also incorporates the use of raw materials and the energy balance. The right procurement procedures bring the best trains into the market faster. Therefore, modern requests for tenders must move away from an often inflexible focus on the purchase price, towards the most economical offer: greater weighting of life cycle costs, sustainability, price-performance ratio and design. When public procurement procedures make the most of taxpayers' money, they contribute to the quality of life and climate protection to the maximum degree.



The cheapest instead of the best supplier? That simply will not do in the 21st century. Because creative and sustainable economic solutions fall through the cracks too easily. Innovation needs more breathing space. A far-sighted, climate-friendly procurement culture must impart stronger momentum to the evolution of rail, to deliver the next level of a service that is appealing to every individual expectation and every lifestyle. Why shouldn't trains become more of an emotional experience again? For example, when their design transforms them into icons of the city they serve.

Frequent public transport users say they choose their mode of transport based 100 percent on travel time, 90 percent on price, 85 percent on comfort, 71 percent on sustainability and 53 percent based on design, according to the McKinsey consultancy[10].

Yet **public tenders**, which determine which technologies enter the market, all too often disregard these customer preferences when evaluating bids. This is what McKinsey writes, among other things, in a report jointly produced with the VDB.

Awarding contracts on the basis of the lowest purchase price is holding back innovation and stifling competition for the best solution. In addition, the risk of higher costs in development and in the life cycle, as well as the likelihood of supplementary work and budget overruns increases. The railways are in danger of falling far short of their potential.

MEAT

Quality

Service

Organisation

Criteria are already stipulated in public procurement legislation. The EU calls this the "Most Economically Advantageous Tender" (MEAT). The methodology? Defining economic efficiency in a more holistic way, sparking a competition of ideas, incorporating the demands of society more effectively, with no templates, no snapshots. The best should win the contract, not the cheapest.

EU public procurement law is showing the way: MEAT awards for Green Public Procurement (GPP). What is missing is consistent implementation. In future, MEAT criteria must be weighted with at least 70 percent in public tenders. Numerous state-of-the-art awards are already setting the pace in Germany, Europe and the world. Tendering bodies and industry are often partners in innovation. Best practice examples and benchmarks pave the way.

Future Mobility calls for courage. Quality and climate protection – in its Sustainable Development Goals (UNSDG), the United Nations also calls for sustainable public procurement across the board. It is time to put them into practice.

Calgary

Why not simply ask the passengers themselves how they envision their trains of the future? This is precisely what the Canadian city of Calgary did in 2018. Citizens voted online on design proposals for the new light rail system. As a result, the Calgary train resembles an ice hockey helmet and is now the trademark of the ice hockey-mad metropolis. This process creates a sense of identity. This process has transformed the new train, from what might have been just a train, into our new Calgary train. Incidentally, the design was the brainchild of a medium-sized railway company in Germany.

Wien

In Vienna, the expansion of the public transport network followed the principle of connecting every household within a radius of max. 500 m to a station. In addition, the City of Vienna has invested more than 400 million euros to offer cheap public transport tickets. The use of public transport has increased by about 10 percent points in the last 25 years and now stands at 38 percent.

AROUND THE WORLD

GLOBAL PARTNERSHIPS FOR FUTURE MOBILITY

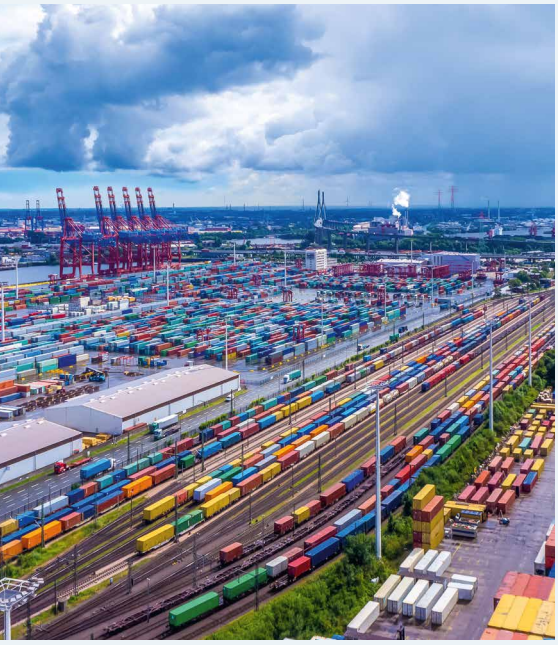
Global challenges are in need of global cooperation if we are to find the right answers. As the global market leader, the rail industry in Germany commands an export quota of over 40 percent, with many companies exporting around 80 percent. Part of the ethos of Germany's rail industry is a commitment to global partnerships, to markets that are open worldwide and to free and fair competition with the same ground rules for all.

As a global player, Germany's railway industry contributes to ecological, economic and social progress all over the world. In order to achieve this, a number of things need to mesh smoothly: our presence on global markets and the European domestic market as well as our commitment to Germany as a business location and of course "Made in Europe".

Rail 4.0 is revolutionising mobility around the globe. Together with international partners, the railway industry is implementing the best, often tailor-made mobility solutions worldwide. Personal encounters that build trusting, inspiring and mutually appreciative cooperation are at the heart of this outstanding export performance.

Sustainable project work creates the perfect win-win strategy for international partnerships. Germany's railway industry also promotes the development of on-site skills, by providing dual training schemes for local employees. Talented people from all over the world are always welcome. Germany's railway industry relies on international project teams, also working virtually, independent of their place of work.

Excellence, fairness, trust and openness. These are the cornerstones of the German railway industry's unique, global reputation. Exciting partnerships generate real customer benefits all over the world. The VDB manifests this strategy by leading trips for delegations, in its worldwide presence at trade fairs and forums and in countless other valuable encounters.



The openness of the rail industry's global market fell from 71 percent in 2008 to only 62 percent in 2020. In some regions, **market access** fell from 63 percent in 2009 to 19 percent in 2017[11].

Global growth of 2.3 percent p.a. is forecast for the rail industry market through 2025. However, **national protectionism** is hampering the dynamics of the global market[12].

Mandatory, extremely high **Local Content Requirements** (LCR) of often well over 65 percent in the rail industry are undermining competition between locations, leading to a parcelling of the global economy.

The VDB has been extraordinarily successful in facilitating international partnerships. For example, in the USA for the "Second Great Railroad Revolution"; by organising market development trips to every continent on earth; and with its three representative offices in China, which serve this highly dynamic market. Above all, this accomplishes one thing – progress that benefits all of humanity. While many partnerships have flourished for decades, new relationships are being added every day. Collectively, they are the heartbeat of the digital mobility revolution.

The architects of Future Mobility meet every two years in Berlin at the InnoTrans, a unique forum for innovations that are catapulting the transport sector into a new era. Like no other trade fair, InnoTrans is the epicentre of the mobility of the future – and of the excellent climate protection industries that are making it happen. More than 3,000 exhibitors from 60 countries and 153,000 trade visitors come to Berlin every two years, aiming to revolutionise mobility as we know it. The VDB and Messe Berlin cooperate very closely and trustingly for the world's leading trade fair of the railway industry.

Future Mobility depends upon global partnerships operating in a world at peace. Only by working together can we successfully implement the world's best solutions. As an experienced partner, the railway industry in Germany is ready and willing to play a part in writing a new chapter in the history of mobility across borders.

The export philosophy of the railway industry in Germany consists of four pillars of fair partnership:

Cost-effectiveness. Favourable purchase price, predictable life cycle costs over 30 years for example, instead of unpleasant surprises; quality with a unique price-performance profile.

Energy efficiency. Climate-friendly, economical mobility through cutting-edge drives, components and materials.

Intelligent maintenance. Predictive procedures, open standards and reliable spare parts supply without lock in conditions.

Cooperation. Long-term, fair cooperation, joint development of transport concepts, dual training on site, reliability and transparency.

OUR MISSION
OUR RESPONSIBILITY

The German Railway Industry Association VDB has a clear-cut mission: zero-emission mobility for people and for the planet. Mobility for climate protection, social connections, individual freedom and economic prosperity. The VDB represents around 220 companies – the architects of Rail 4.0. Who are the creators of the next mobility revolution? The more than 54,000 people directly employed in our climate protection industry. They digitise, electrify and decarbonise, they re-imagine train design and improve the quality of travel and life worldwide. If you want to use your talents to make the world a better place, you are very welcome – come and join our team.

Who we are. The members of the VDB are constantly reinventing mobility. Globally leading system houses, specialised medium-sized "hidden champions" and dynamic start-ups – it is the interplay that counts. Thanks to its around 30 working groups and expert committees, the VDB possesses outstanding professional competence. The member companies not only benefit from this unique network – they also contribute to it.

Member companies

+200

DIRECT

54,000

Employees in Germany

150,000

INDIRECT

Internationally, the VDB is a renowned, well-respected point of contact. From delegation trips to our offices abroad – we work towards achieving the best solutions worldwide. For German and European political bodies, ministries, the scientific community, schools, international institutions, the press as well as for operators and customers, the VDB is a knowledgeable, reliable and creative partner. The VDB is a member of the European umbrella organisation Unife and maintains close partnerships with the French, Austrian and Swiss sister associations for instance; it is also a member of platforms of the EU Commission and the German Federal Government. The VDB represents the railway industry in political discourse with a powerful voice – and in the context of social responsibility for the common good.

Principle of ethical climate protection. The VDB naturally stands for peaceful and open coexistence worldwide. The VDB strongly condemns Russia's war of aggression against Ukraine, which is in violation of international law. The VDB fully supports all sanctions. Our heartfelt solidarity is with the people of Ukraine. Wherever possible, we provide help. This war and the terrible humanitarian suffering must stop immediately.

Success has a foundation that we never call into question: ethical values. That is why we created the VDB Code of Conduct (CoC). In addition to strict compliance with the law, transparency, honesty, fairness and decency are the benchmarks of our conduct as a corporate citizen. This is how we earn the trust of our partners. Simultaneously, we are committed to our social mission.

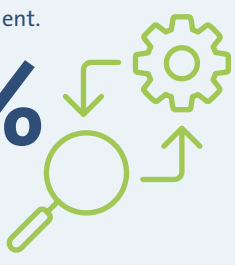
Our aspiration is to be a role model – both in terms of products and behaviour. The rail industry in Germany is a committed advocate of Corporate Social Responsibility (CSR) in accordance with the principles of the UN Global Compact (UNGC), which we actively promote in our sphere of influence. For climate and environmental responsibility (emission-free mobility, resource efficiency). For workers' rights, social responsibility and occupational health (ILO conventions, safe working conditions, trade unions, respect for all forms of diversity and individual personality, equal opportunities). Respect for human rights (UN Universal Declaration of Human Rights 1948, UN Guiding Principles on Business and Human Rights). For the fight against corruption (transparency, vigilance). Social responsibility does not end at the factory gates. A culture of watching and taking action for ethically sound behaviour in the supply chain is of fundamental importance for us. The result? We call it ethical climate protection.

Export quota

40%

Average of of the railway industry's turnover invested in research and development.

8%



Ø Annual turnover 2011–2021

13

Billion Euro

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