DB Systemtechnik
Activity Report
2018/2019

Photos, title: Alstom, Kristin Heinrichsmeier
Photos: Dr. Kai-Uwe Nielsen, DB AG / Pablo Castagnola

Our Knowledge: **Your Success**

We are:
Technical service provider for the DB Group FOC with its own fleet and locomotive drivers

We are capable of:
consulting on technical railway expertise
Design and modernisation of vehicles
Testing, approval and maintenance of vehicles and infrastructure

And we are unique:
We are familiar with the entire railway system
We offer all services from a single source
We are always on hand for our customers, no matter where they are

Die DB Systemtechnik:
Classic specialist railway knowledge with digital expertise

The "rail" mode of transport is currently experiencing unprecedented political support. After all, the railway is regarded as the mode of transport that makes it possible to achieve the climate policy objectives of the mobility sector. Consequently, considerable funds are now being invested into development of the infrastructure.

To achieve the objective of "doubling local and long-distance passenger numbers by 2030" and "increasing the modal split for freight transport to 25%" requires a substantial increase in both infrastructure and vehicle capacity.

DB Systemtechnik believes that it is ideally equipped to support rail transport companies and infrastructure managers in overcoming the challenges they face. ETCS, ATO and predictive maintenance are topics with a considerable impact on capacity and quality, and they are becoming increasingly important.

By combining digital expertise with specialised knowledge of classic railway technology, we are ideally positioned for the future. We invite you to take a look at the wide range of projects that we have been involved in over the past year.

Ihr Hans Peter Lang
Managing director
CTO Deutsche Bahn AG

Contents

Photos: Schweizerische Südostbahn/Christopher Hug, SIEMENS AG

SOUTH EASTERN RAILWAY

Switzerland

Continuous monitoring now also in Switzerland

Since autumn 2018, the Südostbahn (Swiss South Eastern Railway) has been working together with DB Systemtechnik and the Swiss Federal Railways (SBB) to test a new system for controlling track systems.

"Onboard Monitoring" – a compact measuring system on-board a regular train – is used to continuously monitor the state of tracks in the railway network. The objective is to lower maintenance costs and reduce susceptibility to faults.

#seeitnovotest vehicle in the DB Systemtechnik ICE S

At InnoTrans 2018, Siemens presented Velaro Novo for the first time to an international exhibition audience.

Under the slogan "Shaping connected mobility", the manufacturer wants to make the transport of today and tomorrow more attractive and sustainable.

The first runs of the test car for the new high-speed train took place in the convoy of the ICE S test train of DB Systemtechnik.

→ *see page 42 for more information*

SIEMENS VELARO NOVO

Germany

Photos: Martin Loibl, Jörg-Michael Reinecke

Shorter travel times between Poland and Germany

APPROVAL MANAGEMENT

Poland

After the time table change last December, the cross-border traffic between Germany and Poland takes place without any time consuming locomotive changes. Because of the different voltages in the overhead contact lines, the future locomotives of class 189 will need two different pantographs.

DB Systemtechnik has prepared and conducted the necessary tests on site in Poland for two multi-current locomotives of class 189.

DETECTION SYSTEM

Switzerland

Rhaetian Railway to install wheelset diagnostics system

The Rhaetian Railway (RhB) has commissioned DB Systemtechnik to produce, install and start operating a wheelset diagnostics system. The tried and tested system analyses wheel geometry.

The system developed by DB Systemtechnik, together with Talgo and Progress Rail, comprises of an out-of-round detection system, a wheel profile measuring device and a hot box detector.

It will be installed onto the existing infrastructure without track construction measures. This means that train operations of RhB will largely be unaffected by the installation. The measuring system is suitable for both low and high train speeds in Switzerland

Photos: Niklas Möhrwald

DOUBLE-DECKER TRAIN

Sweden

Aerodynamic approval "Mälartåg" in Sweden

In Söderhamn, around 250 kilometres north of Stockholm, the DB Systemtechnik team tested the aerodynamics of the new electric double-deck-multiple units.

Mälartåg trains, manufactured by Stadler are particularly winter-proof (with closed engine rooms, double-walled interconnecting gangways, and underfloor heating). They are currently undergoing final approval tests.

Photos: DB AG/Oliver Lang, Martin Loibl

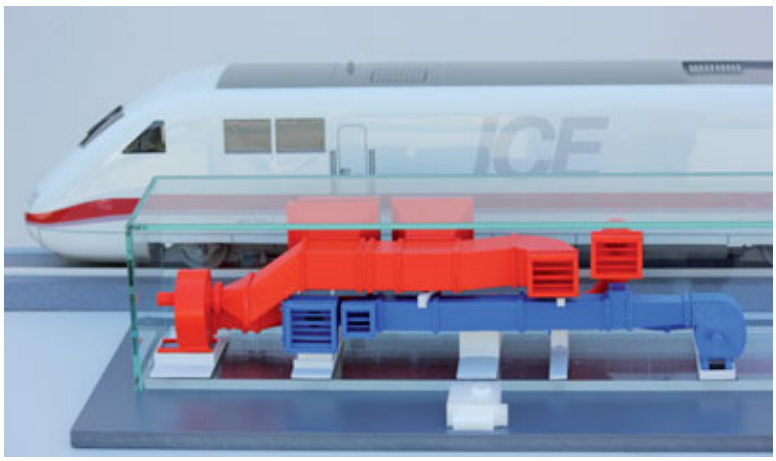
CONFIGURATION TESTS

Germany

New tests with ICE 4 even 13-car

DB Systemtechnik received a follow-on order from Siemens Mobility for additional ICE 4 testing. At the end of February 2019, the test runs started in new ICE-4 configurations, 6-car and 7-car trains and double traction.

Furthermore, a 13-car train is being tested, with additional test runs taking place for a 12-car train. Due to the very tight schedule, tests are being conducted on up to four trains in parallel during certain time slots



CLIMATE TEST BENCH

Germany

Laying the foundation stone for the MEikE "brother"

DB Systemtechnik is building an extremely modern climatic test rig in Munich. The LUDEK will be the new laboratory test bench for testing, diagnostics and development support for air conditioning systems. Supporting the MEikE climate chamber, it complements DB Systemtechnik's climate technology service portfolio.

Photos: CNA Fuchs, Martin Loibl

CNA special award for "fully automatic hump locomotive"

The Free State of Bavaria promotes the technological expertise of key industries and "Cluster Bahntechnik" has awarded a number of prizes in the rail sector. A special award for "outstanding achievements in business or science" was awarded to the consortium of DB Cargo, AAIT Angewandte Anlagen- und Industrietechnik, DB Systemtechnik and the Institute for Automotive Engineering at the Technical University in Nuremberg, for the project "Fully-automated hump locomotive VAL2020".

DB Systemtechnik receives Europe-wide AsBo certification

In 2018, DB Systemtechnik was accredited as an assessment body (AsBo) with professional expertise and methodology, in accordance with regulation (EU) 402/20013 (CSM-RA), by the German Federal Railway Authority.

Similarly, Railway Approvals Limited (RAL) in Derby, an affiliate of DB Systemtechnik, was accredited as an AsBo for safety assessment of railway vehicles and operation by the UKAS.

Photos: Martin Eisenlauer, Martin Loibl 2x

RUNNING SYSTEM TESTS

Germany

Giruno in Bavaria and Lower Saxony

From March to September 2018, DB Systemtechnik was working on behalf of Stadler, in Bavaria and Lower Saxony to ensure that the new SBB Giruno high-speed train was ready for aerodynamic and driving regulatory approval. Twelve instrumented wheelsets manufactured by DB Systemtechnik were used for the running system tests.

STADLER TEST OBJECTS

Germany

Undertaking equipment test runs with Stadler

DB Systemtechnik was responsible for carrying out test runs between Donauwörth and Treuchtlingen during December 2018, for two Stadler products: The powerful six-axle EURODUAL locomotive and a modern sleeping car.

The running tests, lasting several days, are part of the approval process for these vehicles, which are to be operated at Havelländischen Eisenbahn (the EURODUAL locomotive) or in night-time traffic between Azerbaijan and Turkey (the sleeping car).

Photos: Alstom, DB Engineering&Consulting 2x

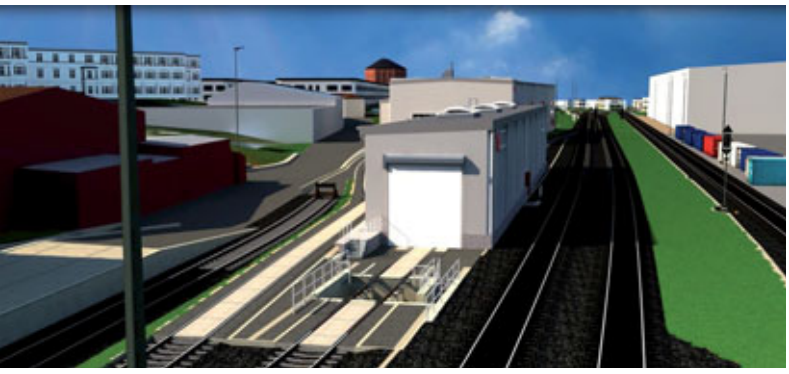
Alstom places order for traffic in Belgium

INSTRUMENTED WHEELSET PRODUCTION

Belgium

DB Systemtechnik has received an order from Alstom for the production of test "instrumented wheelset and running equipment". The order is related to the delivery of at least 445 double-decker vehicles, which the Belgian state railway has ordered from manufacturer consortium Alstom-Bombardier.

For DB Systemtechnik, the work for Alstom began in June with production of four instrumented wheelsets, with approval testing of running equipment starting in October.



DEPOT OPENING

Germany

Kurhessenbahn depot commences operation

In December 2018, the new Kurhessenbahn depot opened. Together with its depot planning team, DB Systemtechnik helped the client to answer questions about the maintenance concept and machinery at the depot, created the final design and provided project support until final acceptance.

Photos: DB AG /Frank Barteld, Lutz Friedrich, Dr. Klaus Keske,

NOISE REDUCTION

Germany

DB Systemtechnik takes lead role in developing "Guideline on Bridges and Viaducts"

On behalf of DB Netz AG and under the leadership of the Acoustics and Vibration department of DB Systemtechnik, a guideline has been created that will help planners to plan, design and implement measures to reduce noise emission from bridges and viaducts.

This is aimed at ensuring the identification of any necessary noise control measures required during the construction, renewal or repairing of bridges and viaducts.

→ *see page 39 for more information*

15-year partnership with CFL-Luxembourg

Since 2004, DB Systemtechnik has provided support for 20 Class 4000 electric locomotives and 105 double-decker cars belonging to the Luxembourgian state railway, CFL. At a festive event, the management of both companies praised the long-standing and excellent collaboration.

SYSTEM SUPPORT

Luxembourg

Regulatory approval tests for 55 Polish rail vehicles

DB Systemtechnik is helping Polish vehicle manufacturer FPS, with the regulatory approval of 55 new passenger cars for the Polish long-distance transport operator, PKP Intercity.

DB Systemtechnik is responsible for managing the approval of the new vehicles in Germany, acting as a de-signated body (DeBo) and conducting various tests in according with TSI and NNTR.

PASSENGER COACHES

Poland

Grafic: Icon-icons.com

25 years after the railway reform: what opportunities and risks are there for railways?

How will our rail transport in Germany and Europe develop over the next few years? 25 years after the railway reform, there are renewed discussions about the structural order of oursector and above all, about the need for funding.

The last 25 years have seen enormous changes that also point to a trend for the future:

Operation has become much more varied – 448 railway undertakings are essentially competing on the same network.

The manufacturers have undergone a concentration process that is still ongoing. At the same time, the procurement of production resources has become more international.

And yet never before have so many people been transported by rail as in recent years. The tonne-kilometres of freight traffic is also impressive.

Finally, the federal government is prepared to invest in rail transport.

However, these positive trends are associated with expectations. Expectations of our customers, the federal government and the responsible authorities with regard to the quality and performance of the system, which we are currently unable to meet.

Whether this positive expectation of rail transportation – which is seen as a solution to transport and environmental policy challenges – continues, or whether society comes to the conclusion that rail transport is not in a position to contribute, encouraging more investment in electromobility on the roads or alternative mobility concepts, depends to a large extent on whether the rail sector provides the right answers.

The future of rail transport is largely determined by three factors:

1. **Social trends**
2. **The structural order of our industry**
3. **An overall sector strategy to meet transport policy expectations**

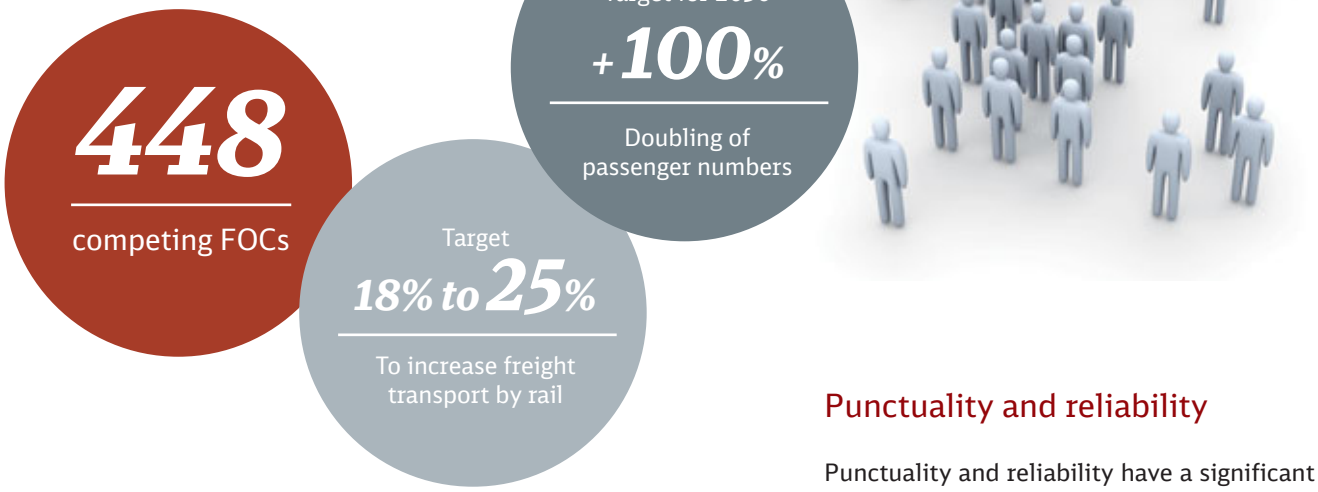
Social trends

The railwayis still regarded as the most eco-friendly mode of transport. The high utilisation of road infrastructure and traffic density in conurbations is forcing the expansion of rail transport. The aim is to achieve a noticeable shift from freight transport to rail, with an increase in the modal split from 18% to 25% and doubling of passenger numbers by 2030. This is not feasible using the existing infrastructure and technologies. Without targeted expansion, these targets cannot be achieved.

The challenge for the technology lies in the full ETCS equipment of our system and, building on this, in meaningful ATO concepts, e.g. in highly compressed local transport networks. If the relevant network and all the vehicles running on it can be fully equipped with ETCS, a crucial prerequisite will be created for resolving rigid block headways which have a considerable impact on line capacity.

However, equipping all vehicles operating on the network with ETCS also includes existing fleets. An important issue both in terms of funding and the required technical undertaking.

Grafic: Icon-icons.com, Fotolia



If it is not possible to support the socio-politically desired increase in capacity with public funding, for both the infrastructure and vehicle equipment. It will not be possible to determine when ETCS conversion will have been completed.

Without public funding, the operators bear a large proportion of the costs involved. The retrofitting costs incurred by FOCs – especially those operating regional services – are not offset by sufficient economic benefits for the operator.

There is a need for political action here.

As an expert in rail technoloogy, DB Systemtechnik, must also make a contribution, helping to develop ETCS vehicle equipment that is economical in the long term and based on plug-and-play solutions, and with open interfaces. Solutions are also required for retrofitting existing systems that do not involve the replacement of hardware, with a new approval procedure for every major software change

One example is the automatic train operation concept in Hamburg. Together with the Hamburg S-Bahn, Siemens and the Hanseatic City of Hamburg, DB Systemtechnik is working on a GOA2 solution for a section of the Hamburg S-Bahn. We are providing our expertise in risk and hazard assessments, approval management and engineering.

Punctuality and reliability

Punctuality and reliability have a significant impact on system capacity. The basic requirements of customers, passengers and shippers must be met. DB Systemtechnik is working on the following topics, together with colleagues in the transport divisions and infrastructure:

We are creating flexibility in maintenance by spreading maintenance intervals on the basis of legally secure and/or experimental evidence.

We are developing diagnostic procedures for components affecting availability, e.g. GTO modules in the ICE 1.

We are increasing the reliability of air conditioning systems. The redesigned systems of the ICE 2 are reliable even on hot summer days.

We are meeting the challenge of converting the power electronics of the 28-year-old ICE 1 power cars from GTO to IGBT technology.

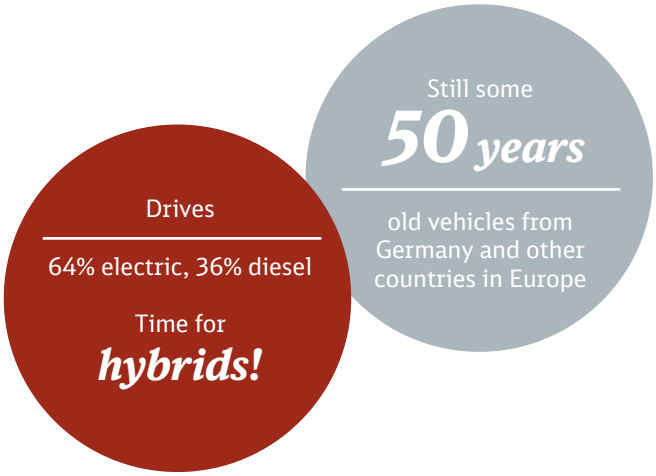
We are creating economical repair solutions for existing vehicles with accident or corrosion damage.

Specialist knowledge of the condition of the infrastructure and vehicles is required in order to develop and implement effective measures to enhance quality and availability. Our vision is to set up a data platform that we can use as a basis to assess the condition of all subsystems at any given time, with a consistent data landscape, allowing fleet and infrastructure managers to access the same sources for their specific data evaluations.

The combination of information from vehicle and infrastructure technology and the use of innovative analysis methods, creates completely new opportunities for making decisions relevant to availability.

Environmental awareness

Another social trend is the growing environmental awareness in our society. Although railways are still considered to be the most environmentally friendly mode of transport, with 64% of regional transport using electric traction during 2018, 36% still required diesel vehicles. There are major questions over the use of diesel. The bids for non-electrified lines currently demand alternative drive technologies.



Technical solutions for new vehicles already exist. The first vehicles with fuel cell drive are in regular use with diesel hybrid or e-hybrid vehicles being offered. But there are also a large number of existing diesel vehicles that have not reached the end of their technical service life.

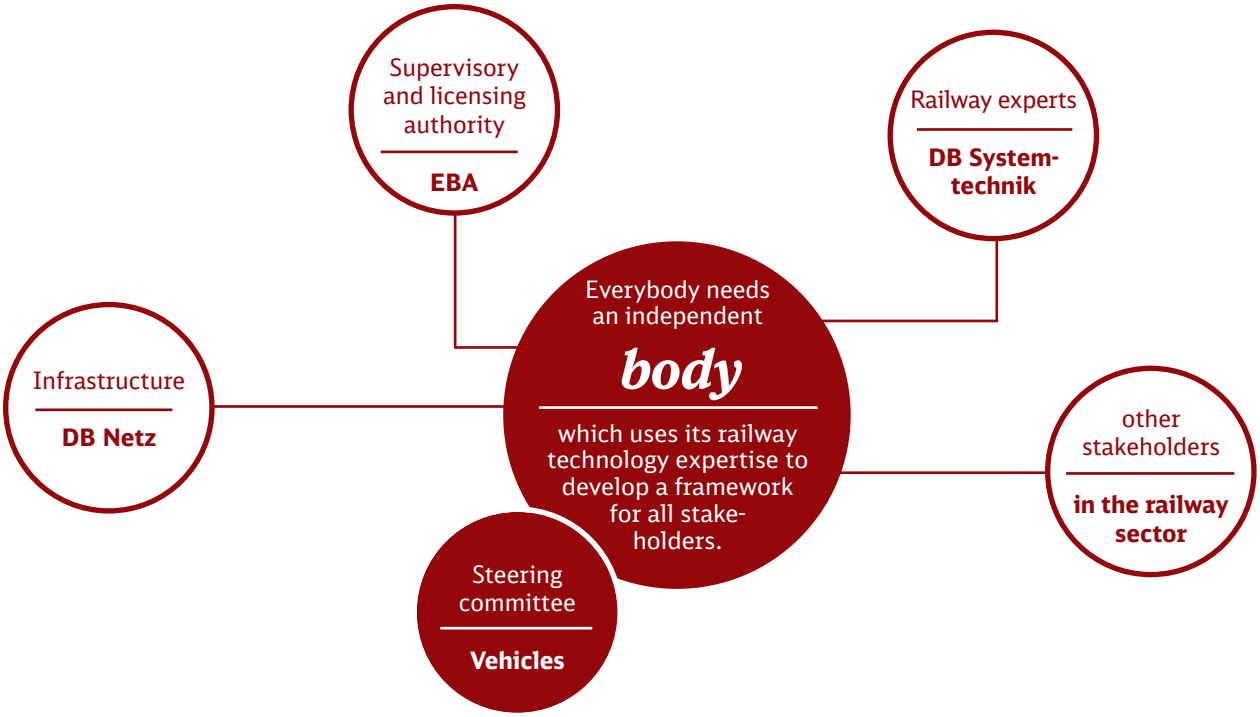
We are therefore working extensively on retrofit solutions for the existing vehicle fleets, whether commuter trains or shunting locomotives.

To be able to offer economical conversions for diesel commuter trains, we are currently developing hybrid solution concepts that are based on a prototype of the BR 642 that has already been largely implemented. These activities are part of the TecEX innovation programme, in which projects underpinning DB's strategic objectives are grouped together.

This program deals with topics such as condition-based maintenance concepts for vehicle fleets and infrastructure facilities, driver assistance systems and hybridisation concepts – group-wide and with the involvement of external partners from industry and higher education. DB Systemtechnik is an important partner in this.

Structure

The structure of the sector has also a considerable impact on the succes of the railway transport. 25 years after the railway reform, 448 RUs with completely different business models are active in the market; from operators with their own vehicles and maintenance, to operators who rent vehicles and entrust their maintenance to the manufacturers. There is also a large number of companies, like rental or maintenance companies as well as operators without own means of production that take a place within the value chain.



There is an unprecedented variety of fleets running across the German rail network. Including vehicles that are over 50 years old and the entire range of platforms provided by the European manufacturers and, in future, non-European manufacturers as well.

Is this diversity in our sector capable of being controlled in the long term and suitable for achieving the ambitious transport policy objectives?

Is there not a need for a strategy supported by the entire sector that goes beyond the primacy of competition?

There is no authority with railway engineering expertise that is independently developing a regulatory framework and coordinating it with all stakeholders in the sector. For a long time, it was assumed that Deutsche Bahn would take on a large number of general tasks. But with competition increasing, that is no longer possible. Even the infrastructure managers, DB Netz and the EBA function are not free of self-interests, although everyone uses the infrastructure.

The Vehicles steering committee was set up in 2001 to clarify cross-sectoral, technical issues.

Originally exclusively concerned with vehicle engineering issues, this committee now also deals with vehicle-infrastructure interface issues, aspects of the European approval processes and the effects of network access on operation.

Decisions are generally made by consensus. This committee was formed because of the initiative of sector parties. It is capable of acting, has proved its worth and can certainly serve as a model for other liberalised railway systems in Europe. DB Systemtechnik experts are also active on this committee: neutral in their technical assessment and committed to the success of the overall system.

To meet this future demand, we are building up our ETCS expertise, combining classic railway expertise with specialised digital knowledge and forging partnerships with start-ups, in order to benefit from technical developments outside our industry.

We believe that the framework conditions and positive social support for the "rail" mode of transport, is a great opportunity and we will play our part in meeting the expectations of our customers.

DB Systemtechnik will contribute.

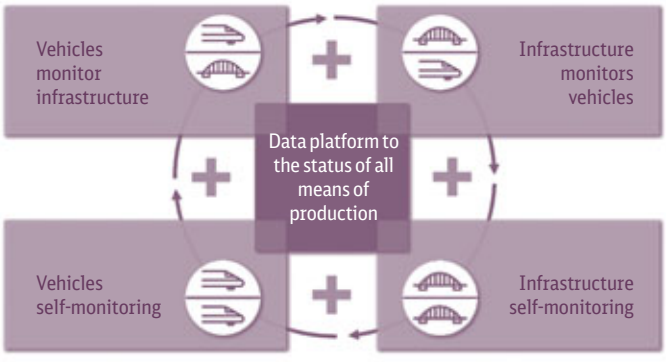
DB Systemtechnik 4.0 digital solutions for the rail system to increase reliability and reduce life cycle costing

Everyone is talking about digitalisation and big data. How can this help make the rail system more reliable and reduce costs? Using digital methods to monitor components in rail vehicles can increase their cost-effectiveness and reliability.

DB Systemtechnik provides the necessary tools and relevant expertise to develop related products. DB Systemtechnik has the system and component engineering knowledge, which is essential for evaluating results. The goal of digitalisation is to move from preventive and corrective maintenance to condition-based maintenance, in which data is continuously recorded and evaluated, making it possible to detect whether a component is about to fail. The detection period must be long enough, however, so that maintenance tasks can still be time tabled in to prevent operational damage. Only then will the objective of increasing availability through the use of digital methods be achieved.

To sustainably reduce life cycle costings, predictive maintenance is necessary. However, a component is only replaced once it has reached its end of life and not after a defined period of time. Through continuous monitoring and the information gained, a maintenance task is subsequently only performed when necessary. This can have a significant impact on the life cycle costs, equirings the system to understand about wear behaviour, and safety.

The four-quadrant model



Extensive analysis is needed in advance, in order to firstly identify and then monitor components that can restrict availability. To enable corrective measures to be implemented before failure occurs. Particularly with older vehicles, it is not beneficial to collect data for all components.

A decision must be made as to whether additional sensors need installing or whether it is sufficient to evaluate the data already recorded by the vehicle diagnostic system. The key to success is to compare big data analysis with engineering approach findings. As a final step, implementation in maintenance has to take place.

The sections below describe the generic tools, the hardware, software and methods that are necessary to successfully implement digital solutions.

Hardware

To record and process data from vehicles, rail-compatible computers in various configurations are available. Data bus gateways are also used on the vehicles to ensure that there is no hardware feedback to the vehicle. These are certified and approved by the EBA. As a result, the software can be dynamically configured on the data loggers.

For the procurement of future vehicles, DB Systemtechnik believes that advanced standardised technical specifications should be used, which would ensure the provision of standard interfaces to allow data to be monitored d and transmitted without needing any additional hardware.

Software

To efficiently record vehicle data and transfer it to land, coordinated software is used both on the vehicle and in the control office. By aligning the software tools – both on vehicles and on land – data can be transferred without the loss of information using today's wireless communication networks, despite occasional breaks in network coverage.

The software on the vehicle is module based and can be fully configured on the land side. Solutions for the land-side data links (connectors) can be used in both cloud environments and on IT infrastructure systems (on-premise solutions). On the land side, the vehicle data can be connected to other data sources, such as weather data or train configurations. Through storage of data in data lakes, big data can be analysed over longer periods of time.

Methodology/domain model

The standards developed over the years to build data structures and files for diagnostic messages are no longer enough to tackling the challenges of digitalisation.

Data analysis requires comprehensive knowledge of the vehicles, their structure and data coding. In collaboration with infraView and DB customers, DB Systemtechnik has developed a generic data model that allows data to be captured for all types of vehicles and for all manufacturers.

Any of today's common rail vehicle components can be uniquely classified within this generic model. The assignment of operational or functional states, process variables and diagnostic messages, as well as the addition of attributes, allows every relevant piece of information for describing the vehicle's condition to be classified within the model.

Life cycle costing (LCC) assessment

The costs for implementing digital solutions are high and the technical implementation is time consuming. For this reason, an LCC analysis must be carried out for each component. The relevant tools are currently being created at DB Systemtechnik and calibrated in pilot projects.

Machine Learning (ML)

ML requires large samples of data to exist for the period before and after a failure occurs, to obtain a workable level of accuracy in the results. This is often not the case.

If such samples exist, ML algorithms can be used to find patterns in longer data series and larger datasets on a target-oriented basis. The engineering evaluation of the systems to be monitored is enhanced using ML, particularly if unique rules for identifying deviations have not yet been determined. This can reduce the necessary calculation effort by allowing you to search through the data of problematic components, restrict the search period and combine the results effectively.

Engineering approaches

The evaluated faults data always needs to be compared against real findings. To do this, DB Systemtechnik experts examine the components that failed and try to establish the correlation between the actual pattern of damage and the picture in the data collected. This is all the more important, since even pattern recognition using ML methods could potentially lead to the wrong correlations and conclusions being drawn if the data is complex.

This is particularly important f the step from condition-based maintenance to predictive maintenance is to be made because the existing maintenance regime will be interfered with using this approach. Without knowing the history of components, pure data analysis can lead to entirely wrong conclusions being drawn.

For example, if a component fails due to an external factor that was not recorded, the data must not be evaluated as typical for this specific technical failure. Engineering methods range from simple visual evaluation to calculations and the use of highly complex tools such as test rigs or simulations.

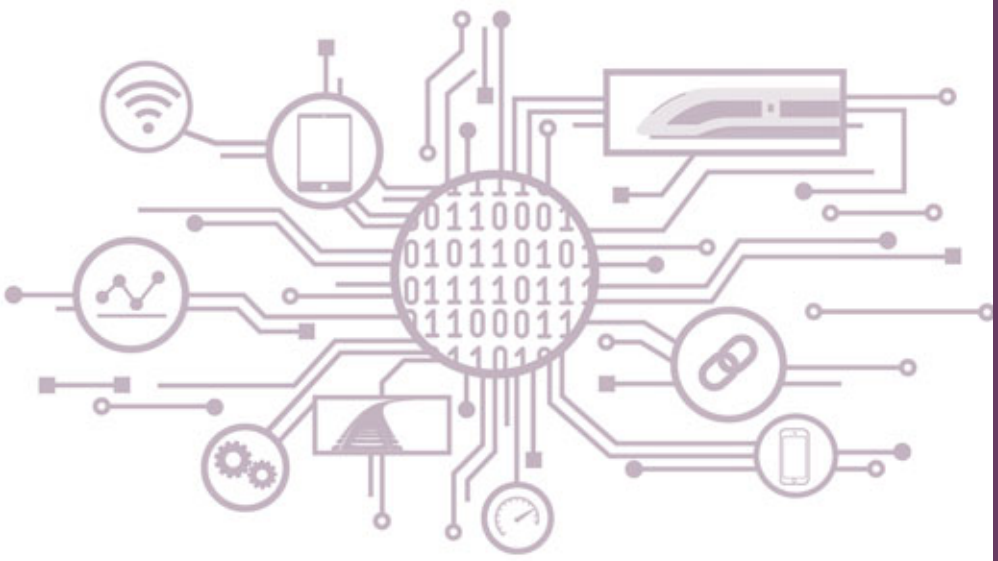
More and more vehicles are being equipped with digital monitoring to enable future maintenance. There are already promising results. However, there is still a long way to go in terms of using data to increase reliability, availability or even as a basis for maintenance planning.

The targeted use of devised methods and tools is expected to make significant progress in the future. Basic data analysis, according to the big data approach is simply not enough. It must always be combined with engineering approaches and methods. DB Systemtechnik can help you do this.

Earth fault monitoring in HGV multiple unit ICE 1

To monitor an ICE1 drive system, which is a vulnerable component affecting availability, part of a fleet has been successively equipped with a smart rail system, since August 2018 to identify imminent ground faults and thus avoid traction failure. If the voltage in the converter is exceeded, this leads to the existing ground fault being monitored. The corresponding drive module is then shut down.

The new method uses a voltage measuring system to continuously record the history of the voltage signal and transfer it to land for evaluation purposes. The first promising results were observedduring the test phase, as a ground fault was recorded. However, an analysis and definition of rules is still required, as well as the engineering rework and proof that a ground fault is detected early enough to be able to initiate efficient corrective measures.



Reference projects of DB Systemtechnik 2018/2019

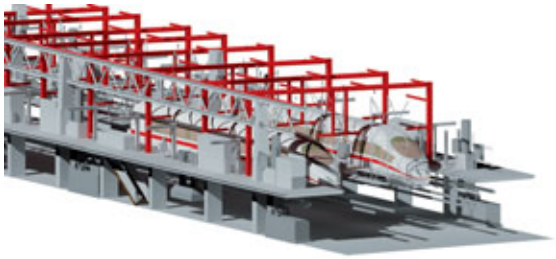
Photo: DB Systemtechnik 2x

Retrofitting roof-mounted platforms at the ICE Hamburg-Eidelstedt plant

The ICE depot in Hamburg-Eidelstedt, the largest in Germany, was originally designed for the maintenance of ICE-1 trains that went into service in 1991. The main production lines in the North and South sectors of the work stations are equipped with roof working platforms with cranes, as the ICE-1 requires roof work only in the power car areas. However, ICE-4 multiple units have roof assemblies on each of their cars. These likewise require maintenance, requiring additional work stations at the depot.

DB Systemtechnik was awarded the contract to provide the overall design management for two work stations for the maintenance of ICE-4 multiple units to be retrofitted.

For this purpose, the specialists from Kirchmöser developed a solution along the lines of an elevated structure that can be inserted into the existing facilities. This structure can also accept the additional loads of the train-length roof working platforms and heavy cranes.



The heating and power supply systems in the area of the affected track line, had to also be re-engineered as part of the overall design management, this was coordinated by DB Systemtechnik. The final design had to make modifications to the supply and disposal systems as well as to the pantograph and battery change systems. It was also necessary for additional measures to be devised, coordinated and integrated into the design as part of the construction sequence. This included modifications to the overhead line feed-in points, a safety concept for roof access and the impact on the concept for traffic routes, fire protection and logistics.

The invitation to tender, resulting from the preliminary work, was published in August 2018. This level of detail formed the basis for the price and deadline reliability of the offer, allowing a purchasing effect of over one million euros to be achieved compared to the cost estimate and enabling commissioning to be reached before the major timetable change in 2020.

Photos: Thorsten Tewes, Patrick Raabe

Testing of running characteristics of ETR 610 in Switzerland and Austria

In order to be able to offer new route connections, Swiss Federal Railways (SBB) needs trains that are able to operate these routes. In particular tilting trains require a technical approval and also the tracks need the approval to operate specific trains.

A line-specific vehicle homologation was conducted. This included measurment runs using instrumented wheelsets with a 10% higher unbalanced lateral acceleration. The aim was to ensure compliance with the driving safety limits.

Between March and May 2019, test runs with the ETR 610 were conducted on the lines between Winterthur and St. Gallen as well as St. Gallen and St. Margrethen. They served the purpose of first-time vehicle homologation of the train for speed series N. A further goal was to widen the approval of the running characteristics of the train itself for special conditions. This resulted in additional measurement runs in Switzerland and Austria.

For these tests, SBB contracted DB Systemtechnik to deliver an entire package. The desired measurements were conducted by the "Running Systems Testing" department in Minden.

Central coordination made it possible to effectively combine the various test goals (testing of vehicle and rail line). This saved time and cost. The measurement frequently also called for real-time evaluation, as a basis for influencing the measurement programme, while the tests were still running.

By conducting the tests, DB Systemtechnik was able to achieve the goals set by the client and to impress with their extensive experience and flexibility.

Grafic: Martin Eisenlauer

Measurements of flow conditions at the Rosenheimer Platz S-Bahn station

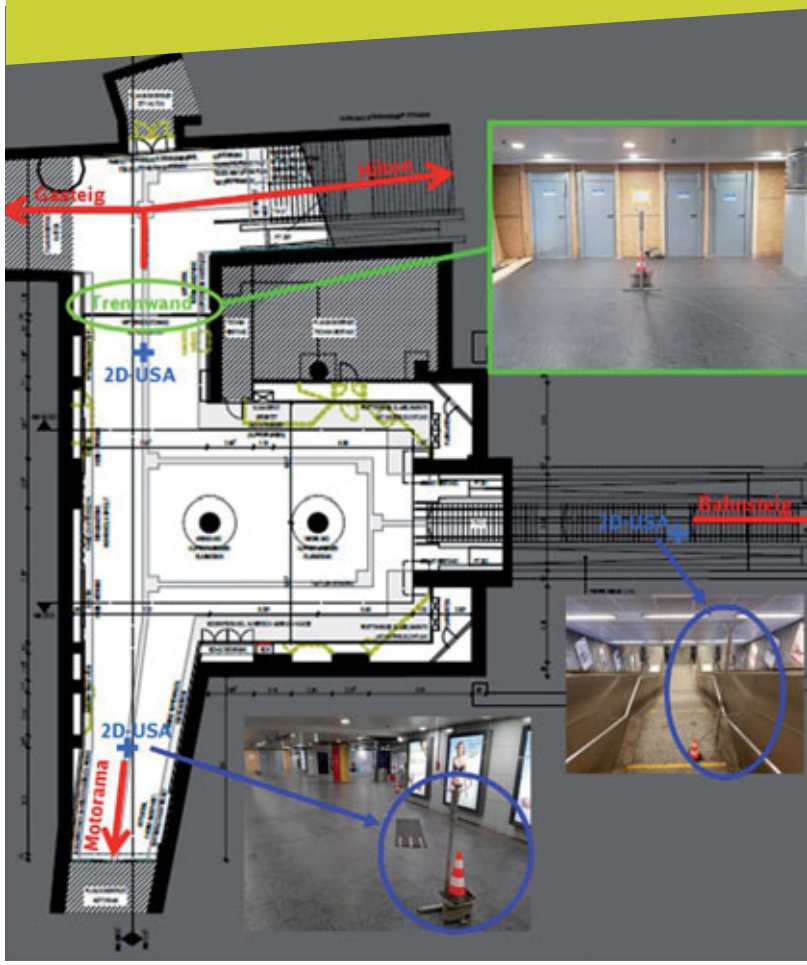
During ongoing S-Bahn operation, very high air velocities are generatedin the stairwell of the western exit area, at Rosenheimer Platz, in Munich, these are perceived as being disruptive.

To reduce the air speeds, DB Station&Service tasked DB Systemtechnik with carrying out tests based on a prototype air lock.

The idea was to create a physical separation between the exit and the stairwell. In consultation with the client, a four-door partition, similar to an air lock was installed in the mezzanine of the S-Bahn station. Next, flow measurements were conducted for different operating scenarios and opening conditions of the prototype air lock: with the S-Bahn in regular service, with the S-Bahn in reduced service and with the S-Bahn out of service.

The measurements revealed that the physical separation of the exits from the stairwell at the station leads to a significant calming of the air flow while the doors are closed. At peak times with high customer numbers, however, the doors are left open, with the result that the general feeling of comfort is significantly improved only at times of the day when there are only a few customers. The client was able to visualise this for themselves live on location.

Thanks to its pragmatic approach to the project, DB Systemtechnik helped to provide the client with appropriate construction measures. The documentation of the parameter variations and operating scenarios as well as the relevant flow conditions were compiled in a test report.



Automatic train-running control for BR 420

The Munich S-Bahn operates Class ET420 and ET423 vehicles. The operator wished to further increase the passenger capacity by adding 21 extra vehicles, Class ET420.8. To guarantee a high-frequency of trains running through the core route in Munich, the vehicles are equipped with continuous automatic train-running control. The operator also required the installation of a new passenger information system with automated announcements as well as new LED displays.

DB Systemtechnik was contracted to perform the vehicle integration of the automatic train-running control system and of the new passenger information system, including support with conversion at DB Fahrzeuginstandhaltung in Nuremberg.

Furthermore, DB Systemtechnik was responsible for the verification and the entire approval process with the integration runs on the route network in Munich. By modernising the existing rolling stock, the Munich S-Bahn is now able to use the main Munich line in at a high train density, whilst also increasing passenger capacity, without having to invest in new vehicles.

Photos: DB Systemtechnik 2x

Commissioning measurements on the Main bridge at Wiesen

The Main bridge at Wiesen is on the high-speed line between Nuremberg and Erfurt. With a length of 219 metres, it consists of a series of three tied-arch bridges. Tied-arch bridges are subject to general building inspectorate requirements for speeds of up to 160 km/h. As the Main valley viaduct is designed for speeds of up to 250 km/h, a specific-case approval is required before it can be taken into service.

This approval requires the series of tied-arch bridges across the Main and the Main flood channel to be accompanied by a programme of measurements before being taken into service.

DB Systemtechnik was contracted by DB Netz to perform the measurements on the Main valley viaduct.

A permanent measuring station was set up near the bridge. It has the following functions:

- Measurement of strain based on strain gauges at the rail base, dropper, girder and web plate
- Measurement of accelerations based on sensors at dropper, girder and web plate
- Measurement of the longitudinal movement of the bridge
- Recording of environmental conditions such as temperature, wind speed and wind direction
- Video train detection by the use of camera systems

The measured data were sent via GSM signal to the computers for evaluation, while access and data transfer took place via the "TeamViewer" remote control program.

The measurements and accompanying analytical investigations led to findings on the load-bearing behaviour of the structure under the dynamic effects of high-speed rail traffic. The goal is to bring together these findings to form recommendations for standard solutions.

The German Federal Railway Authority issued the specific-case approval for the Main valley viaduct and it was possible for the measuring station to be taken down in the summer of 2019.

Photos: DB Systemtechnik

Tests of a metro vehicle in the MEikE climate chamber

As part of the approval of the Desiro City Class 717 metro vehicle, it was necessary to investigate the climatic characteristics of the driver's cab. This involved testing the air conditioning system under various ambient conditions for compliance against comfort parameters (temperature, humidity, air speed).

DB Systemtechnik was contracted by Siemens to perform the relevant tests in the MEikE climatic chamber in Minden. To determine the climatic comfort and thermal conductivity, the following work steps were performed:

- The driver's cab, as per EN 14813, was equipped with heating mats and an evaporator for realistic simulation of a human driver. The air/surface temperatures, air speed and relative humidity was also set up.
- The multiple unit was equipped with low-radiation convection heaters for measuring the k-value
- Preliminary tests were performed to optimise the driver's cab air conditioning system, e.g. by adjusting the air flow and air routing
- Acceptance tests were carried out as per EN 14813
- Determination of the k-value
- Functional tests (brakes, emergency exit steps) were performed at low temperatures using ice and snow
- Functional tests were carried out at high temperatures

All tests were performed in accordance with the relevant standards. The subsequent test report was a necessary part of the vehicle acceptance process.

Photos: Kompetenzcenter Marketing NRW (KCM), DB Netze, DB Systemtechnik

Technical consultation for the procurement of vehicles for the Rhine Ruhr Express

The Rhine Ruhr Express (RRX) guarantees state-of-the-art, forward-looking mobility between Rhine and Ruhr. The infrastructure required an upgrade for this and new vehicles needed to be purchased. Regarding both the infrastructure and vehicle procurement, the issues of environmental compatibility and noise insulation were key factors. The franchise to operate the network was awarded to the rail companies Abellio and National Express as part of a competitive bidding process.

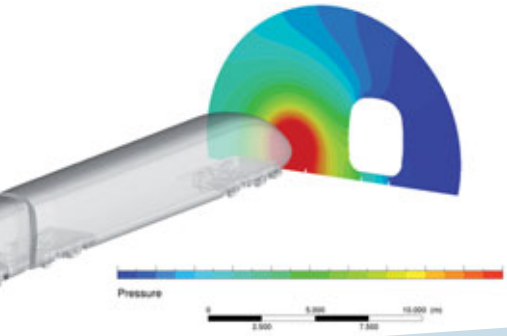
The vehicles are being procured by a collective of inter-municipal local transport associations and then leased to the operators. The double-decker electric multiple units of type "Desiro HC" are being supplied by Siemens Mobility.

As part of the vehicle procurement process, DB Systemtechnik was contracted by the collective of inter-municipal local transport associations to provide technical control and extensive specialist consultation services, as well as to conduct various testing on the RRX trains.

The implementation period runs from 2015 to 2020. DB Systemtechnik also contributed its technical expertise in the field of acoustics.

This involved technical support and an evaluation of the acoustic vehicle characteristics, especially with regard to noise emissions and acoustic travelling comfort. The type testing for verification of the vehicle characteristics were overseen and coordinated with the manufacturer.

The award of this contract to DB Systemtechnik has made it possible to safeguard the interests of the vehicle purchaser vis-a-vis the manufacturer, by examining and confirming the suitability and validity of the verification process.



Aerodynamic studies for a high-speed line in Sweden

Sweden is planning a new high-speed rail (HSR) line of speeds up to 320 km/h between Stockholm and Gothenburg. For the section between Gothenburg and Borås, the Swedish engineers needed to address various aerodynamics-related issues, in addition to carrying out aerodynamic design calculations. As HSR is new to Sweden, the country possesses only a little aerodynamics expertise.

Therefore, the experts from DB Systemtechnik were contracted to perform aerodynamic studies to support the design of the HSR line in Sweden.

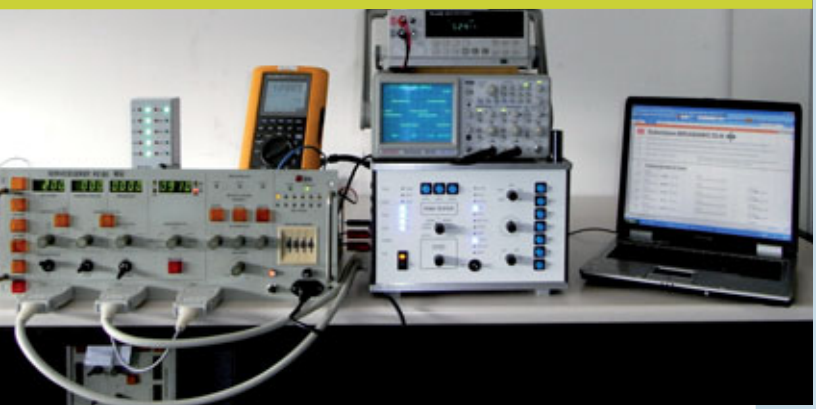
Different aerodynamic aspects were considered as part of these studies:

- Design of the tunnel cross sections on the HSR line in compliance with the specified TSI limit values.
- Calculation of the anticipated aerodynamic loads on infrastructure components and vehicles.
- Simulation of pressure and flow loads at underground stations.
- Assessment of the pressure comfort inside vehicles when passing through tunnels.
- Determination of the additional traction energy requirement due to the increased traction resistance within the tunnels.
- Assessment of the necessary track centre distance based on CFD simulations.
- Investigation of the necessity of wind protection measures (wind protection walls) in exposed sections.
- Acoustic investigations in relation to micro-pressure waves.

Thanks to DB Systemtechnik's many years of aerodynamics expertise, the client was provided with a complete package of aerodynamic investigations, providing answers to previously open questions. The client was able to benefit not only from engineering and consultancy services, but also from the comprehensive regulatory knowledge of DB Systemtechnik.

Photos: Patrick Raabe, Lutz Müller

Calibration and repair of PZ80 service units for the PZB automatic train control system



On more than 300 legacy vehicles (formerly Deutsche Reichsbahn) in Germany, a part of the automatic train control ATC (intermittent automatic train-running control) uses on-board equipment of type PZ80. This applies to both DB and other rail companies. According to the vehicle operators, there are no plans to replace this PZ80 equipment with different ATC equipment. The vehicles are currently expected to remain in service for at least another 15 years, which would see the equipment remaining in use for at least the same length of time.

To guarantee safe and reliable operation, the on-board ATC equipment requires regular maintenance. This is carried out exclusively using PZ80 service units, there is no alternative for this.

In the past, these PZ80 service units were calibrated and repaired by DB Regio. This work has now been completely taken over by DB Systemtechnik's calibration and testing organisation, which is an accredited calibration laboratory.

The specialists from DB Systemtechnik very quickly developed from scratch a standard for calibrating the service units. The goal is to guarantee maximum precision, while minimising the previous sources of calibration error. The award of the contract to DB Systemtechnik resulted in optimised processes and an improved technical quality.

Installation of Colibri Wi-Fi in Class 423 units for Stuttgart S-Bahn

A total of three different EMU classes for the Stuttgart S-Bahn were to be equipped with the "COLIBRI" system from DB Fahrzeuginstandhaltung. 60 vehicles of the four-carriage EMU Class 423 were started first.

DB Systemtechnik was contracted to upgrade the Wi-Fi on the Stuttgart S-Bahn.

At the beginning of any Wi-Fi project, it is important to analyse the optimal antenna location on the roof of the multiple unit. It is important to check that other antenna systems do not interfere with this system, as the RIS (passenger information system), AFZ (automatic passenger counting), vehicle location and train radio systems all have their own antenna systems. An intensive concept phase and coordination of all internal specialist services is therefore necessary for Engineering.

In cooperation with DB Regio, conversion of one of the vehicles took place in Plochingen at the end of extensive preparation and planning. The multiple units were equipped with the necessary hardware: Wi-Fi computer, access points, interior antennas, exterior antennas, DC/DC converters and a considerable length of cabling. After the initial test vehicle had been successfully put back into operation, the serial conversion of the 60 vehicles was undertaken. The successful cooperation with DB Regio has led to further contracts, such as conversion of the EMU Class 426 and 430.

Photos: DB Systemtechnik 3 x

Testing of alternative refrigerants for air conditioning systems

An EU regulation calls for a significant reduction $CO_2$by 2030. There will be a major impact on the options available for air conditioning and a shortage and increased price of the refrigerant R134a.

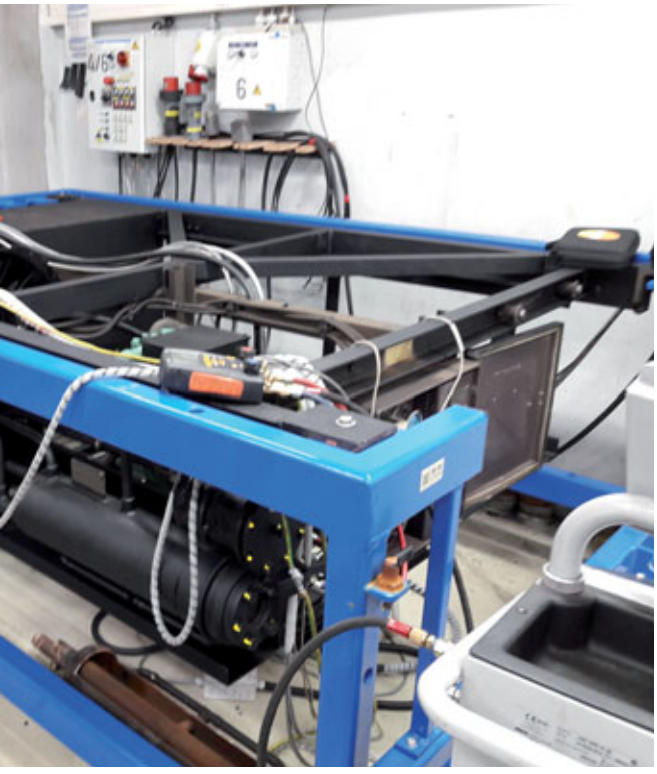
DB AG is therefore studying whether existing air conditioning systems can be run on alternative refrigerants (drop-in refrigerants). For this purpose, DB Systemtechnik was contracted by DB Long Distance and DB Regio to examine two possible alternatives.

Based on initial test results,as well as theoretical considerations, the air conditioning experts from DB Systemtechnik drafted a first assessment of the two potential drop-in refrigerants.

In addition, DB Systemtechnik tested the drop-in refrigerants on a passenger carriage under various conditions in its own climatic chamber in Minden. The chamber was heated to up to 52 °C in order to test the temperature resistance of the air conditioning systemin extreme temperature conditions. Furthermore, it was established that the mechanical control valves in all systems needed to be optimised according to the drop-in refrigerant used. Both drop-in refrigerants showed a similar performance to the R134a refrigerant, with the result that temperature comfort inside the vehicles would be assured.

The findings will flow into recommendations for the field testing of further classes of vehicle. They also make an important contribution to the future guarantee of the availability of air conditioning systems in DB AG vehicles.

Grafic: Hans-Joachim Wormstall-Reitschuster

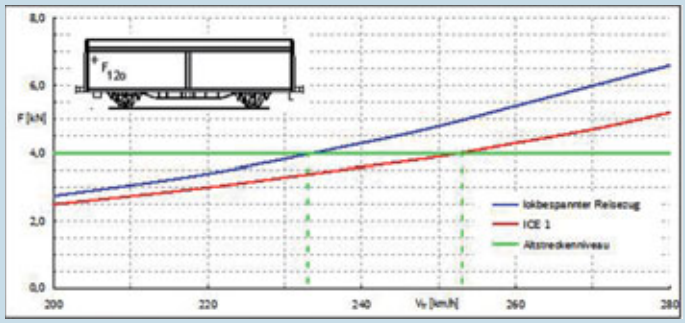


Testing aerodynamic loads in tunnels during mixed operation

The high-speed line (HSL) between Fulda and Würzburg together with the connecting curve at Nantenbach are to be more intensively used by simultaneous, mixed operations of high-speed trains (HSTs) and freight vehicles. The existing tunnels are extensively double-track, which means that there is the possibility of trains passing in tunnels. It is important to be able to guarantee the structural integrity of freight trains even under the occurring pressure and suction loads. The maximum running speed of high-speed trains in the tunnels must therefore be limited.

DB Netz intends to employ a system capable of monitoring, detecting and, if necessary, reducing the speed of high-speed passenger trains. The goal is to make use of signalling to prevent trains passing each other at inadmissible speeds in tunnels.

The aerodynamics experts from DB Systemtechnik, using one-dimensional, numerical simulations, determined the anticipated aerodynamic loads on freight vehicles, as a function of the running speed of passing high-speed trains.



Based on many years of positive operating experience, the load level on the existing rail network, which is viewed as safe, was used as a reference criterion. Accordingly, it is possible for a high-speed train running at up to 200 km/h to pass a freight train in the double-track tunnels on the Fulda-Würzburg HSL without the load level regarded as safe for freight trains being exceeded.

By limiting the aerodynamic loads to a level regarded as safe, DB Netz is able, both now and in future, to guarantee safe operation in tunnels.

Photos: DB Systemtechnik 4 x

External noise measurements as proof of compliance with acoustic limit values

As part of an invitation to tender, DB Regio was required to provide proof that its local-transport diesel railcar, LINT 41 NWB (Nordwestbrandenburg) was compliant with the acoustic limit values, according to the "TSI NOISE" standard.

The acoustics experts from DB Systemtechnik were therefore tasked with carrying out external noise measurements. The measurements were conducted on a TSI-compliant, single-line section of track near Uelzen, at the following running speeds:

- 0 km/h to 30 km/h start-up
- 80 km/h pass-by and
- 120 km/h maximum speed

The tests were carried out in accordance with TSI NOISE requirements, with four microphones on both sides at a distance of 7.5 m from the centre of the track and 1.2 m above the top edge of the rail, and a radar gun used to determine the speed. The noise measurements made it possible to establish the sound pressure level when the train started up and passed by. Next, the measurement data was evaluated for conformance against the standard and compared with the TSI NOISE requirements. The resulting findings were documented in an inspection report and presented to the client. Due to the high train utilisation, it was important for the train to be returned to service as quickly as possible.

The rapid selection of the measurement location and the flexible deployment of the acoustics experts made it possible for the measurements to be conducted within a very short timescale. The test results have confirmed the TSI compliance of LINT 41 NWB. DB Regio was able to provide the required proof and thus participate in the invitation to tender.

Acceptance run in Halle an der Saale with DB Systemtechnik's noise measurement car

Photos: Matthias Kretzschmar 2x

Noise immissions and vibration forecast for the construction of the new Neu-Ulm substation

Substations are used to transform electricity from the traction power transmission network into electricity for the overhead line. The voltage is converted by the transformers in the substation, from the 110 kV voltage of the traction power transmission network, to the 15 kV overhead line voltage.

Construction of a new Neu-Ulm substation is planned to guarantee the future traction power. The new facility required several engineering works to be carried out, the most noise-intensive being the demolition of the old switchgear building. Other noise-intensive works are the renewal of the catenary support and the construction of a new switchgear building, with new switchgear. The overall construction project is estimated to take two years.

During approval planning, DB Systemtechnik was commissioned by DB Energie to survey noise and vibration immissions during the construction period in accordance with AVV Baulärm, as well as surveying noise immissions caused by operation in accordance with TA Lärm (Technical Instructions on Noise Protection).

DB Systemtechnik's experts first collated all the necessary geodata from the responsible land registry office to build up an acoustic forecast model. Next, the noise immission situation during the construction phase was investigated on the basis of the most noise-intensive work and compared with the guide values set out in the General Administrative Regulation for Protection against Construction Noise. The vibration immissions caused by the building works were also estimated. The operational noise immissions of the new plant were forecast as part of a noise immission forecast, in accordance with TA Lärm. This focused on both the circuit breakers and the transformers. If the guide values were expected to be exceeded, noise reduction measures were specified according to both the Technical Instructions on Noise Abatement and the General Administrative Regulation for Protection against Construction Noise.

By compiling a noise immission forecast, the client was able to help identify possible immission guideline value overruns, in the area of the substation due to construction and operational noise, and to estimate and plan the costs of possible noise reduction measures for the affected buildings at an early stage.

In connection with the construction of the train formation yard at the Halle (Saale) node and the laying of tracks, there was a remeasurement of the noise emissions from train operation. The noise reduction measures laid down in the planning approval included the "specially monitored track" method. This is a recognised infrastructure noise reduction measure that follows the principle that a smooth rail running surface reduces the rolling noise of trains. For this purpose, the affected track sections need to be grounded and regularly monitored.

On completion of this work, DB Systemtechnik was contracted by DB Netz to check the quality of the grinding completed –using noise measurement runs.

The measurements were carried out using the noise measurement car of DB Systemtechnik. In addition to the timely planning and execution of the measurement runs using DB Systemtechnik's own drivers, the project included a root cause analysis in cases where the limit values were reached.

The noise measurement runs were completed successfully and on schedule. The test report with the measurement results is part of the new track commissioning and has been submitted to the Federal Railway Authority (EBA). The test procedure used with the DB Systemtechnik sound measurement vehicle is accredited according to ISO/IEC 17025 and recognised by the EBA.

Photos: Maike Uhlig 2 x

First article inspections on new generation of switches for DB Long Distance fleet

Due to growing multimedia (ICE Portal) and increased streaming consumption (Wi-Fi on ICE), higher data throughput rates are required in long-distance trains.

DB Fernverkehr therefore invited tenders for the provision of new switches that have an increased efficiency. They asked DB Systemtechnik for support. The range of IT tasks at DB Systemtechnik included the following:

- Drafting of specifications
- Supplier evaluation and supplier selection
- Support of the supplier in finalising the specifications
- Performance of initial sample tests (EMP), including hardware and software tests, at the IT test laboratory at DB Systemtechnik in Munich
- Review and appraisal of standards-related test reports and accreditation certificates (e.g. with regard to suitability for railway use, electromagnetic compatibility and fire protection)
- Various release recommendations

DB Systemtechnik and DB Fernverkehr were working together in agile teams. They were participating either in the role of an engineer as part of a Scrum team, or in a cross functional role as architechts. The 2018 selection process chose switches from the manufacturer Lantech and marketed by the supplier Pan Dacom Direkt. These switches offer a speed of up to 10 Gbit/s, representing a tenfold increase in performance compared to the previously used switches (e.g. installed in the ICE-3 redesign).

The new switches are to be installed initially in the ICE-1 trains as part of lifetime extension/modernisation. Installation of the new generation of switches is planned for the ICE 4 in 2020. The new switches are also to be used in the Eurocity successor.

Function investigations on a Class 714 in the environmental chamber

Photos: DB Systemtechnik 2x, Benjamin Reffay

Acceptance testing of a high-speed line in Denmark

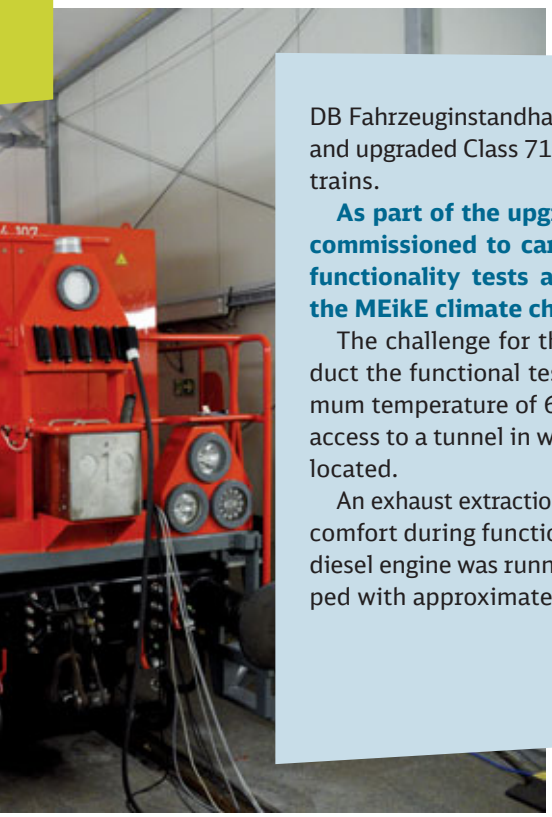
The new line from Ringsted to Copenhagen is Denmark's first high-speed line designed for speeds above 180 km/h.

To support the Danish track infrastructure manager "Banedanmark", DB Systemtechnik carried out extensive acceptance measurements on the new line, both in accordance with international regulations and based on the German regulations for high-speed lines.

Most of the tests were conducted using a test train made up of two Taurus locomotives – one from DB Systemtechnik and one from the rail company "Hector Rail" – as well as three DB Systemtechnik track recording vehicles. The vehicle reaction forces were measured with instrumented wheelsets. The higher the operating speeds, the higher the dynamic forces acting on the vehicle and track structure, as a result of wheel-rail interface.

The interaction between the pantograph and the overhead line was measured using an instrumented pantograph and DB Systemtechnik's optical uplift measuring system. In addition to these tests, the electromagnetic compatibility between vehicle and infrastructure was also monitored.

To guarantee safe operation, it is necessary for high-speed lines, to measure dynamic forces at a speed 10% higher than the planned maximum speed. Hence a new Danish railway speed record was set up with a top speed of 255.6 km/h. The measurements by DB Systemtechnik were able to establish the suitability of the Danish high-speed line for speeds up to 230 km/h.



DB Fahrzeuginstandhaltung in Bremen has converted and upgraded Class 714 locomotives for use in rescue trains.

As part of the upgrade, DB Systemtechnik was commissioned to carry out climate comfort and functionality tests at different temperatures in the MEikE climate chamber in Minden.

The challenge for the test laboratory was to conduct the functional testing of subsystems at a maximum temperature of 60 °C. The aim was to simulate access to a tunnel in which a burning rail vehicle was located.

An exhaust extraction device was installed to enable comfort during functional testing performed when a diesel engine was running. The test object was equipped with approximately 40 temperature sensors. Some of these temperature sensors were installed in the driver's cab to assess the level of climate comfort provided by the climate control system located there. Others were used to calculate assembly temperatures and monitor exhaust temperatures.

Thanks to the waste heat provided by the diesel engine, tests could be performed, not only across the environmental chamber's usual temperature range of -25°C to +45°C, but at +60°C too.

After the functional test had been conducted in the MEikE environmental chamber, the client received an extensive inspection report. This provided an overview as to whether all systems worked properly under these test conditions, or whether the client needed to make optimisations before handing a vehicle over to their customer.

Climatic investigations and functional tests on a metro train for Stockholm

DB Systemtechnik was contracted by Bombardier Transportation to investigate the climate comfort of the Stockholm Metro Movia C30 as part of the vehicle approval of this four-carriage train.

The tests, which occured in the climatic chamber MEikE, served as the "preliminary tests" to the acceptance measurements, which were planned for the Vienna Climatic Wind Tunnel under the influence of wind. At 70 metres, this was the longest train ever to be tested in the climatic chamber.

To perform the measurements, two of the train's passenger compartments and a driver's cab were equipped with measuring instruments in conformance with the standards. Carrying out the comfort testing and determining the k-value in each carriage in parallel made it possible for different measurement results to be obtained in an optimal period. In addition, functional tests (e.g. doors, window de-icing) were carried out at high and low temperatures, as well as under the influence of snowfall and ice. These findings allowed the energy consumption cycle to be determined and documented.

Extensive climatic testings of the vehicle in the climatic chamber MEikE enabled early adjustments of the air duct system and the air condition performance. These preliminary tests were significantly cheaper and took less time to complete when compared to a climatic wind tunnel. The subsequent acceptance tests were carried out and successfully passed, cheaply without the need for extensive optimisation.

Photos: DB Systemtechnik 2 x

Optimisation of traction system in ICE 4

Photos: Philipp Schäfer

Standard inspection of tilting technical lines in Switzerland with the VT 612

Since 2009, SBB has contracted DB Systemtechnik to test the tilting technology lines in Switzerland.

Test runs determine the interaction between the vehicle and track with regard to operational safety, track loading and running behaviour for the locally permitted speed. All SBB lines approved for tilting technology are tested within six weeks. The test runs were conducted using DB Systemtechnik's tilting technology reference vehicle VT612, which was hauled during the measurement runs by an ICN from SBB. The VT612 was equipped with instrumented wheelsets that measured the forces during wheel-rail interface. In addition, the cross sections of the rail heads were measured by means of an optical profile measuring system (OPMA).

The test runs conducted by DB Systemtechnik allowed SBB to provide the necessary proof of safe operation on the tilting technology lines in Switzerland.

The speed of the train must be adapted to the radius of any curve, meaning that the permitted speed must be reduced the tighter the curve is.

The use of tilting technology on vehicles makes it possible to increase the speed that the train is able to travel in curves by up to 40 km/h. This considerably shortens the journey time, particularly on curvaceous routes. When negotiating a curve, the train tilts towards the inside of the curve in order to balance the centrifugal forces.

To guarantee safe operation, it is necessary to regularly measure the occurring reaction forces of the vehicle. This is done during a routine inspection of running characteristics, which must be repeated at regular, 12 to 18-month, intervals.

Failure of traction systems in powered vehicles often has an impact on the operational sequence and timetables. As part of the procurement process for the ICE 4, DB Fernverkehr was commissioned to compile the specifications for the traction systems, with very high traction system redundancy. This should reduce the impact on the operating sequence in the event of faults. Currently every second car in the ICE 4 is powered. In the event of a malfunction, the traction power is reduced by 16% for the ICE 4 and by up to 50% for other ICE series.

During the timetable planning phase, the experts from DB Systemtechnik conducted the design reviews for the traction system at the manufacturer's premises. The type testing results were evaluated, and initial sample tests were also performed to ensure maintainability and manufacturing quality.

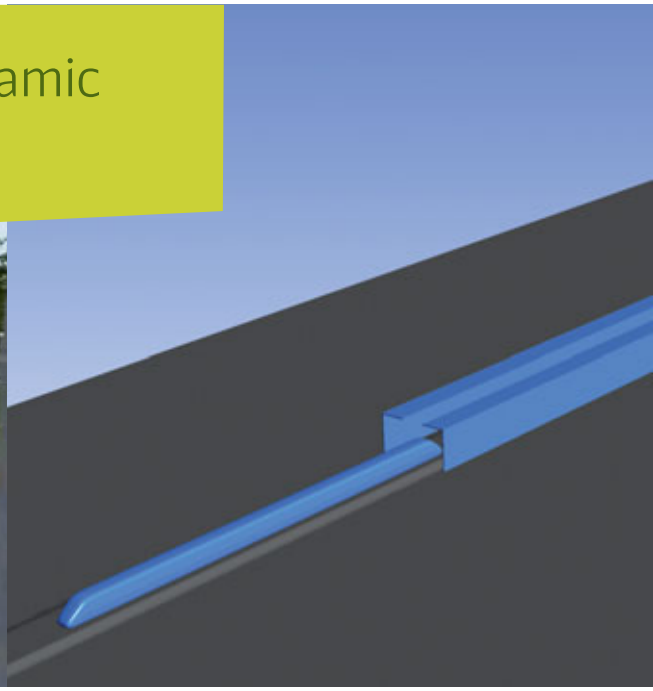
Representatives from DB Fernverkehr, DB Einkauf and DB Fahrzeuginstandhaltung provided support. The findings and indications observed during this process led to a significant number of improvements in the traction system.

Since the start of passenger services, DB Systemtechnik has carried out systematic evaluations of the ICE 4's traction issues. Fault patterns have been identified; misdiagnoses are separated from technical faults; and necessary improvements to software and hardware are agreed, together with the manufacturer to still further improve the already excellent traction performance.

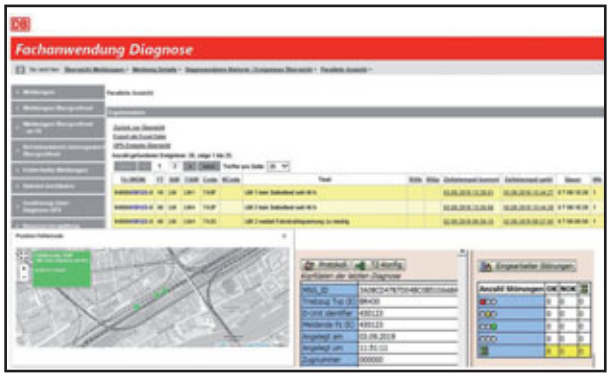
After more than one year of scheduled ICE 4 service, the availability of the traction systems generally meets the expectations. One of the important elements of this success was contributed by the Competence Centre for Traction Technology and Vehicle Control of DB Systemtechnik.

Photos: Christoph Baumann, Felix Weißwange 2x

New calculation method for aerodynamic loads on noise protection galleries



Remote data transmission diagnostics for Class 423 and Class 430



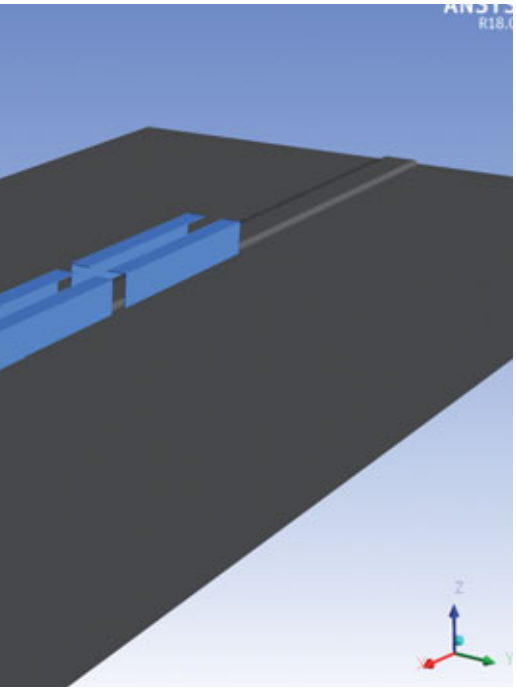
Remote data transmission diagnostics were required when procuring Class 430 and modernising Class 423 for the Stuttgart and Frankfurt S-Bahns.

DB Systemtechnik was commissioned to draft the corresponding specifications. The experts from DB Systemtechnik were also heavily involved in the rest of the procurement process: as well as drawing up the functional specification, they also conducted comprehensive approvals and testing with vendors.

In order to avoid the costs associated with a separate data transmission system, the passenger information system was used to identify synergies, which could then be exploited. An interface via which the data could be transferred to land-based systems was defined, together with the project partners. This interface was designed by DB Systemtechnik to be universal, so that it can be used by other classes (e.g. the new Hamburg S-Bahn). After extensive testing, both classes were successfully connected to the Universal Data Gateway and the specialist diagnostics application.

In December 2018, they were also connected to the maintenance system. Maintenance depots are now notified of any damage at an early stage, allowing them to plan their employees, materials and workstations better. There is no need to manually read out and evaluate the fault memory either, which used to be a time-consuming process. Data has been standardised, so it can also be transferred quickly to a different, customer analysis platform. Another procedure developed by DB Systemtechnik is used here, to convert coded technical values from the diagnostic data into the correct variables.

Photos: Mario Streng 2x

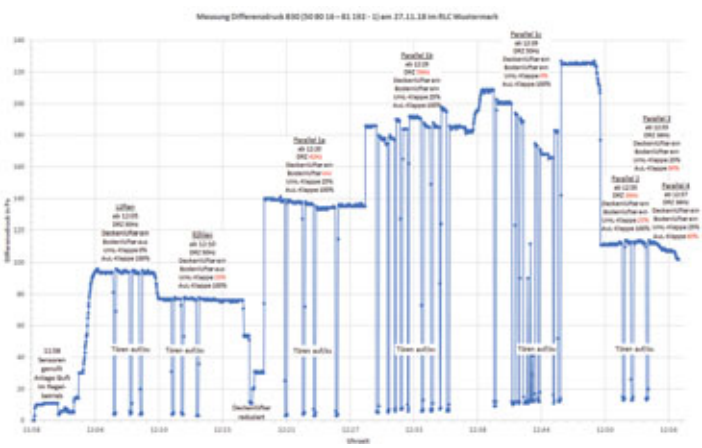


The purpose of a noise protection gallery is to improve the acoustic properties of a simple noise barrier, through an overhanging roof element. In contrast to the road construction sector, noise protection galleries have previously not been used on railways in Germany. The reason for this is a lack of evidence on the relevant aerodynamic effects of pressure and suction, especially in relation to high-speed rail traffic.

The German Federal Railway Authority therefore invited proposals for a research project to develop a model with which to calculate the aerodynamic load of train operation on noise protection galleries. The Aerodynamics and Climate Control department of DB Systemtechnik submitted the winning proposal for this research project.

Extensive CFD (Computational fluid dynamic) simulations were performed, varying the different geometrical parameters. The results were fed into an analytical load model to allow an accurate prediction of the two-dimensional pressure distributions on the wall and roof areas of noise protection galleries. The load model was validated using a comparison of model and simulation, and measurements for the case of a simple noise barrier.

This produced analytical formulas with which it is possible to calculate the loads on noise protection galleries at the design stage, dispensing with the need for extensive and costly testing ahead of scheduled operations, minimising passenger service risks.



Differential pressure measurements in the passenger area of a DoSto 2010

Repeated problems with the doors on the 1st class carriages of the double-decker (DoSto) 2010 were reported in the last two years. Investigations at the factory did not reveal any door faults.

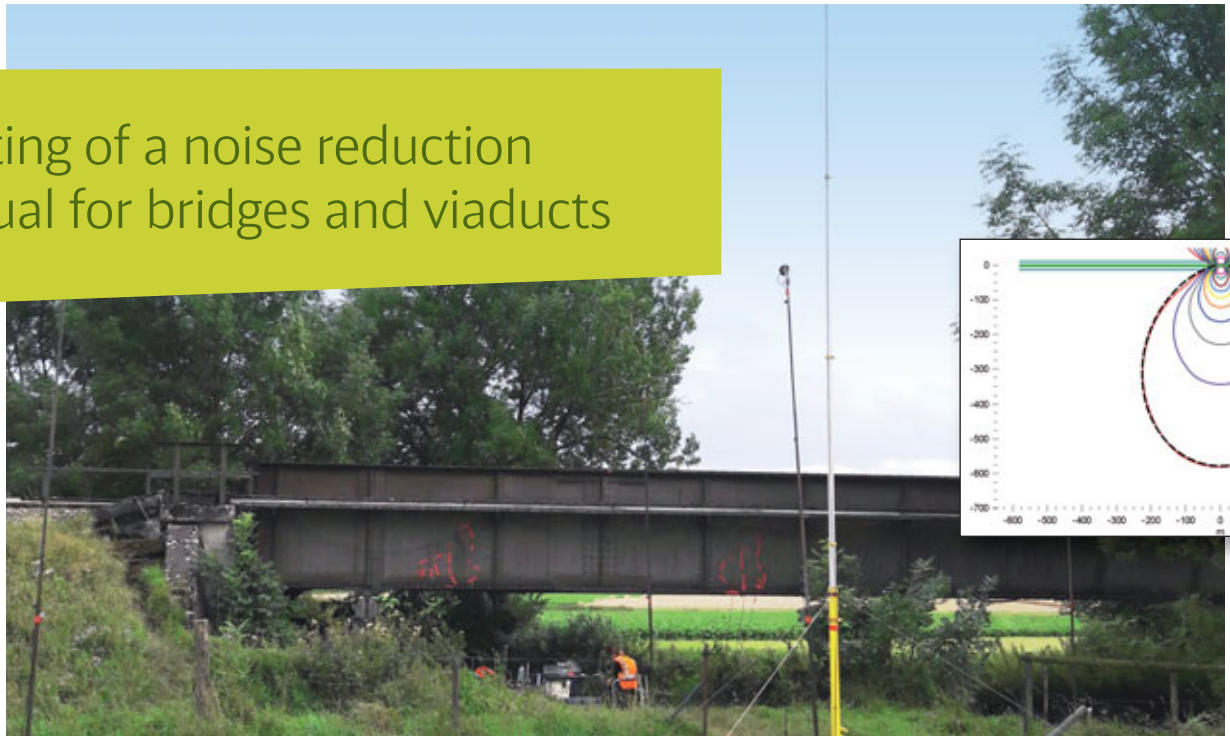
DB Long Distance requested DB Systemtechnik support to clarify whether inadmissible pressure conditions can occur when the train is in service that can affect the operation of the doors.

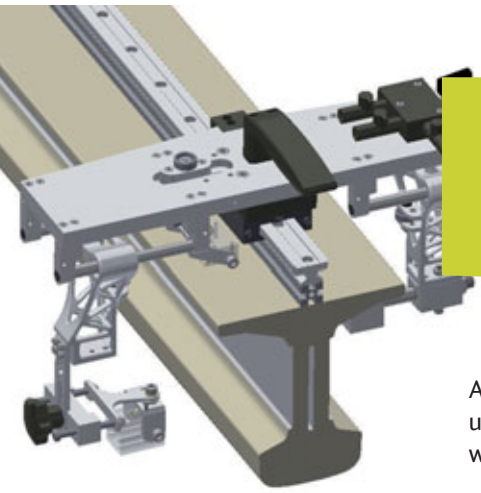
As part of the fault analysis, DB Systemtechnik used measuring equipment installed on the vehicle to carry out differential pressure measurements in the passenger area. The measurements were conducted on the vehicle at rest and once it was moving, demonstrating that, in certain operatational states a very high internal pressure could build up affecting the working of the doors. The air conditioning system, in combination with the non return valve in the exhaust air opening could cause this situation.

Cooperation with the colleagues responsible for the product line, depot and vehicle manufacturer allowed the cause of the fault to be identified. DB Long Distance was subsequently able to have the necessary corrective action carried out under the manufacturer's warranty. This dispensed with the need for unnecessary future maintenance, whilst guaranteeing disruption-free passenger operation.

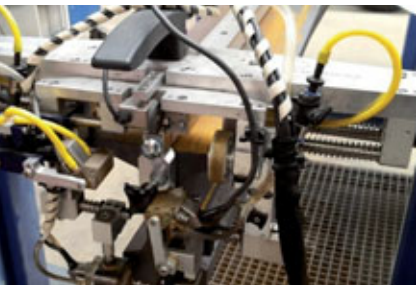
Photos: Dorothee Stiebel 2x, Tobias Görsch 2x

Drafting of a noise reduction manual for bridges and viaducts





Ultrasonic testing with a phased-array system at the Witten Switch Plant



At the Witten Switch Plant, standard rail halves are welded to common crossings using electron beams. Once the common crossing blocks have been made, the welds must be subjected to non-destructive ultrasonic testing.

As a result of design changes to the common crossing blocks and the associated increase in weld depth, ultrasonic testing (UT) can no longer be conducted solely via the time-of-flight diffraction (TOFD) ultrasonic method.

DB Systemtechnik was commissioned to design a test carrier that would allow the welds on the common crossing blocks to be tested using both the TOFD method and UT phased-array technology.

This enabled the testing range to be expanded by pivoting the sonic field. UT phased-array technology was first used as a design and test-engineering extension to the existing TOFD test carrier. The experts from DB Systemtechnik dealt with everything from CAD concept creation, to the procurement of individual parts and on to production of the test carrier; they also supervised the final set-up of the test system.

Prior to the field test, a suitability test for the TOFD/phased-array test carrier was carried out and passed. This test made it clear that the newly defined UT test conditions, with respect to the larger weld depth could be met through the use of UT phased-array technology. At the end of 2019 work was carried out to further development of the the test carrier, by procuring a second test carrier. The test carrier was re-designed to become a pure UT phased-array test carrier. By working together with the DB Fahrzeuginstandhaltung 3D printing project, innovative production methods such as additive manufacturing could also be incorporated into the production workflow.

Photos: Schütte, Eurovia

When a train crosses a bridge, it is not only the train itself, but also the bridge structure that emits noise. The noise from the bridge is heard at a low frequency and can be annoying. Steel bridges, in particular, are acoustically conspicuous and can in intercity areas lead to hotspots that are increasingly no longer tolerated by local residents. The aim is to ensure, in future, that noise emissions are taken into consideration whenever a new bridge is constructed or an existing one replaced.

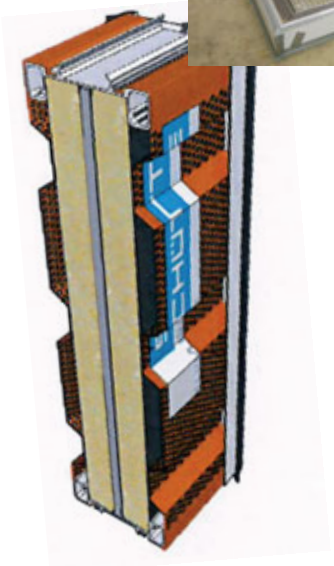
Under a contract awarded by the Federal Ministry of Transport and Digital Infrastructure, the acoustics experts from DB Systemtechnik, together with experts from DB Netz, drafted a manual to assist with the design and implementation of measures to reduce the noise emissions from bridges and viaducts.

To this end, the existing level of knowledge on the noise reduction of bridges and viaducts was first compiled. Next, further investigations, e.g. the need for and the effect of noise reduction measures, were planned and executed. It also became apparent that tools and methods, e.g. the design and documentation of noise reduction measures, needed to be developed. All the findings were described in the bridge manual, which was coordinated within DB AG and with the German Federal Railway Authority.

The bridge manual, which is accessible online since October 2018, allows to eliminate acoustic hotspots with little effort during the maintenance of a bridge or a bridge renovation. This will increase acceptance of rail transport by local residents without further closures of the lines, e.g. for noise abatement purposes. Previous uncertainties on the part of designers are removed. Individual expert opinions on bridges are no longer required in the majority of cases.

While enhancing the environmental compatibility of railways, use of the bridge manual reduces the cost of noise reduction measures for DB AG, minimises operational restrictions and speeds up projects.

Conformity assessment of noise barriers



Under the law, noise barriers must meet certain requirements before they can be used on the railway network of Deutsche Bahn.

Specific acoustic requirements must be met in accordance with the explanations of the "Schall 03" guideline and the requirements of DB guideline 804.5501. Accordingly, noise barriers must have sufficient sound insulation and a high absorption capacity to prevent reflections. The sound insulation and sound absorption are measured by external companies using a reverberation room. The documentation must meet certain requirements and conditions.

The acoustics department of DB Systemtechnik has, in recent years, tested the noise barriers of various manufacturers concerning sound absorption and sound insulation.

A conformity assessment comprises of the following services:

- Review of the noise barrier documentation for compliance with the DB guideline and plausibility check
- Check of accompanying documents for completeness, e.g. measurement reports from the reverberation room, data sheets, system descriptions and outlines, etc.
- Testing of the acoustic values
- Summary of the results in a test report

The client is provided with a test report containing the results of the tests. The manufacturer of the noise barrier must submit this report to DB Netz. After checking the acoustic values, on the part of DB Systemtechnik and examining other necessary conditions, DB Netz grants authorisation for the corresponding noise barrier to be used on Deutsche Bahn's rail network.

Photos: DB AG/Martin Busbach 2x

Development of a monobloc wheel for Class 290–296 diesel locomotives

Class 290–296 locomotives are fitted with tyred wheels. The previous version of the tyred wheel is to be replaced by a monobloc wheel design to reduce maintenance costs. This new version should be used in Class 290–296 locomotives so long as the following conditions are met:

- Unchanged operating conditions
- Continued use of the previous axles and all other wheelset, brake and running-gear components (e.g. axlebox, final drive)
- Braking boundary conditions taken into account and composite brake blocks used in developing the wheels.
- Thermo-mechanical behaviour verified through calculations and rig tests.

In addition, to enable the installation of the wheels as during a rountine maintenance task, the design of the shaft-hub connection must not result in an increased load on the axle and the load capacity of the interference fit has to be equal to or higher than that for the tyred wheel.

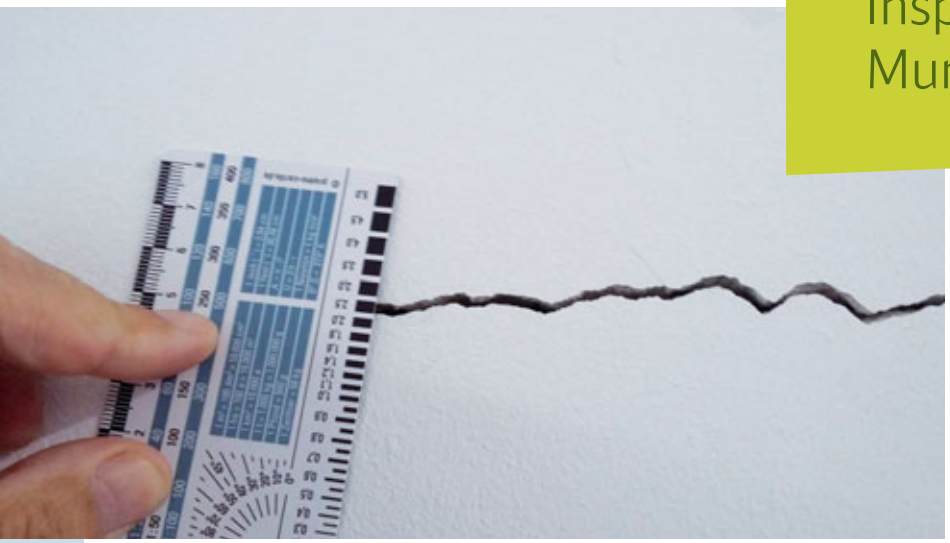
DB Systemtechnik was commissioned by DB Cargo to develop a monobloc wheel and performed the following services within the framework:

- Design of the monobloc wheel and adaptation of the drawing documentation for the drive wheelset
- Simulation of the thermo-mechanical load on the wheel
- FEM calculation for the wheel
- Calculation of hub projection
- Acoustic calculation to prove compliance with Noise TSI
- FEM calculation for the interference fit between the axle and the monobloc wheel/tyred wheel, including distribution of stress in the shaft
- Verification of fit interference and calculation of the transmissible torsional moment of the interference fit wheelset shaft/monobloc wheel
- Rig tests for verifying the thermo-mechanical properties
- Monobloc wheel TSI certificates and verification documents

The monobloc wheel is planned for launch during the first half of 2020.

Photos and Grafics: DB Systemtechnik

Inspection of depot building in Munich-Pasing



The German legal duty to maintain public safety makes it the responsibility of owners to identify any hazards potentially emanating from their buildings and structures.

In addition to this responsibility, enterprises must ensure that their property maintains its value and, for this purpose, order timely maintenance work, before there is any damage to the structural fabric that requires expensive renovation and refurbishment. This is possible, only if the current condition of buildings and structures is determined and documented by regular monitoring and inspection.

DB Systemtechnik offers such a service specifically for rail vehicle depots and all their structures. The depot experts from Kirchmöser advise the site managers on the nature and scope of their inspection duties.

Construction books are created for this purpose, together with regular building inspections and documenting findings in accordance with the guidelines. The term "buildings" covers the workshops and all other structures at the site, including pits, earth structures and roofed areas.

There is a long history of cooperation between the experts from DB Systemtechnik in Kirchmöser and DB Regio Bavaria in Munich. DB Systemtechnik determined and documented in 2018, the condition of the old depot in Pasing and the newly constructed vehicle maintenance and treatment facility. It was possible for the deficiencies discovered to be remedied under warranty at no cost to the client.

Photos: Martin Zwicker, Arnim Kilgus

Measurement runs with the Velaro Novo in the ICE S

Siemens has developed a new and incredibly efficient high-speed train: the Velaro Novo.

An initial test vehicle, dubbed the "#seeitnovo", was built to test out some of its key innovations, a process which DB Systemtechnik was pleased to collaborate on.

The DB Systemtechnik scope of services covered the following:

- Project management
- Network access to infrastructure
- Supply of the complete range of services for railway companies
- Supplying and equipping the vehicle with measuring instruments
- Running and braking measurement runs at up to 400 km/h
- Tests on the Velaro Novo pantograph prototype
- Velaro Novo integrated into the ICE S for continuous testing runs in the context of regular inspections

To enable the "#seeitnovo" test coach to run connected to other units during regular inspections, without the need for metrological monitoring, comprehensive tests had to be performed in advance on its running and brake equipment at speeds of up to 330 km/h on selected routes (e.g. VDE 8.2). Depending on the speed range and requirements, these measurement runs were either conducted with the ICE S (up to 330 km/h) or the locomotive-hauled coaches with automatic coupling (up to 200 km/h). Before the test runs, the "#seeitnovo" test car was technically integrated into the ICE S or the coaches using automatic coupling.

Once the first measurement runs had been completed successfully, no objection certificates could be issued for the running and braking equipment, releasing it for future use without metrological monitoring during regular inspections. Innovative components recently developed by Siemens (e.g. washers that are permeable to radio waves, pantograph prototype, bogies with inside journals and aerodynamic panelling) were also tested during the measurement runs and the regular inspections.

The objective of the entire measurement campaign is to test and validate the innovations found in the Velaro Novo by testing them independently under real conditions.

DB Systemtechnik has been working well with Siemens on this project since the start of the first measurement runs in March 2018 and more joint measurement runs are being planned.

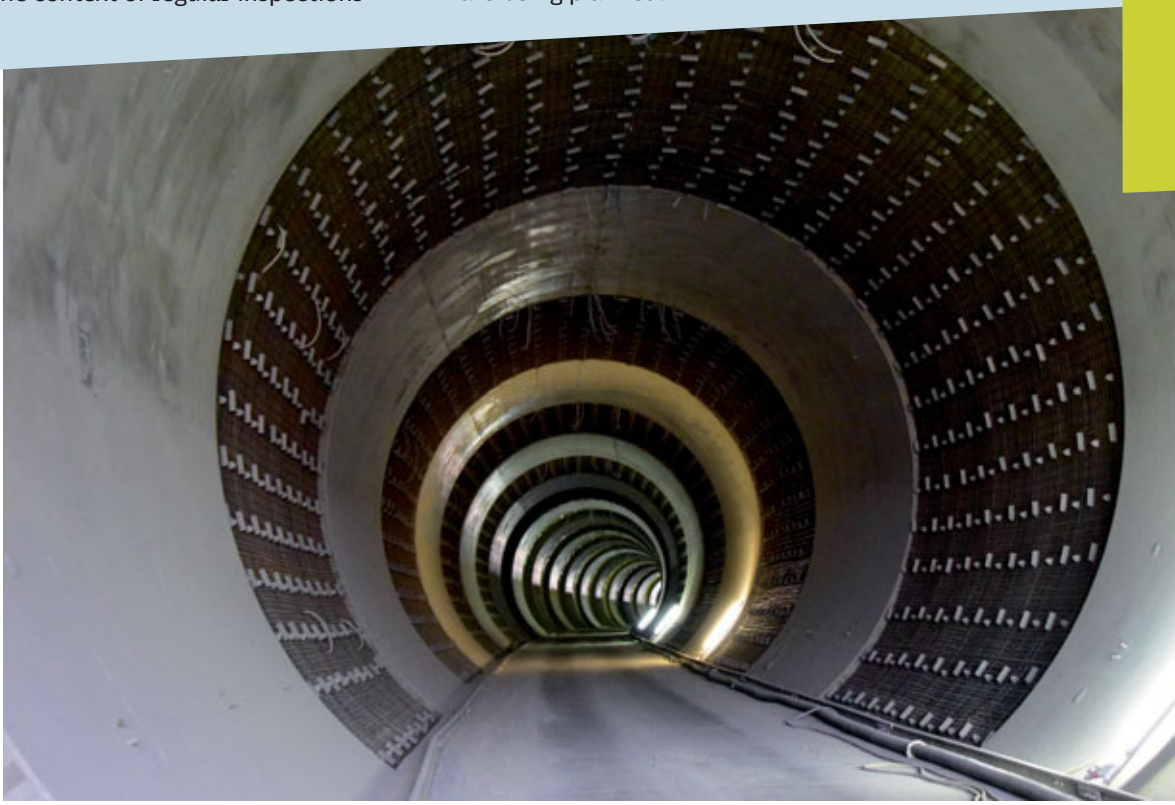


Photo: DB AG/Frank Barteld

Bogie diagnostics taskforce

Railway bogies are monitored all the time. Bogie diagnostics record the lateral accelerations that occur at the bogie frame during operation, making them an important system for ensuring that trains run safely. If a certain maximum value is exceeded, the diagnostics start, which in turn reduces the maximum speed.

2016 saw a rise in the number of bogie diagnostic messages reported by the Deutsche Bahn AG fleet of ICE long-distance trains during passenger service. The reduced maximum vehicle speeds led to many minutes of delay and transport to maintenance depots, more maintenance tasks and increased maintenance costs.

So a team of experts derived from different DB fields and divisions was enlisted to analyse the cause and decrease the number of error messages.

DB Systemtechnik was represented by the Running Equipment Testing department, the Wheelset competence centre, and the Strength and Simulation Testing department.

Speed restrictions and driver orders were put in place on sensitive route sections and shorter wheel reprofiling intervals were introduced for the wheelsets as temporary measures. DB Netz AG also sanded the rail profiles at hotspots. Calipri measuring instruments, part of a system for determining equivalent conicity, were introduced into DB Fernverkehr maintenance depots and a forecasting method was developed to enable critical wheelsets to be identified at an early stage.

Another system is currently being introduced so equivalent conicity can be determined at a standstill. In the long term, a new, dimensionally stable wheel profile will be developed and tested, which will be better adapted to the new wear characteristics. This successful cooperation greatly reduced the number of bogie diagnosis messages.

Risk management for verification of safe operation

The new line from Stuttgart to Ulm involves the construction of several rail tunnels. In addition, the new Stuttgart main station will be built underground. The individual subsystems call for specific safety and fire protection concepts.

Using a risk management procedure, DB Systemtechnik has performed and documented the safety case as per EU regulation for the "Stuttgart 21" project.

To guarantee the safety of rail traffic in tunnels, state-of-the-art safety and rescue concepts are being coordinated during the planning phase. The primary goal of these concepts is to prevent hazardous events. There will only be an event if these measures fail, with appropriate evacuation and rescue measures used to mitigate the consequences. There are frequently constraints that require deviations from regulations, because not every specific construction project case can be reflected in the guidelines. Therefore, the operators of the installations are not only responsible for safe operation, but, under the European railway safety directive and the underlying regulation (EU) 402/2013, they must furnish proof that safety is guaranteed despite modification to the regulations.

For Stuttgart 21, DB Systemtechnik, together with the DB Project Stuttgart-Ulm performed the following services and assessed risks:

- Evacuation scenarios in case of fire
- Design of escape routes in tunnels
- Safety in rail tunnels in case of fire
- Development of measures for comparable security in respect of the regulations
- Documentation of risk management procedures

Photos: DB Systemtechnik 3x

Parallel aerodynamic and climatic testing with an IC 250

In connection with the vehicle approval of the EC 250, Stadler contracted the testing laboratories of the Aerodynamics and Climate Control department of DB Systemtechnik to perform tests:

- TSI measurements of train-indexed flow velocities and aerodynamic loads on clear tracks
- Testing of train-induced flow velocities in the track bed
- Measurement of the traction resistance
- TSI verification measurements of the aerodynamics in tunnels
- Verification measurements of micro-pressure waves as per EN 14067
- Determination of the dynamic pressure tightness

By combining the first three and the last three contracts into a single measurement campaign, it was possible for the associated testing to be performed simultaneously.

To **measure the train-induced flow velocities and pressure loads on open track,** a suitable section of the high-speed line between Hanover and Berlin was selected and checked for conformity with all the TSI boundary conditions. Next, four TSI-compliant ultrasonic anemometers (USAs) and two pressure masts were aligned next to the track within the permissible tolerance range. Setting up a variety of measuring equipment along the route meant that the time required for the required test runs could be halved. The use of automatic blow-out control for the pressure sensors minimised the weather-induced risk of failure.

To **measure the flow velocities in the track bed,** a field-proven, 30-metre-long plate floor, including its measuring equipment, was adapted to the normative requirements.

Once again, the number of sensors, consisting of a grid of Pitot tubes and associated static pressure holes, was doubled in order to minimise the required number of test runs. Apart from an online analysis, for initial classification and quality assurance of the measurement results on site, additional averaging was programmed as per the standardised process in order to characterise the flow conditions in the track bed.

To **measure the traction resistance,** additional, suitable track sections for coasting tests were selected, both ahead of and behind the above-mentioned measuring section. The test runs for the above-mentioned TSI tests were planned so that at least three repeat measurements were possible for each speed level (75 km/h to 250 km/h) for the traction resistance coasting tests.

The rolling resistance was determined by means of force measurements in towing tests. To assess the influence of wind and to determine the air density, weather stations were put in operation in all measuring cross-sections. They were distributed over 20 kilometres of track, operated automatically and monitored by employees by remote interrogation and control, at the parallel measuring location of the TSI test. Therefore only one additional employee, a test manager, was required on the train for professional control and logging.

In a second measurement campaign, the tunnel aerodynamics and micro-pressure wave tests were performed, in addition to the calculation of the dynamic pressure tightness of the multiple unit. In consultation with Stadler, Göggelsbuch tunnel was chosen for the **measurements of the tunnel aerodynamics,** because it was possible to set up the necessary measuring facilities for both directions of travel. The measured data underwent an online analysis at the north entrance, while quality assurance of the unmanned measuring

facility at the south entrance was carried out by remote interrogation. Equipping both tunnel entrences halved the required time and effort for the test runs.

To **measure the micro-pressure waves,** the entrances, as well as in the centre of the tunnel to determine the maximum gradients of the micro-pressure wave over the length of the tunnel. The measuring equipment supported recording in both directions of travel. The automatically measured data underwent online analysis and quality assurance by remote interrogation from the manned measuring cross-section at Göggelsbuch tunnel (around 25 kilometres away). The parallel performance of the measurements with the TSI tests for the tunnel aerodynamics, along with the symmetrical equipping of both tunnel entrances, as well as the centre of the tunnel, made it possible to minimise the time and effort required for the test runs in Euerwang tunnel.

These measurement campaign test runs were used by the Climate Control testing laboratory to determine the **dynamic pressure tightness** of the multiple unit. For this purpose, pressure sensors were positioned inside and outside individual cars. Each pair was placed in the same longitudinal order of position, by comparing the external and internal pressure, to determine the time constant for quantification of the pressure tightness.

All measurement results were analysed and documented in detailed test reports, in compliance with the appropriate standards and client requirements.

The simultaneous performance of the tests and measurement runs made it possible to minimise the time, effort and resource required, as well as reducing the operational costs of the EC-250 test runs.

Photos: Dr. Eric Wild , DB AG/Wolfgang Klee; on the right: PlaneMad

Integration of NDT facilities into the DB Fernverkehr IT network

DB Fernverkehr uses various non-destructive testing (NDT) facilities for maintenance work in the depots. These include mechanical testing facilities for axles with a longitudinal bore (HPS), which test the axles for damage caused by operatational conditions whilst they are still installed on the vehicle.

The existing testing facilities have been procured over the last 20 years as standalone systems with respect to the hardware and software used. The DB Fernverkehr IT strategy stipulates that all relevant facilities shall be integrated into the internal IT network, whilst also being secure and up to date.

It is a challenge to integrate the existing HPS facilities into the IT infrastructure during the software and hardware development stages. The priority must always be to ensure that the NDT facilities are able to perform their primary function, which is to test safety-related components properly. At the same time, predefined IT security concepts must be implemented, and the NDT facilities protected against unauthorised external and digital influences.

To support this, the Non-Destructive Testing and Testing Systems Departments at DB Systemtechnik, in consultation with the client DB Fernverkehr, have developed concepts for encapsulation, as well as software-based and mechanical security measures for external access, whilst at the same time maintaining device-based communication.

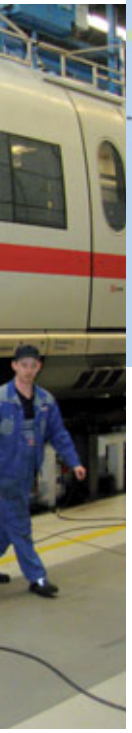
IT-based devices were used for the encapsulation. The different departments worked closely together to integrate all depot applications into the IT Network.

This gave the customer a consistent concept and system for implementing s stand-alone inventory systems in their IT infrastructure. Making it possible to integrate Active Directory administrations, daily backups and virus signatures, global, automated storage options for test data and standardised remote maintenance concepts.

DB Systemtechnik is a key interface that communicates with facility manufacturers to ensure that the provisions made for facility and testing software are also suitable for future procurement needs.

Digitisation of DB Cargo Regulations 4.0

Procurement support of Stadler in relation to air conditioning systems



As a result of an invitation to tender from Indian Railways, for the equipping of long-distance and regional trains with air conditioning systems, DB Systemtechnik helped Stadler to select the appropriate supplier of air conditioning systems.

The specifications for suppliers of air conditioning systems were firstly examined and supplemented by key text modules, to ensure that the procured air conditioning systems was capable of coping with the Indian climate, whilst addressing climate challenges. The bids from the air conditioning system manufacturers were then inspected, commented on and assessed.

Next, at a workshop, the bids and requirements were discussed together with the suppliers. The submitted bids and design calculations were then examined and evaluated by DB Systemtechnik.

This involved the use of DB Systemtechnik's own comparative calculations, in addition to analysing the degree of compliance with the specifications by means of an evaluation matrix. Based on the overall scores, a recommendation was given for the supplier choice.

The good cooperation between DB Systemtechnik and Stadler, allied to the specialist expertise of the air conditioning department, was also supported by DB Systemtechnik's detailed knowledge in long-distance and regional transport comfort standards. This laid the foundation for the successful project conclusion. Stadler was able to make an informed choice of the air conditioning system supplier and to submit a bid with a complete air conditioning description, that met the requirements of the client from India.

DB Systemtechnik was commissioned by DB Cargo to help convert the existing regulations into a digital version called "Regulations 4.0 DM Cube".

It was important that the content was transferred without being altered and converted into a modularised and digitised format, that incorporated all the maintenance engineering regulations. The maintenance manuals for the following classes were assigned for editing:

- Class 232/233 Volume 1–3
- Class 290/294/296 Volume 1 and 3
- Class 298 Volume 1 and 3
- Class 335 Volume 1–3

The following steps were carried out to convert the regulations:

- Formulation of the module structure
- Initial creation of the regulations in the editorial system
- Transfer of valid and approved maintenance specifications in modularised form
- Incorporation of the applicable change orders (IW-C)
- Updating of all references to rules in the created modules
- Support with the regulations migrated by DB Cargo
- Participation in readings to verify the transferred maintenance specifications
- Creation of proposals for headline data
- Provision of documents for user testing
- Process-oriented preparation of all current documents
- Creation of the development files for the modules (up loading of external documents and manual comments)

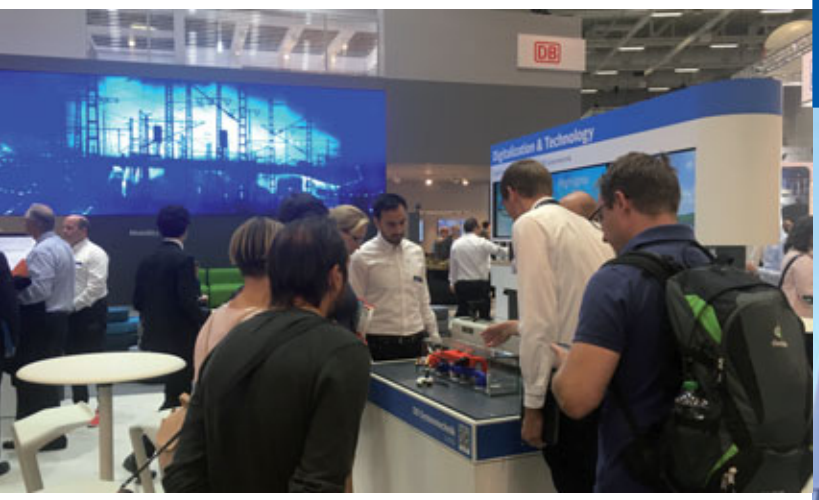
Thanks to the work carried out by DB Systemtechnik, the new digital regulations offer the following advantages:

- Simplified digital workflow to create, amend and provide the regulations
- Avoidance of duplicate work that previously occured
- Simplified navigation within the rules
- System-internal test equipment for error avoidance, in the creation of rules and their regular updating and further development
- Use of digital media such as a tablet or handheld terminal in the maintenance depots
- Groundwork was laid for a dynamic process of change and, therefore, for condition-based and predictive maintenance
- Digitisation and modularisation to allow fast and efficient "customisation" of the required rules for differentiated maintenance orders

Trade fairs and activities

Photos: Martin Loibl 3x, Dimitra Vassilopoulou

Exhibition stand at InnoTrans 2018



From 18 to 21 September 2018, DB Systemtechnik showcased its range of services at InnoTrans, the world's largest railway trade fair in Berlin.

The DB Systemtechnik's focus at the central DB exhibition booth in the CityCube, was the air conditioning testing services. The new labaratory test bench LUDEK was presented for the first time. Although it was still a 3D-printed model at the trade fair, from 2020 it will be used in Munich to inspect removed air conditioning systems, as well as diagnose and optimise air conditioning systems.

At a joint booth in the outdoor area, specialists from DB Systemtechnik and DB Fahrzeuginstandhaltung showcased a selection of predictive maintenance solutions for rail vehicles and rail infrastructure.

They demonstrated the latest sensor and transmission systems that can continuously monitor vehicles, tracks and switches, and analyse during normal operations. There was a focus on secure data transfer from train to land, as well as correct interpretation of data to allow maintenance individuals to respond in good time, increasing the availability of their vehicles and infrastructure assets.

Photos: Kristin Heinrichsmeier 2x, Frank Lüders, Andreas Bittger

10 years climate chamber MEikE

On 19 March 2019, DB Systemtechnik marked the 10-year anniversary of the MEikE climate chamber with a ceremony in Minden. The climate chamber itself served as the perfect venue. The event opened with a speech by Thomas Jäcke, Mayor of Minden. Peter Lankes, former Head of Rail Vehicle Technology at Deutsche Bahn, and one of MEikE's launch customers, then gave a humorous speech.

The air conditioning technicians from Minden then rounded off the event with a photo slideshow. The celebratory event was flanked by an internal railway climate day for Deutsche Bahn technology managers and the "Symposium on Climate Technology" on 20 March for internal and external customers working in the climate technology sector.

Fire protection day for DB customers in Kirchmöser

Photos: Martin Loibl 3x; DB Systemtechnik

RAILTEX exhibition in Birmingham, UK

In May 2019, DB Systemtechnik made an appearance alongside DB ESG and DB Fahrzeuginstandhaltung, at the RAILTEX international railway exhibition. The three companies presented their range of services at the show on a 40 sqm exhibition stand, including testing, engineering expertise, measuring equipment, vehicle conversion and maintenance.

DB Systemtechnik 2019 Customer Day in Munich 2019

In May 2019, DB Systemtechnik greeted 100 guests at the customer day in the district of Freimann in Munich. As part of the evening programme, there was an "all around Munich" city tour in a modernised suburban multiple unit train. The following day involved exciting talks and workshops.

Following the motto "Rail technology 360°" there were insights into the diverse range of topics of DB Systemtechnik. For example, there were workshops on conversion and accident repair of rail vehicles, on the new NDT regulations and on the implications of the fourth railway package for vehicle authorisation.

Five years since the introduction of the European standard for fire safety EN 45545-2, there are still many unresolved issues. This is why DB Systemtechnik's fire protection experts invited customers to a Customer Day in January 2019. Participants were able to exchange and discuss their previous experiences of component procurement, operational maintenance and redesign projects.

The prevailing opinion amongst the participants was that it was crucial to consider fire safety requirements early on during conversion projects and the associated approval procedures in order to detect and eliminate risks in projects from the outset. During a tour, the 39 participants of the fire safety workshop had the opportunity to find out more about the range of services of not only the fire safety lab, but also other testing facilities in Kirchmöser.

DB Systemtechnik
Kundentage 2019
München

Bahntechnik **360 °**

Photos: HTW Dresden/Peter Sebb, DB Systemtechnik

16th wheel-rail conference in Dresden

470 participants from 10 countries went to Dresden in September 2018. In seven plenary talks, DB Systemtechnik again demonstrated its technical expertise. The following topics were presented:

- Monobloc wheel fractures in freight transport – solutions to a European question
- Service strength verification for axles
- Calculation of wheel profile wear
- Verification of vehicle models as per EN 14363:2016
- ESAH-M – electronic system analysis in the core area to increase the time needed to lay points
- Underfloor wheelset processing
- CBM – increasing availability and punctuality through digitalised failure prognosis

14th KNRBB contractors meeting in Kirchmöser

The Network Meeting of Kompetenznetz Rail Berlin-Brandenburg was held in Kirchmöser in December 2018. 40 participants, some of whom travelled over especially from Denmark, Poland, Sweden, the Czech Republic, the Netherlands and Austria, viewed the facilities of DB Systemtechnik. New network partners also introduced themselves and presented.

Photos: DB AG/Henry Sulz, Kristin Heinrichsmeier, Martin Loibl

2018 Cooperation with Japan

As part of the cooperation between JR East (East Japan Railway Company) and DB AG that is existing since 26 years, a one-week get-together of the technology experts of the two companies was held during October 2018.

More than 50 experts and managers took the opportunity to exchange ideas about relevant specialist topics and current developments in vehicle technology, infrastructure, control-command and signalling, digitalisation, safety and station development.

Traditionally, this annual exchange alternates between Japan and Germany. Once again, the one-week event this year included a detailed three-day technical exchange, including a day with the management boards of both companies.

DB Systemtechnik presents the 500th instrumented wheelset

DB Systemtechnik presented its 500th instrumented wheelset in Minden on 20 November 2018. The previous wheelsets have covered around 30 million train kilometres with their measurement runs – Equivalent to circumnavigating the globe 750 times. The latest model of an instrumented wheelset is the result of over 40 years of systematic technology development.

Thirty selected guests from the railway sector accepted the invitation to this event. DB Systemtechnik demonstrated in presentations that it is the technology leader in the development and implementation of instrumented wheelsets.

DB Systemtechnik theme day – traction technology 2018

In November 2018, the Powertrain Technology and Vehicle Control Competence Centre issued an invitation for a technical exchange in Munich-Freimann. A total of 44 guests accepted DB Systemtechnik's invitation and participated in a varied programme.

Besides providing an insight into extensive expertise in the field of drive technology, the emphasis was placed on specific technical topics, such as new features in exhaust gas legislation, preventive maintenance options and alternative drives.

DB Systemtechnik: Our products

Testing

The Testing Services' Business Line comprises of 250 employees, who are on hand with their extensive system knowledge, suitable test procedures and tools and in-depth testing expertise.

Testing
- Vehicles
- Infrastructure
- Components

Approval
- Vehicle approval
- European requirements (TSI certifications NoBo)
- National requirements (DeBo)
- Partial releases for infrastructure
- Expert opinions
- Safety-critical changes (AsBo)

Measurement technology
- Sale of measurement and diagnostics systems

Engineering

At several locations with a total of 350 employees, the Engineering Business Line supports customers with design, engineering and digitalisation for vehicles and components.

Engineering design
- Design support:
  New and existing vehicles & components
- Conversion and redesign
- Damage and accident refurbishment

Engineering
- Supervision of production assets
- Fleet management
- Procurement accompaniment
- Supplier/product qualification
- Undertaking studies & expert reportss
- Operating regulations
- Representation on committees
- IT use & diagnostics
- Accident and damage analysis
- Assessment of financial benefit (RAMS, LCC)

Maintenance systems

Our 150 employees in the Maintenance Systems' Business Line advises and supports customers with engineering services for the design, set-up and optimisation of all maintenance system elements relating to railway technology and associated infrastructure. We support our customers with testing and measuring equipment related condition-oriented maintenance.

Maintenance systems
- Development and supervision
  of maintenance concepts
- Condition-based maintenance
- Works planning and intra-plant logistics
- Testing and diagnostics equipment
- Non-destructive testing
- Metrology/calibration technology
- Materials engineering
- Welding and adhesive bonding

Consulting

DB Systemtechnik is the only provider of consulting services to be born out of an overarching rail operations company. We analyse problems and design individual solutions looking at the rail system as a whole. We cover areas such as rolling stock, components and infrastructure. We always keep our customer's economic success in mind and are focused on the financial aspects of the overall rail system.

System consulting
- Strategy and controlling
- Qualification
- Quality and management
- Environmental dimension
- General system issues
- Operations planning and implementation

Technical consulting
- Optimisation of the entire life cycle
  of rolling stock and components
- Procurement of rolling stock
- Vehicle maintenance
- Workshops

Photos: Kai-Uwe Nielsen, DB Systemtechnik, ESG Rail

Hans Peter Lang
Managing Director

Christoph Kirschinger
General Manager Sales

Stefan Schneider
General Manager Finance/Controlling, Human Resources

Steve Goebel
Sales Germany, Austria, Switzerland

Sergej Samjatin
Sales Asia, America, South and Eastern Europe

Jérome Robin
Sales France, Luxembourg, Belgium, Norway

Paul Forrest
Sales UK

Alfred Hechenberger
Marketing/Sales Deutsche Bahn

Dr. Lars Müller
Business Line Testing

Nils Dube
Business Line Engineering

Dr. Burkhard Schulte-Werning
Business Line Maintenance Systems

DB Systemtechnik
Your contacts

Nick Goodhand
Managing Director DB ESG

Dr. Stephan Schubert
CTO, Innovations-management

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Our Knowledge: Your success

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DB Systemtechnik GmbH
Pionierstraße 10
32423 Minden, Germany

Further information:
Website: www.db-systemtechnik.de
E-mail: db-systemtechnik@deutschebahn.com
Contact: Alfred Hechenberger

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