



informer

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47



SPOTLIGHT

Kiepe Electric

New member of the family

CUSTOMERS + PARTNERS

New climate

Best-practice solutions
worldwide

PRODUCTS + SERVICES

Sanding systems

Sophisticated
high-tech systems

KNORR-BREMSE



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Harald Schneider,
Member of the Executive Board
of Knorr-Bremse Systeme für
Schienenfahrzeuge GmbH

INFORMATION FOR KNORR-BREMSE'S CUSTOMERS AND BUSINESS PARTNERS

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Systeme für Schienenfahrzeuge GmbH
Marketing: Katharina Bachem
Moosacher Straße 80
80809 Munich
Germany
Tel. +49 89 3547-0
Fax +49 89 3547-2767
www.knorr-bremse.com

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Text: Thorsten Rienth
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Dear Reader,

Let's cast our gaze ahead a few years into the future. If we had the choice, what would we want our inner cities to be like? We would probably want vibrant city centers with low noise levels, "green lungs", local spaces providing a refuge from the hustle and bustle, and excellent accessibility. It will be fascinating to see where the creativity of urban planners takes us. The ways in which we travel around this city of the future will also be different. And I am not just referring to self-driving cars. There will also be fundamental changes in public mass transit – at least as far as its drive technology is concerned. Almost all mass transit vehicles will be electric.

This foreseeable development was one of the key factors that led Knorr-Bremse to acquire Kiepe Electric just over a year ago. It is no exaggeration to say that the acquisition marked a milestone for the Company. As a result, our rail vehicles portfolio, which was previously known mainly for its braking technology, now includes drive technology. This edition of informer turns the spotlight on the background to the acquisition and on how the newest member of the Knorr-Bremse family has fared in its first year with the Group.

But we also have many other things to report on from the Knorr-Bremse world. For instance, there is our new approach to developing future HVAC systems. This systematic approach enables us to make best-practice solutions from across the Group available to every individual HVAC project worldwide.

Another example is our latest generation of power supply systems. Our colleagues at Knorr-Bremse PowerTech have developed a consistent, decentralized design that resolves the long-standing conflict between the objectives of outstanding operating performance and high system efficiency. Furthermore, by matching activation of consumers such as HVAC systems and air supply units with demand, it is possible to extend their service life.

Efficiency is also at the heart of the platform door systems that Knorr-Bremse is supplying for the eight tunnel stations of London's new Elizabeth Line – in more ways than one. Firstly, because the systems cleverly direct passenger flows, facilitating rapid passenger handling. Secondly, because the trains force less conditioned air back into the tunnel system. And thirdly, because Knorr-Bremse is using a new technique to install the systems. We are now fitting them from a small rail vehicle rather than from the platform. This means that during installation the platform is kept free, allowing any other necessary work to be done.

As you can see, we really do think of everything when executing our projects. I hope you find plenty to interest you in this edition of informer.

Best regards,

Harald Schneider

news

RailServices modernization



▲ ▼ Rheinbahn uses iCOM

Rheinbahn to begin piloting iCOM

iCOM Monitor, Knorr-Bremse's digital platform for condition-based maintenance, is about to begin its next pilot project. Düsseldorf's public transport corporation Rheinbahn will initially equip five of its 76 Type NF8U low-floor light rail vehicles with the new system. The system improves workshop scheduling, increases vehicle availability, and reduces operating costs.

The iCOM platform functions by accessing information supplied by vehicle subsystems and a large number of sensors, most of which are already installed, and uses these data to determine the condition of individual vehicle components. Algorithms raise the alarm if there is a significant increase in the likelihood of a product or system failing. Transmitted online to Rheinbahn's back office, this warning gives the operator time to respond, reducing downtimes and preventing unanticipated failures. Where possible, iCOM Monitor helps avoid in-service failure of products and systems altogether, as they can be replaced on a plannable basis thanks to early detection.



New door leaves for Berlin commuter trains

This is a project in which S-Bahn Berlin (part of the Berlin Transportation Authority) is upgrading vehicles from its older BR480 series to enhance longevity. In addition to other technical upgrades, the twin multiple units, which have been in service since 1990, will be equipped with new door leaves – 480 units in total. They will be supplied by Knorr-Bremse subsidiary IFE, which has its head office in Kematen, Austria. Recertification of the subsystem will not be necessary, since the door leaves are already in service as a proven and approved system.

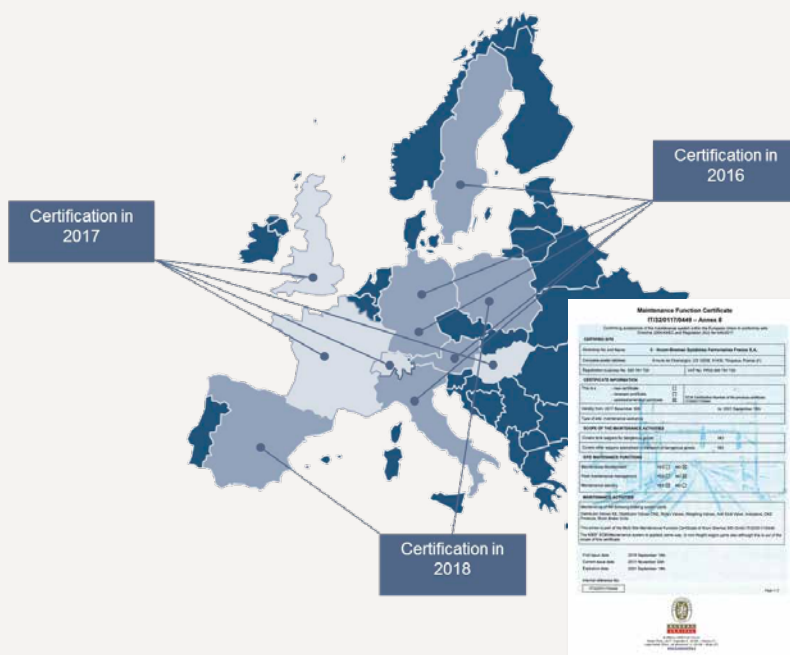
"This is a classic replacement part order," explains Sven Kompa, IFE Head of Sales, Aftermarket, Germany. "The new door leaves will replace those that have reached the end of their service life and for which an overhaul is no longer feasible." The call-off order will commence during the course of 2018. The 70 BR480 twin multiple units are then intended to remain in service until 2025.

Door on Berlin commuter train ►



ECM certification: Knorr-Bremse completes second wave

Knorr-Bremse successfully concluded its second wave of ECM certification at the end of 2017. In addition to the central processes in Munich, the service centers in Berlin, Lund (Sweden), Florence (Italy), Mödling (Austria), Melksham (UK), Niederhasli (Switzerland), Budapest (Hungary), and Reims (France) now each possess an Entity in Charge of Maintenance (ECM) certificate in accordance with EU Regulation No. 445/2011. The third and final wave of ECM certification involving the service centers in Kraków (Poland) and Getafe (Spain) will be completed in the course of 2018.





Hitachi's Rail Europe "Class 800" line. ▲►

New Hitachi intercity trains enter service

The United Kingdom's Great Western Main Line is currently undertaking a truly impressive rail project as part of the Intercity Express Programme (IEP), replacing its existing intercity stock with the new "Class 800" series from Hitachi Rail Europe. With top speeds of up to 200 km/h, these trains will gradually replace the Intercity 125 fleet between London and Aberdeen, Bristol, Cardiff and Edinburgh.

Knorr-Bremse is part of the project as the supplier of the complete braking systems. These consist of the EP Compact electronic brake control unit, bogie equipment and an air supply system using an oil-free compressor. Around 20 of the 57 "Class 800" trains have newly entered service – and the braking system is living up to its promise. So say reports from engineers at Knorr-Bremse Rail Systems UK in Melksham, who have been monitoring commissioning of the trains on site. But that's not all. They will also be responsible for servicing the braking systems for at least the next 28 years.



▲ BU Cia ius. Tor susam et estiant quam quossit atenda



▲ Gmundener "stadt.regio.tram", © Stern & Hafferl



▲ One-piece shop, IFE Brno

IFE: New one-piece shop and major orders

IFE's Brno facility in the Czech Republic took a major step forward with the opening of a new one-piece shop last summer. It now allows IFE to achieve the same short lead times for individual items, prototypes, and very small batches as in serial production. To make this possible, core processes such as machining, bending, welding, bonding, pressing, and final assembly have been duplicated in a separate 800 m² shop for batch sizes of up to five.

England, Qatar, Austria

The Austrian door system specialists have also announced a number of major OE contracts. The E4 entrance system is once more on board for the recent additional orders for Bombardier's AVENTRA platform. IFE has already begun production of entrance systems for 111 trains in the new Greater Anglia fleet. A total of 2,660 systems are scheduled for delivery by the end of 2019. Meanwhile, production for the next AVENTRA project for South Western Railways is due to begin in mid-May. In this case, the order comprises more than 3,000 E4 passenger entrance systems.

Two further orders have been received from Qatar: Japanese vehicle manufacturer Kinki Sharyo ordered 1,350 RLS systems with sandwich door leaves for Doha's driverless metro. And Alstom ordered 336 of the same entrance systems for 28 light rail vehicles, albeit with a different opening width and full glass door leaves.

Meanwhile, the last of the current batch of eleven vehicles for the Gmundener Tramway has successfully entered service. In total, IFE has supplied Vossloh with 44 double-leaved and 44 single-leaved door systems including door drives and door leaves.



◀ New tread brake unit

New tread brake unit launched for Japanese market

A new tread brake unit designed especially for the Japanese rail transportation market (PSC7) was added to Knorr-Bremse's portfolio at the beginning of 2018. The PSC7 is a particularly compact tread brake unit that caters to the limited installation space allowed by the narrow bogies found in Japan. It can be installed vertically or horizontally, depending on the application. The PSC7 attracted a lot of interest from visitors to the Mass-Trans Innovation Japan



▲ Impressions from the Mass-Trans exhibition stand

trade show in Tokyo (from Nov. 29 to Dec. 1), where it featured alongside the new brake control unit developed for the diesel multiple units on the East Japan Railway Company, Akita-Niigata line. The "Mass-Trans" is Japan's only rail related exhibition, attracting some 500 exhibitors and more than 30,000 visitors.

Although Knorr-Bremse does not have its own Rail production facility in Japan, the maxim "think global, act local" still applies in the Far East. The local staff employed at the Sakado Service Center (SSC) provide aftermarket services for the products and systems that the Group offers in Japan throughout their entire life cycle. In addition to the brake control and tread brake units mentioned above, these also include brake discs and calipers, the VV180T and VV90T oil-free compressors, and the EP2002 control system. As is customary in the Japanese market, all of these products are also available as enclosed versions.

Major order for LL pads from PKP

Having already replaced conventional cast iron brake shoes with low-noise organic LL pads on some 1,400 of its freight cars, Polish operator PKP Cargo recently took an even bigger step: Towards the end of last year, in anticipation of introduction of the revised TSI Noise, it ordered Icer Rail IB116* pads for more than 10,000 cars – a total of over 240,000 LL pads. The retrofitting process will be completed within the next couple of years.

Fitting organic LL pads is an attractive option for reducing noise emissions from existing rolling stock. Old cast iron brake shoes can be replaced with new LL pads without any need to modify the braking system.

The advantage can be summed up in a single phrase: 'Smooth wheels on smooth rails.' Unlike cast iron shoes, LL pads roughen neither the running surface of the wheels nor, indirectly, the top surface of the rails during braking. The result is less vibration from

the interplay of wheels and rails and a significant reduction in perceived noise. Operating with smooth wheels on an average set of rails, a train equipped with composite brake pads generates some 10 decibels (dB(A)) less noise.

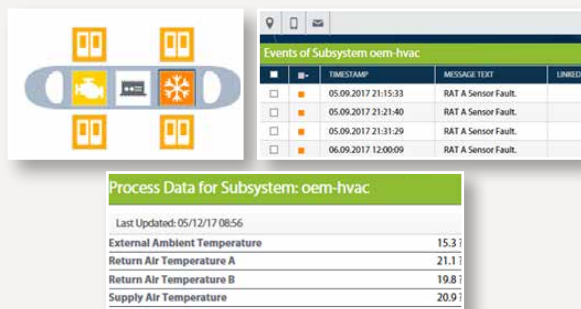
Witold Bawor PKP CARGO S.A., Grzegorz Fingas PKP CARGO S.A., Jacek Bilas Knorr-Bremse Systemy Kolejowe Polska Sp. z o.o. (from l.) (Photo: PKP CARGO S.A.) ▼



Smart vehicle integration

This example shows how easily and flexibly the iCOM platform 4.0 can be integrated even into older rolling stock. As installed in Class 158 vehicles operated by British operator Scotrail, for example, the software runs on the new controller of an upgraded air-conditioning system. The system directly transfers the diagnostic data collected together with the data from the condition monitoring unit for the pneumatic door systems and the diesel engine drive to the operator's back office for evaluation. The engineers devised this hitherto unique solution by equipping an HVAC controller with additional data inputs.

▼ iCOM Monitor Dashboard for CI158



The installation of iCOM in Class 158 vehicles makes this the second vehicle fleet operated by Scotrail to be equipped with the platform. While the Class 158 trains operate in the Scottish Highlands, the Class 334 fleet mainly commutes between Glasgow and Edinburgh.

▼ Class 334 EMU



▲ Cécile Daveau, Knorr-Bremse France (IFE)

Passenger transportation in France: Talks held with key players

France is one of the largest rail transportation markets in Europe – and Knorr-Bremse one of the technological pacesetters for many different vehicle subsystems. To mark "Mass Transit Day" on February 6, Knorr-Bremse invited the key players involved in French passenger transportation to Tinqeux for joint discussions on trends in the rail industry, new products, and the requirements placed on future systems. On this occasion, Knorr-Bremse was able to give the operators and vehicle manufacturers a concise overview of the Group's product portfolio.

"It is clear that the major investments in the years ahead will focus on improving everyday mobility," summed up event organizer Cécile Daveau. At the same time, particular attention will be paid to issues of safety, life cycle costs, energy efficiency, and digitalization – aspects which will be widely reflected in Knorr-Bremse's portfolio particularly in the foreseeable future.

▼ Johann Bramauer, IFE Austria (I.), Joaquim Ramos, RATP (r.)





Electrical systems from Kiepe in the mass transit sector



Esslingen's IMC electric bus



In-house system test bay (9 test stations, voltage range of up to 30,000 volts)

spotlight

New member of the family

Kiepe Electric has been part of Knorr-Bremse since January 2017. With the increasing electrification of mass transit systems, the Knorr-Bremse Group has already come up with new application possibilities for vehicle manufacturers and operators.

"We don't have a one-size-fits-all approach," explains Dr. Ludger Schülting, member of the Management Board of Kiepe Electric. "Rather, we tailor energy management systems to the specific application requirements of each rail vehicle or e-bus." The portfolio includes everything from heating, air conditioning, ventilation and cooling systems to traditional rail components such as on-board power and traction converters, battery chargers and energy storage systems, as well as even small rail appliances. These include control units, signaling and safety devices, relays, and switches – in short, everything necessary for a transport market heading inexorably towards electric mobility.

"We are clearly addressing the market requirement that the local public transport of the future will almost exclusively be powered by electricity," says Schülting. Transport experts are in no doubt about the promising future offered by the prospect of electric-powered mass transit systems, not least because this drive system represents a major factor in keeping particulate emissions in inner cities within prescribed limits.

State-of-the-art systems testing facility

Kiepe Electric tests its systems for production readiness at its own systems testing facility in Düsseldorf. The facility consists of nine test benches capable of handling up to 30,000 volts. Firmly anchored in tons of foundation cement in the basement are a number of giant dynamometers, some of them powerful enough to measure up to 1.4 megawatts. Despite this aura of intense power, the testing facility remains incredibly intricate. The dynamometers enable engineers to precisely adjust rotational speed and torque

– in other words the engine speed and pulling force of the products and systems being tested. "We use them to test specific driving profiles under various loads," explains the head of the Systems Testing Facility, Holger Stiber. Anything leaving the production lines at Kiepe Electric has already undergone extensive testing here, regardless of whether it is a small component, a complete traction system, or a new roof container.



Roof container, Gothenburg

Kiepe Electric recently developed the latter for a project in Gothenburg, Sweden. The system symbolically combines the company's core competencies: traction, on-board power, and vehicle control system – all working hand in glove and housed in a space-saving container so flat as to allow vehicle manufacturers to mount it on the vehicle roof.

Powerful diagnostic tool

The approach taken by Knorr-Bremse and Kiepe Electric is one of well-conceived integration into the Group. This has been achieved, for example, by combining the Kiepe System Diagnosis (KSD) with the Knorr-Bremse Connected Systems approach to create a powerful diagnostic tool, or by introducing the globally standardized Knorr-Bremse Production System (KPS) in Kiepe Electric's production facilities. In turn, of course, best-practice examples are also fed back into the Group-wide KPS.

A number of specific projects reflect the fact that Kiepe Electric has already become an established member of the Knorr-Bremse family. In Vienna, for example, an extensive modernization project for the city's trams is currently in progress. Its focus is on completely replacing the drive units of 78 low-floor articulated railcars. In addition to installing modern air-cooled converters, Kiepe Electric is also fitting on-board power converters of the new 600 generation, which are based on innovative control technology. The package also includes a new vehicle control system – as well as an upgrade for 468 doors with new electric door drives. These will be supplied by Knorr-Bremse subsidiary IFE.

Kiepe Electric team, Düsseldorf:

Passionate about product and project solutions ▼



customers + partners



Benchmark and Best-Practice Selection: KPIs are used to analyze the internal benchmark and select the best-practice reference unit on the basis of the performance of the main HVAC subassemblies.

Risk & Opportunity Management: Once the project configuration is defined on the basis of the best-practice reference, comparative charts are used to manage risks and opportunities during tender and design. Each subassembly is compared with similar ones from other projects. In the comparative charts, the red line is the benchmark, the blue line is the average, and the hatched line is your project.

Target-Setting: The tool allows best practices to be identified for each subassembly, so that they can be used as a reference to challenge both the design and the purchase line. This enables the right targets to be set for the design.

Technical Subsystem Analysis: Best-practice guidelines define a methodology for the technical analysis of each subsystem. This enables best-practice configurations to be embedded into the design from a very early stage. The analysis is always based on the comparison between existing best practices from all HVAC locations worldwide.

Detailed Library: Value engineering allows best practices to be embedded within pre-designed components and assemblies, so that the user can conveniently select and implement them for specific projects. We have about 800 items within four libraries today. Commercial components are standardized by the different manufacturing locations worldwide. Standard commercial components and subassemblies are designed by the New Climate team in collaboration with the HVAC project engineering teams.

Application Guidelines: Design guidelines are defined for each best-practice assembly to support engineers in the decision-making process. The Library contains parametric CAD and design guidelines for each sheet-metal or system best-practice solution. Decision aids are defined to support engineers in the selection and modification of the different base models.



A new climate

With HVAC facilities in Austria, Australia, China, India, North America, Spain, and the United Kingdom, no one can rely on as much experience as Knorr-Bremse when it comes to rail vehicle air-conditioning systems. Under a new approach, best practices from the individual markets are now being shared systematically across the globe.

At some point, every technology company is faced with a fundamental decision about whether to adopt a project-based or product-based approach. This decision determines the proportion of development work carried out under customer deadline pressure within the constraints of a particular project and the proportion completed before the project even begins, ensuring that the product is already tried-and-tested and as mature as possible when it enters service. Building a bridge or a railroad line would be an example of the project-based approach, while developing a new smartphone would typically involve a product-based approach. In the manufacturing sector, it is necessary to adopt a strategy somewhere between these two extremes.

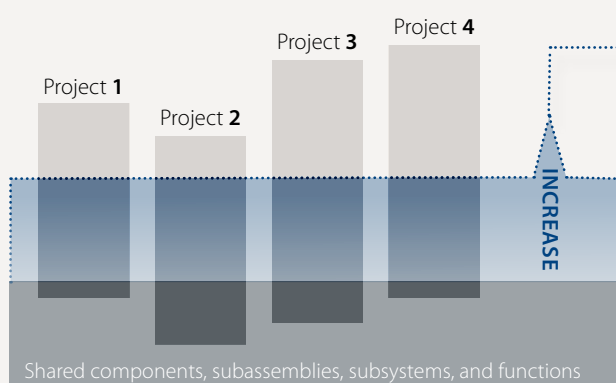
The HVAC systems business is strongly project-driven. In simplified terms, the vehicle manufacturer tells us the technical specifications, the installation space, the key air interfaces and the date on which they want the first unit to arrive at their production line. Put simply, the customer has a hole in the car to fill with a HVAC unit, and unfortunately the size and shape of that hole is different from customer to customer. HVAC Group's Technical Director, Michael Powell, explains the underlying concept of the new strategy: "We wondered whether we could add value for our customers by moving our business towards a more product-based development approach."

Sharing best practices across the Group

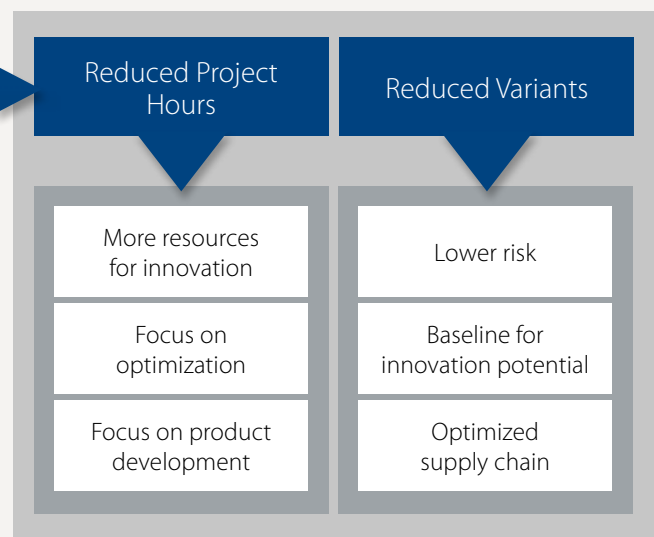
In addition to reducing the number of product variants, this approach would also help to make project execution easier to plan. It would free up resources that Knorr-Bremse could then use to accelerate the continued development of the individual system components and subsystems in order to reduce their life cycle costs and improve their efficiency, for example. All of this would also bring benefits for the operators. "Our HVAC businesses and the joint venture in China are focused on different markets, and they all possess a wealth of best practices. This makes them logical candidates for our new approach," says Powell.

However, when it comes to deciding how far the pendulum should be allowed to swing towards product-based development, there is no denying that the required new structure presents a challenge. "A well-conceived strategy requires a product-driven basis with relatively uniform structures and functionalities across the different markets."

HVAC systems look completely different from one market to another. In the UK, the units tend to have a curved profile, whereas in North America they are an integral part of the vehicle structure. This requires the units to have an extremely low profile. Other parts of



▲ The key to moving to a more product-based business is to increase the number of shared components between projects. The Library of Proven Solutions in Windchill enables both the number of project variants and the project hours to be reduced.



the world have, over the years, developed a preference for installing them on the roof of the vehicle rather than embedded in the car. HVAC systems for the Southeast Asian market must be able to cope with a combination of high humidity and high temperatures, whereas markets in colder climates require additional heating capacity. In Europe, the systems tend to be passive in design, since passengers do not like too great a change in temperature when entering the vehicle, so the HVAC system is not supposed to be noticed by passengers. In some warmer parts of the world, however, the units are intentionally designed to cool the interior of the car with a strong airflow.

“Library of Proven Solutions” for faster project planning

But what if, despite the many differences, the proportion of common and reusable functional components and subassemblies could be increased? This would go a long way towards enabling a shorter time-to-market and reducing both costs and weight.

It quickly became apparent that the best way to approach this goal was to compare the designs of a sufficient number of reference projects from the individual HVAC facilities. The parameters compared included the required output and airflow, as well as factors such as the number of intakes and outlets in the systems. Once the right methodology had been developed, it was possible to carry out a robust comparison of very different HVAC solutions right down to the component level. “This comparison allows us to ensure that all new HVAC projects have access to every single best-practice solution from right across the Group,” explains Powell.

A Library of Proven Solutions provides the basis for putting the new approach into practice. The Library is a universal tool which allows us – even at the bidding stage – to ensure that the individual system components are drawn exclusively from the identified best-practice solutions. By comparing the specific system requirements against the parameters of existing projects incorporated into the Library, appropriate design solutions can quickly be identified and then implemented in the project.

After the ramp-up of a dedicated team, Knorr-Bremse started implementing the new approach almost 12 months ago. Already there are concrete customer projects in progress at all Knorr-Bremse HVAC sites.

Risks and opportunities

This new approach also allows a more robust approach to risk and opportunity management both in offers and in the project phase. Designers can immediately see how a proposed design compares with similar projects already delivered. If it is performing badly, opportunities can be immediately identified and solutions found because they have been done before. If its performance is too high, specific actions can be taken to mitigate risks.

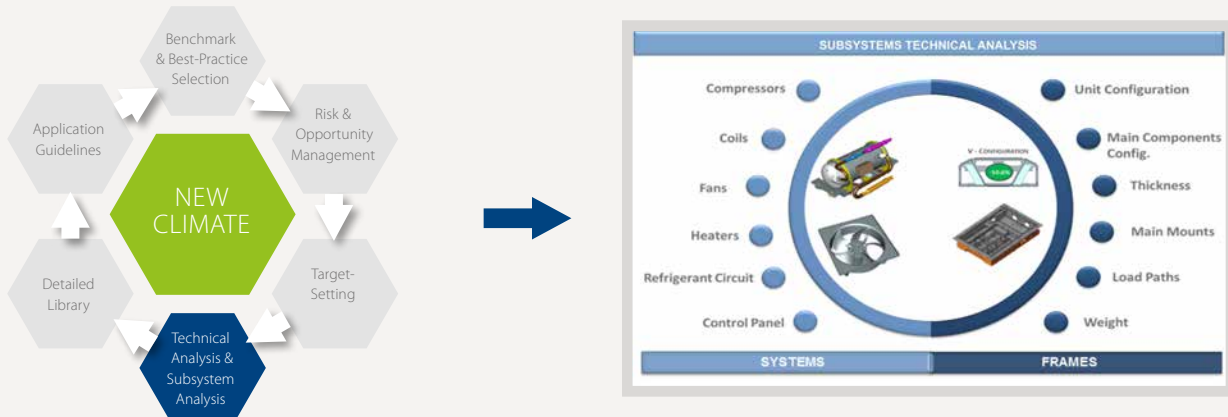
A systematic approach is taken to incorporate new designs into the library under a strict change management to ensure our designs are continually updated, improved, and optimized. Or to put it more generally: Knorr-Bremse makes the best-practice solutions from across the Group available to every single HVAC project worldwide.



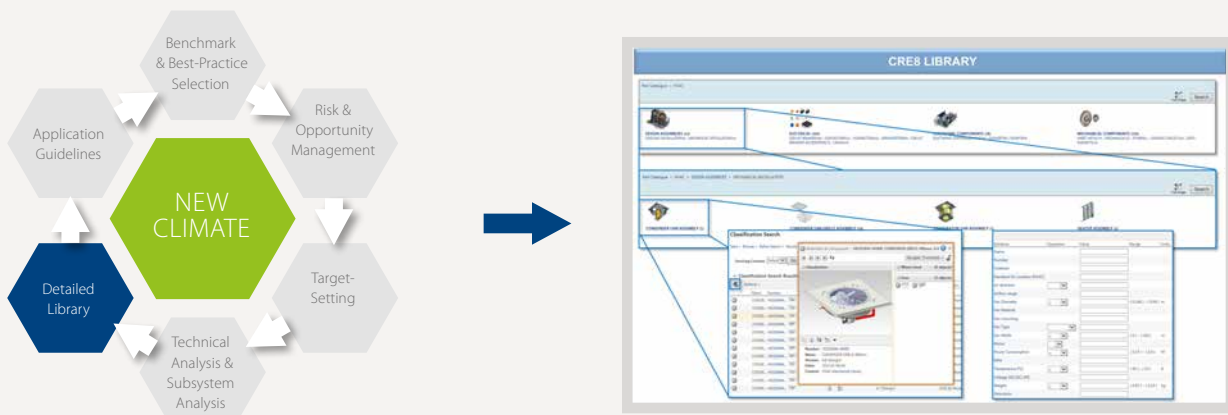
▲ The release of the tools was accompanied by roll-out events at all HVAC locations, for example in Getafe (top), Sydney (center), and Wuxi (bottom).



▲ KPIs facilitate selection of a best-practice reference unit as an initial basis, analysis of the HVAC configuration, identification of opportunities, and control of the design. In the chart above, each project subassembly is compared with others via KPIs. Each subassembly is rated on a scale from red (bad) to green (good).



▲ Technical analysis of each subsystem enables best-practice configurations to be incorporated at a very early stage of the design. The image above shows the most critical areas for the analysis of systems and frameworks. These are described in best-practice guidelines and are always based on comparisons between existing best practices from all HVAC locations worldwide.



▲ The library of predefined base models enables engineers to embed best practices into the design with a minimum of effort. Each solution is composed of parametric CAD models and application design guidelines, which are defined and validated in a cross-functional approach.

A new face

For Alstom Transportation it was the largest order in the company's history. And for South African rail operator PRASA, this mammoth project will ultimately result in an almost entirely new fleet of mass transit vehicles. The door systems are to be supplied by Knorr-Bremse subsidiary IFE.

X'Trapolis Mega is the name of the electric multiple-unit train – and it could hardly be more fitting, for the project, comprising 600 trains with 3,600 cars in total, is worth approximately 4 billion euros. Alstom Transportation will deliver the project over a period of ten years. The trains will give an entirely new face to local mass transit in South Africa.

Space for 1,300 passengers per train

"This marks the beginning of the revival of passenger rail transport," said Jacob Zuma, President of the Republic of South Africa, when the first X'Trapolis Mega went into service last year. From now on, he continued, uncomfortable, unreliable, and unsafe rail travel would be a thing of the past. Following the initial introduction on the corridor between Koedoespoort and Rissik in Pretoria, the operator PRASA (Passenger Rail Agency of South Africa) will gradually extend the use of the new trains to include the Johannesburg, Cape Town, Port Elizabeth, and Durban areas.

The clearly defined purpose of the vehicles is to handle the dense commuter flows between the townships and major centers. The design provides space for over 1,300 passengers to travel in comfort in the airy six-car trainsets. They are currently designed for speeds of 120 km/h and could be upgraded to enable speeds up to 160 km/h, should that be decided.

The trains will be produced by the Gibela consortium, an alliance between Alstom Transportation and the South African companies Ubumbano Rail and New Africa Rail. Alstom built the first 20 six-car sets at its Brazilian plant near São Paulo. The remaining 580 will come off the production line at the consortium's new plant at Dunnottar near Johannesburg. The first of these deliveries – which will also be the first train to be produced entirely in South Africa – is scheduled for late 2018.

Local production meets local-content requirements

Once production has been ramped up, PRASA will take delivery of up to 62 trains per year, i.e. around five each month. Gibela will generate a significant part of its value added locally. The project will create over 1,500 direct jobs at the plant over the ten-year term. According to the consortium, more than 200 local suppliers will be involved in manufacturing the trains.

Each train will have 36 door systems – three per side of each car. When passengers get on and off at stations, stopping times are to be as short as possible. In total, IFE will contribute 21,600 S3 sliding door systems to the project. The engineers specified the required tolerances, dimensions, contours, interfaces, pressure values, and anti-corrosion requirements. IFE worked closely with the South African company Siyahamba Engineering on corrosion protection, because empirical values for the required 3Cr12 corrosion-resistant door leaf material were not available in Europe.

Local value added is also a key principle for Knorr-Bremse beyond the issue of materials. Just as the first 20 trains were built in Brazil, IFE manufactured the corresponding door drive units at its Czech plant in Brno. Since May 2017, however, IFE has been producing these units and the doors themselves locally at Knorr-Bremse South Africa's Kempton Park facility near Johannesburg.



◀ Presentation of "X'Trapolis Mega", © Gibela



Knorr-Bremse SA worker
on new S3 production
line ▶



◀ PRASA train with S3 sliding-door
system from IFE

Screen doors for the Tube

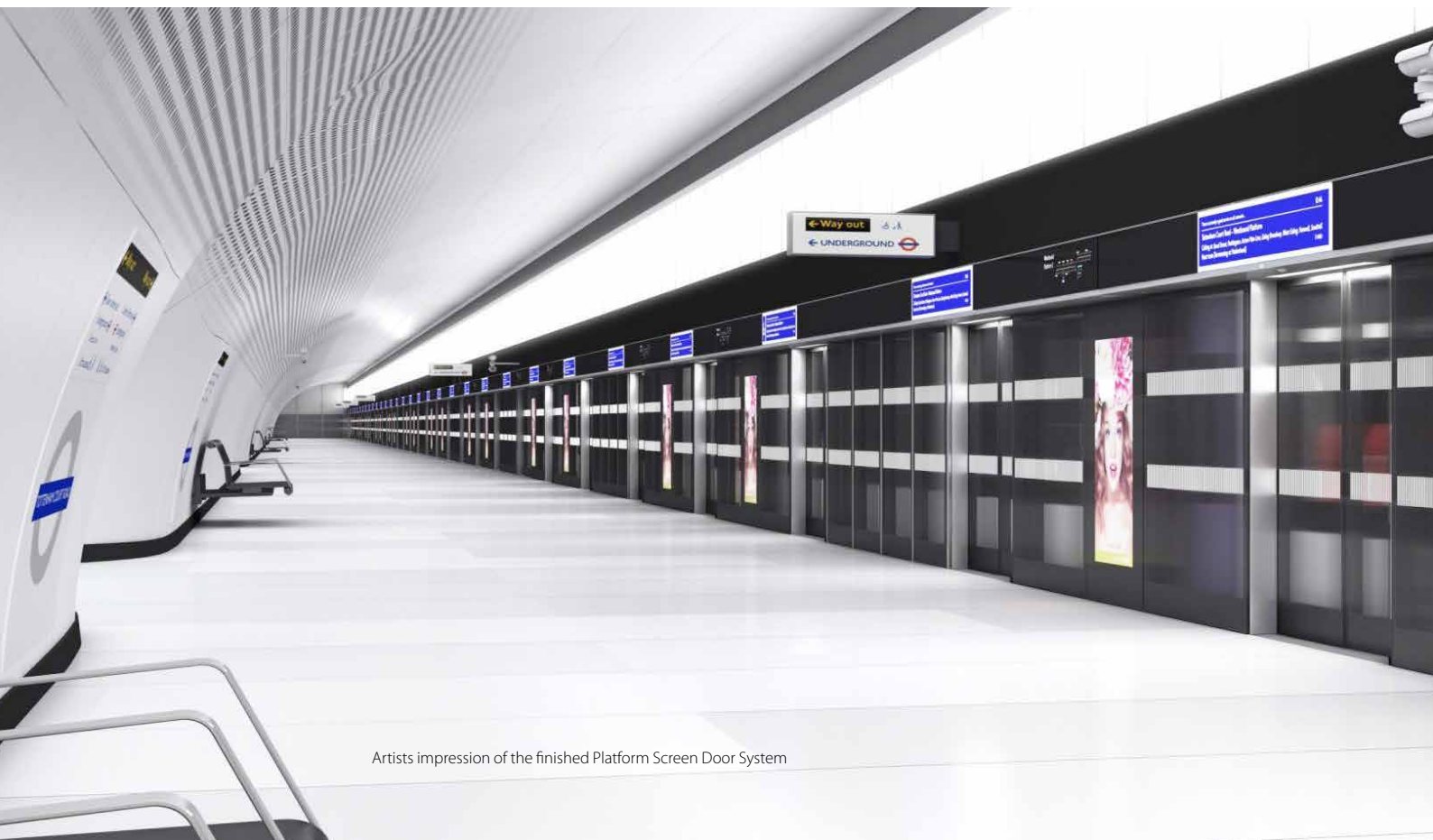
Together with its subsidiary Westinghouse Platform Screen Doors, Knorr-Bremse is currently installing platform screen systems at the eight underground stations of the new Elizabeth Line in London. The installation involves the first use of an innovative technology.

The distance from one end of the station to the other is a little more than 240 meters. That will leave plenty of room for the approximately 160-meter seven-car trainsets that will be in service initially. Even when nine-car sets are phased in later, there will still be enough room at either end of the platform. In fact, the planners looked even further ahead: Should passenger numbers in London continue to rise, as would seem likely, it would be possible for the operator London Underground Ltd. to make trainsets even longer. But one thing is certain: The platform screens will extend the full 240 meters of each platform from the outset. Eight stations, each with two platforms, means 432 screen door systems in total. These prevent passengers on crowded platforms from being pushed onto the track or into an incoming train. Boarding and alighting from trains is also quicker, as trains always stop with their doors precisely aligned with the platform screen doors.

In addition, platform screening makes air conditioning at stations more energy-efficient. And barriers at the platform edge simultaneously provide screening from any draught created by incoming trains. The screens also stop volumes of cooled or conditioned air from disappearing into the tunnel system. Displays attached to the screen door modules will provide passengers with up-to-date travel information about connections and stations.

Installation from the track side

A team of around 70 installation engineers from the Knorr-Bremse plant at Melksham is currently carrying out work on the platforms. It is using an entirely new system to install the platform screen doors. "Instead of fitting them from the platform, we are using a specially designed vehicle to carry out the work from the track-side," explains Knorr-Bremse site manager Steve Black. "Not only is



Artists impression of the finished Platform Screen Door System



▲ Canary Wharf station under construction

this approach faster; it also means we can install complete, fully tested modules." This saves time when it comes to commissioning. Moreover, since platforms are not taken up with installation equipment, other work can be done at the same time.

Chris Bathurst, also from the Melksham plant, is responsible for coordinating activities between Knorr-Bremse and London Underground Ltd. "Being part of the project is special in so many ways," he says. "The length of the platforms, the frequency of trains and, of course, the fact that the line runs right under central London." A project of this scale throws up very unique challenges. "But everyone involved – in whatever capacity – is fully committed. Everyone knows they are working on one of the biggest infrastructure projects currently underway in Europe – and that fills people with enormous pride!"

▼ Bond Street station under construction



Smaller, smarter, better – “LITE”

The “LITE” system recently developed by Knorr-Bremse PowerTech delivers major energy efficiency and uptime improvements for decentralized power supply systems in railroad vehicles. The key is a significant reduction in complexity.

At present, the on-board electrical system of modern rail vehicles usually comprises a battery-powered DC network and an AC on-board power supply operating at fixed voltage and frequency. Consumers with high power requirements, such as HVAC systems and compressors, are connected to the AC power supply, and are powered centrally via high-performance on-board auxiliary power converters. Additional inverters are also called for to adjust the power supply to the consumers’ requirements. These inverters are built into the consumers themselves and adjust the voltage and frequency to their current needs.

“The main drawback of this system architecture is the need for power conversion by means of a cascade of converters,” explains PowerTech’s Head of Engineering Andreas Maroschik. On the one hand, this results in significant power loss. “The complexity of this design is also reflected in greater susceptibility to failure.”

Required number of transformations cut by at least 50 percent

Knorr-Bremse PowerTech has been able to dramatically reduce this complexity with its latest power supply system generation “LITE,” the Light Integrated Train Energy system. LITE supplies electric consumers with high power requirements via its own 680-volt DC on-board power supply. “This allows us to reduce the required number of transformations by at least 50 percent,” explains Maroschik. “It means we can significantly reduce the number of hardware components in both the power supply system and the individual consumers.” It also significantly improves on the performance of the previous system architecture in terms of power loss and reliability.

The new concept has a dramatic impact. In a six-car metro train with two HVAC units per car, for example, it allows the weight of the power supply system to be reduced by 45 percent. The weight distribution across the train is also improved. Power loss is reduced by approximately 40 percent, and material costs by around 10 percent. Crucially, the system’s reduced complexity also delivers measurable improvements in terms of reliability.

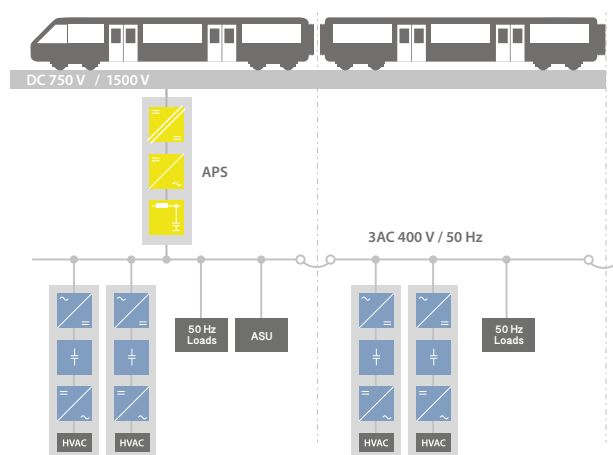
The development phase of the new power supply system has now been concluded. Field trials are currently underway on Chinese metro trains, where LITE is being deployed to optimize the power supply for Merak HVAC systems. A similar complete system solution is of course also possible with air supply units from Knorr-Bremse.



◀ Modular stand-alone inverter for metros

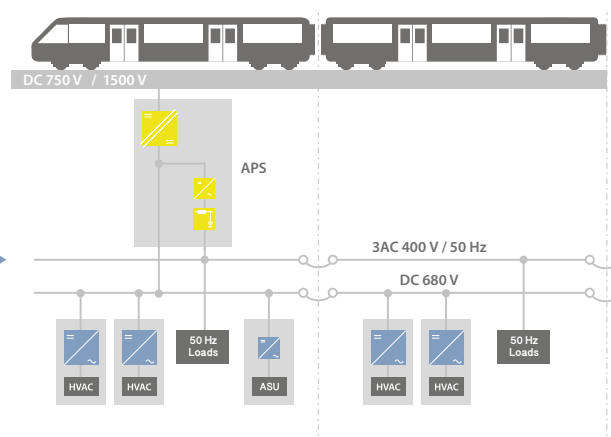


BENEFITS OF DECENTRALIZED POWER SUPPLY FOR RAIL VEHICLES



- Smooth operation and reduced stress for electrical and mechanical components
- Increase in lifetime and optimized maintenance of heating, ventilation, air conditioning (HVAC), and air supply units (ASU)
- Noise reduction thanks to variable compressor speeds
- Enhanced passenger comfort thanks to stable temperature and air conditioning

BENEFITS OF DECENTRALIZED POWER SUPPLY USING "LITE"



- Retains and optimizes the advantages of a decentralized power supply architecture
- +
- Improved environmental compatibility due to reduced energy consumption
- Significant weight reduction in auxiliary power supply (APS)
- Increased system efficiency due to reduced power loss
- Increased uptime and lower material and total system costs

Two joint projects with NedTrain

Knorr-Bremse is training NedTrain employees for service work and supplying iCOM on-board computer units, including sensor kits.



◀ Assembly with iCOM OCU, Selectron I/O modules, antenna (rear view)

NedTrain is a subsidiary of the Dutch state-run railroad company (Nederlandse Spoorwegen), for which it provides rolling stock repair and maintenance services. Knorr-Bremse RailServices and NedTrain recently commenced two joint projects, a shop-in-shop concept for overhauling Knorr-Bremse brake components and a pilot project using iCOM Monitor to monitor the Knorr-Bremse air supply system on VIRM trains.

The shop-in-shop partnership involves RailServices training NedTrain employees to repair and overhaul brake components on behalf of Knorr-Bremse. This will guarantee the required quality through consistent implementation of Knorr-Bremse quality standards. RailServices supplies the necessary spare parts. In return, it receives valuable direct feedback about how its products perform in the field in the context of a specific project – in this case the air supply system for the Rotterdam Metro (RET).

Air supply systems are also the focus of the three-year pilot project with iCOM Monitor. Six iCOM on-board computer units, including a sensor kit developed while carrying out a refurbishment order, are due to be installed in the first six months of this year. The first stage will involve collecting operational field data. Once consistent, high-quality data are available, the next step will be to analyze and evaluate them. However, the project's main goal is the third stage, in which the results of the analysis will be used to make evidence-based judgements regarding the maintenance, repair or replacement of components, thus enabling genuine condition-based maintenance. This will increase fleet uptime and cut operating costs.

Doors and wheel slide protection for SBB fleet modernization

Modernizing the Swiss IC2000 fleet. Knorr-Bremse is closely involved.

It is approximately 20 years since the IC2000 fleet first entered service with Swiss Federal Railways (SBB). In the aptly named IC2020 project, its 341 double-deck cars are now being refurbished so that they can keep going for another 20 years. While the trains' exteriors are getting a new coat of paint, SBB is also enhancing passenger comfort through a revamped interior design and a variety of technical improvements. The full package of individual enhancements is so extensive that it will involve stripping each vehicle down to the car body and completely refitting it from scratch. The new interiors will feature lighter-colored materials, LED lighting and integrated power points at every table. SBB is also fitting new seat covers and carpeting, installing diaper changing tables and redesigning the dining cars.

Knorr-Bremse is involved in several of the technical enhancements to the brakes and doors. RailServices is upgrading the wheel slide protection systems in each of the 341 cars with new wheel slide protection controllers and valves and speed sensors. RailServices Engineering Munich and Electronic System Engineering Knorr-Bremse Kraków worked together to produce a system design compatible with the existing vehicle interfaces.

Meanwhile, IFE has developed a new sliding step to improve access for passengers with reduced mobility. Their biggest challenge was to find a way of fitting the step into the available space. The trains currently provide very limited access aids. The engineers managed to fit the new sliding steps into the almost identical installation spaces, with due consideration for the interfaces.

IFE is also supplying electrical obstacle detection systems and door seals for the fleet's 1,364 doors and loading doors. This will be the first time that the FLEX nano control unit – which was specially developed for refurbishment projects – has been used. It allows the right and left doors of each pair to be operated and monitored using a single control unit, saving space and cutting costs. The first IC2020 prototype is scheduled to commence active test operation by the fall of this year.



IC2000, © SBB CFF FFS ▶



products + services

Sand – the nitty-gritty

Rail vehicle sanding systems have tended to be regarded as only a minor subsystem.

However, they are actually sophisticated high-tech systems that are virtually indispensable for safe and efficient rail transportation..

When engineers design rail vehicle braking systems, they generally base the system design on an effective adhesion coefficient of 0.15. The maximum (effective) wheel-rail friction coefficient is typically much higher – at least in dry conditions. Service braking requires an adhesion coefficient of somewhere between 0.08 and 0.10.

However, the adhesion coefficient drops off dramatically when, for example, there are leaves, aerosol deposits, or even just ice on the line. Under these conditions, braking can relatively quickly lead to the vehicle overshooting the platform or signal. In these situations – as well as when the vehicle is starting off – sanding systems provide a well-proven means of delivering critical enhancement of wheel slide protection system performance when friction coefficients are low.

Speed-dependent sanding saves resources and reduces operating costs

Sanding systems have evolved from what were once simple devices into sophisticated high-tech systems, with pressure-controlled sand delivery, sand level and sand flow sensors, a means of keeping the sand dry, a solution to prevent blockages in the tubing, and sand pipe heaters.

As a rule, the systems employ the pneumatic conveying principle to deliver the sand into the wheel-rail gap. Sanding can either be activated automatically by the braking system software or manually by the driver. When the sand is ground up in the wheel-rail gap, it increases wheel-to-rail adhesion and dries the rail.

“The key is to deliver exactly the optimal amount of sand,” says Dr. Peter Krieg, Head of Sanding Systems at Knorr-Bremse Rail Vehicle Systems. Quite apart from anything else, this is important for safety reasons. Too much silica sand between the wheel and the rail induces an electrical insulation effect. This could affect track release signaling systems, causing them to wrongly signal a section of track as clear for the next train.

A constant volume of two grams per meter

But there is also another reason why modern sanding systems no longer blow the sand onto the tracks at a constant rate at all times. “Especially at low speeds, this would result in a great deal of sand being wasted,” Krieg cites tests showing that the quantity of sand used can be reduced by up to 50 percent if the sand is delivered at a constant rate of two grams per meter. “You can do this without adversely affecting braking distance,” explains Krieg.

The results of this approach are extremely impressive. Based on environmental reports and the figures supplied by vehicle operators, an average of 500 kg of sand is used per sanded axle per year. But the benefits to operators go beyond the cost savings achieved by using less sand. The use of this technology means that the sandboxes do not need to be refilled at such frequent intervals, reducing downtimes and keeping the track bed significantly cleaner.

◀ Queensland Rail Australia
▼ Delivering sand to the wheel-rail gap



Global systems competence

It is relatively straightforward to incorporate sanding systems into the vehicle architecture when designing new vehicles, and they can also be easily retrofitted during upgrade projects. Here is an overview of sanding system retrofits..

Ireland

The Class 201 is a diesel electric locomotive made by General Electric (GE) that first went into production in 1994. The six-axle locomotive's central power supply makes it ideally suited for passenger trains on routes such as Dublin to Belfast. Owing to the restrictions on sand volumes (max. 2.25 g/m) and the very high efficiency requirements, a speed-controlled sanding system was installed, controlled by an additional ESRA. The systems were installed on the first axle for each direction of travel. A total of 24 locomotives were retrofitted.

China

Particularly on coastal routes, low adhesion coefficients caused by fog and air pollution result in trains overshooting signals and platforms. In order to avoid delays and maintain service quality, the national state-owned rail company China Railway decided to retrofit sanding systems to the entire fleet of CRH2 high-speed trains currently in service. Cleverly flange-mounted on the bogies, the units can, if necessary, sand two to three axles per direction of travel. A total of 360 trains have been retrofitted with Knorr-Bremse sanding systems.

Australia

The Melbourne Bayside EMUs were regularly overshooting platforms due to subtropical weather conditions and the presence of organic matter on the track. This caused delays, as did the instruction to drivers to start braking sooner in potentially critical situations. A sustainable solution has been achieved since sanding systems were retrofitted to the 72 three-car trains. The units are installed on every third and seventh axle in both directions of travel and are automatically activated by the ESRA control system in the event of very low wheel-to-rail adhesion. The quantity of sand delivered is speed-controlled.

USA

The Metropolitan Transportation Administration is one of the largest mass transit operators in North America, operating in the Washington-Baltimore metropolitan region and providing connections to the neighboring states of Virginia and Pennsylvania. Although they were already equipped with sanding systems, 54 light rail vehicles were fitted with new systems as part of their mid-life overhaul. While the old units had performed adequately, the operator hoped that the installation of speed-controlled systems would deliver significant operational improvements. Using less sand would mean that the sandboxes would not need to be refilled as often. Sand delivery sensors were also integrated, allowing simple and efficient day-to-day function monitoring. These measures significantly reduced the LRVs' downtimes. The MTA also ordered heated sand pipes to improve uptime even in wintery weather conditions.

▼ LRV MTA Maryland/USA



▲ Class 201 locomotive Ireland
◀ CRH2 China

