PJM Magazine
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News on innovations, novelties and latest projects of PJM

Digital rail transport is on track

Automated brake testing is available NOW and creates the much-needed efficiency boost

Automated rail freight transport has arrived and is no longer a long-awaited vision. This has been made possible by our complete digital system WaggonTracker, which automatically checks the brakes and monitors the loading process of goods trains. Extensive monitoring information in real time is also determined by the WaggonTracker system. Automated processes - and especially automated brake testing - are elementary for the urgently needed efficiency boost in everyday rail freight. PJM's system is the first in Europe to be positively assessed in spring 2022 and to meet all technical, formal and safety criteria. In addition, the PJM system is already in widespread operational testing. The system for fully automatic checking of the brakes is in use on more than 200 SBB Cargo freight wagons. But pilot trains of Mercitalia and DB Cargo are also on rail with the brake testing system in other parts of Europe.
The automated brake test is an important part of making rail freight transport more efficient, faster and more attractive. The automated system creates efficiency: the time saved for a 500 m long goods train is around 2 x 35 minutes and the procedure can be carried out by the locomotive driver or wagon technician alone. This is a great advantage from the perspective of the future labour market. The shortage of skilled workers and shunting personnel will increase in the coming years due to demographic developments. *„It is high time to replace outdated work and tedious manual tasks with automated processes. Automation brings the urgently needed boost in efficiency as well as increasing the profitability of rail transport and creates attractive job profiles,"* analyses Günter Petschnig, CEO of PJM.

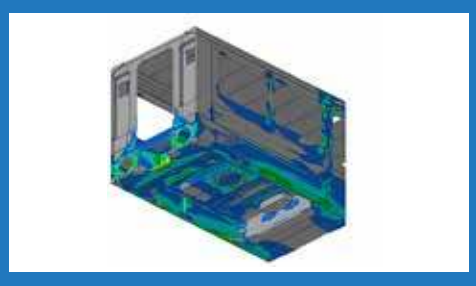
Strong technical design and fit for the future
Thanks to the energy-autonomous and powerful power supply and the local radio system of the WaggonTracker system, the system is now available and can be flexibly used for existing wagons as well as new wagons. The modular design ensures compatibility with the future DAC, but other functionalities can also be added on a customer-specific basis.

Overview: The automated brake test in operation
→ The automated brake test is an innovation of the development consortium of SBB Cargo, PJM and Rail Cargo Austria.
→ The automated brake test fulfils all safety-relevant specifications with regard to operation and vehicle.
→ Pilot trains have been in operational use at SBB Cargo since August 2017. By the end of the test, the wagons will have covered 1,000,000 kilometers. For 20 wagons alone, the brake test is carried out 500 times and the brakes of all wagons are tested 10,000 times. Parallel to the operational testing, SBB Cargo is adapting its operational processes to the new automated system, for example in the areas of training, IT and workshop.
→ For SBB Cargo, the automatic brake test is an important component in the „one-person operation" automation project. The other two components are the collision early warning system and the automatic coupling. SBB Cargo has now equipped around 200 wagons with the automated brake testing system.
→ January 2022: Mercitalia Intermodal has a pilot train in operation for intermodal traffic.
→ March 2022: PJM's innovation automated brake testing was assessed by TÜV and positively evaluated without any further conditions.
→ July 2022: DB Cargo has equipped a pilot train with the PJM system as part of the AmaBPro project, which has recently started operational parallel operation. Depending on the workload, the brake test will be carried out automatically 4 - 6 times a day or around 1,800 times a year. AmaBPro is part of the Future of Rail Freight Transport programme funded by the BMDV. The TU Berlin (Institute for Land and Sea Transport, Rail Vehicles Department) is also on board as a project partner.
→ The automated brake test fulfils all safety-relevant specifications with regard to operation and vehicle and completely replaces the manual, strenuous inspection.


Everything in view with one click: The results of the automatically performed brake test are clearly displayed on the tablet of the train driver or brake test supervisor.

Automated load weight monitoring
PJM has developed a load monitoring system that automatically determines various loads and analyses the loading process. The loading is shown by means of signal lamps at the relevant points directly on the means of transport or clearly on the display of the person responsible for loading. The system also shows whether the freight wagon is balanced or asymmetrically loaded. This enables the person responsible for loading to react immediately, correct the loading if necessary and load the wagon according to the optimum capacity. Optimal loading saves time, costs and at the same time increases safety.
The LoadMonitor system is a great advantage especially for timber transports, as timber cannot be loaded according to volume. Rain or snow have an enormous influence on the weight which can change up to 50 %. Transwaggon (one of the largest wagon keepers in Europe) and Mercer Holz appreciate the big economic advantages of the system. Mercer transports over 2 million tonnes of timber by rail every year. Currently, more than 500 freight wagons were equipped with the WaggonTracker system and the integrated LoadMonitor system. The Austrian company Lenzing AG was also one of the first customers of the LoadMonitor system.

Excellent Technology:
7 Awards for PJM



Engineering:
Optimum construction for Stadler Rail

Testing facility:
Approval tests in Canada

Voith and PJM:
Rail freight of the future

In Interview:
Voith and PJM cooperating on digitalization of rail transport

Since May 2022, Voith and PJM have been closely cooperating on the future of rail freight transport. The joint mission is to promptly realize the automation and digitalization of the transport mode in order to shift more goods quickly onto environmentally friendly railways.
Matheus Habets (VP Digitalization Mobility at Voith) and Christoph Lorenzutti (COO at PJM) talked about the status of the rail freight revolution:

Why are automation and digitization of operations essential for rail freight?
Matheus Habets: For the EU to meet its targets for reducing CO2 emissions, more freight transport must be shifted to the railways. However, the transport mode is currently stuck in outdated, slow and labor-intensive processes. Automation and digitalization will significantly speed up these processes in the future. The basis for this is the digital automatic coupler. It enables automation and the establishment of a digital backbone across the entire train.
Christoph Lorenzutti: If a train stands around for more than an hour before departing, it will never be able to catch up on its route. It is therefore essential to extract maximum time savings and acceleration effects through digital solutions and the automation of processes. Demographic changes and fewer personnel in the field, along with higher expected transport volume, require such solutions as well. Our automated brake test addresses exactly this issue. It saves an enormous amount and accelerates train preparation. Furthermore, our automated load weight monitoring supports the personnel onsite in optimally loading wagons and utilizing existing capacities. Overloading or asymmetrical loading of wagons is avoided, and the potential loading capacity is utilized fully.

On which digital features are Voith and PJM currently working and what are the challenges?
Matheus Habets: The future will bring a wide variety of digital functions. As part of our partnership, we are currently focusing on remote uncoupling (= „top class“) and its basis, the automatic formation of trains. The challenge is the operational integration into shunting procedures, most of which have been untouched and deeply rooted for decades. What is needed, therefore, is a uniform solution that is both robust yet safe and that convinces European operators.
Christoph Lorenzutti: Our technology must be perfectly aligned with the operators‘ process landscape. To achieve this, the cooperation between us as a system supplier with those who will use the solutions in day-to-day operations is essential and requires the coordination and adaptation of modern, digital operating processes.

What will rail freight transport look like in 2050?
Matheus Habets: The mode of transport will be faster in 2050 and will have a substantially larger market share of the overall transport performance. In combination with modern train control systems, longer trains will be able to be formed and they will travel faster thanks to the selective control of the brakes. The job profile of shunting personnel will have changed. Many dangerous, physically demanding and time-consuming work steps that still must be performed manually today will be a thing of the past in 2050. Even autonomous driving on the first and last mile could be implemented by then.
Christoph Lorenzutti: Rail operations will be highly automated in all areas, and the modal split will shift towards rail. There will be a change in goods transported, for example, away from bulk goods such as coal. LCL and single-wagon transports are experiencing a renaissance, and smaller units will be quickly transported. The quality of rail freight service will be significantly improved. Transports will be secure, and their condition known. Perishable goods will be transported without hesitation. Transnational transports will become uncomplicated and greatly expanded. ■

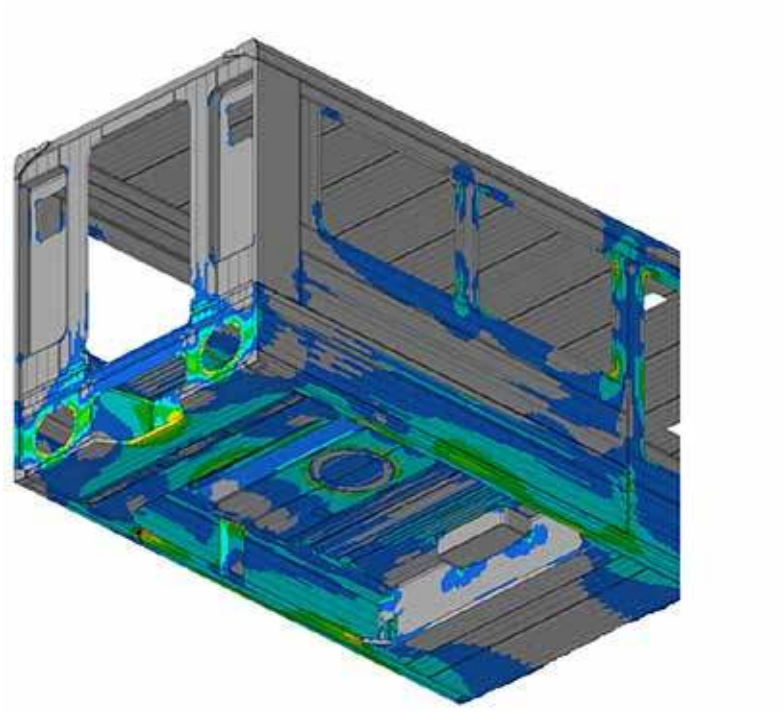
Award-winning technologies: **Innovation awards for our automated brake testing & state prize for mobile measurement technology**

Our technology in the digital rail freight won a real prize. We are very pleased about the assessments of the independent expert juries, which positively evaluated the innovative strength, benefits and future potential of our overall digital system. Recently, the area of measurement technology also received an award. Our solution for the efficient determination of rail profiles using mobile measurement technology for the Barcelona metro convinced another jury of experts.

The digital WaggonTracker system was awarded 6 times:
→ Winner Export Award 2022
→ RailTech Innovation Award 2022
→ ERCI Innovation Award 2021 (PJ Monitoring was awarded „Best SME“ among 17 states of the European Railway Cluster Initiative)
→ German Innovation Award Winner 2020
→ Austrian Mobility Award 2020 by VCÖ
→ Fast Forward Award 2019

Awarded measuring technology:
→ Austrian National Award for Engineering-Consulting 2021

Engineering – Optimised design for Stadler Rail AG



In the development of railway vehicles, a key factor is: as little material and weight as necessary, but as much load-bearing capacity as possible. Topology optimisation has been part of our everyday engineering work for years. Among others, Stadler Rail AG relies on our know-how. In a current project, our engineering team is dealing with structural optimisation and strength verification of the car bodies of a local transport vehicle.

We think out of the box

We have a particularly effective and efficient engineering team, as experienced experts in design, calculation, simulation and certification work very closely together. Expanded by measurement technology specialists, we offer unique know-how in the product development of structural railway components. Our innovative strength is further enhanced by our distinctive out-of-the-box thinking: All engineering staff have many years of experience in the automotive and mechanical engineering sectors in addition to their railway activities. Therefore, we are not only engineering experts in rail transport, but also in projects in other sectors, such as the optimization of waste treatment plants or other mechanical engineering projects.

Best calculations for the future

With our concentrated knowledge in calculation, simulation and measurement, as an accredited testing laboratory we are well prepared when calculations and simulations are increasingly used for the approval of railway vehicles in the future. For all this, FprCEN/TS 17833:2022 comes into play, the „Guideline for the use of simulations to demonstrate compliance with technical and regulatory requirements“.

We seamlessly dovetail our profound experience from worldwide test drives and approval trials with our engineering know-how. We link our empirical values from track tests with our design knowledge and thus create great added value for our customers.

Our engineering portfolio includes:

→ In-house duck developments, e.g. automatic suspension device, track scales, etc.

→ Static structural optimisation and strength verification in accordance with worldwide regulations:
- Vehicle bodies of passenger coaches and freight wagons with topology optimisation for weight reduction.
- Bogie frames and add-on parts such as wheel sets, gearbox housings, etc.
- Thermo-mechanical calculation of brake discs and block brakes to reduce time-consuming and cost-intensive tests.

→ Dynamic proof calculations and optimisations
- Collision safety (crash) of vehicle bodies
- Optimisations for positive fulfilment of vibration tests of electrical components
- Reduction of drivetrain vibrations for increased comfort
- Calculation of sound radiation from wheels to minimise cost-intensive tests

→ Multi-body simulation
- Derailment safety
- Running comfort
- Comparative simulations, e.g. impact tests to reduce costly tests
- Wheel-rail forces and load determination for strength verification
- Special projects such as long rail transport
- Railway line price model ■

Testing facility: **Approval tests in Canada**

Our measurement technology experts often find beautiful backdrops for their projects. Like this summer in Canada, where operational strength tests were carried out on the line between Montreal and Windsor, which partly runs along the Saint Lawrence River. For a Via Rail Canada passenger locomotive, the operational measurements were carried out on the line for a strength verification. ■

Current projects: Where are our teams globetrotting?

In the last few weeks, measurement inspections and test drives have taken our teams to Canada, Berlin, Italy and Switzerland, among other places. But it is not only abroad that calls for our metrology expertise. Our „Austrian“ projects are distributed in Vienna, Linz and northern Styria. As an accredited testing laboratory according to ISO / IEC 17025, PJM has already carried out projects on 6 continents: North and South America, Africa, Europe, Asia and Australia. Our international projects include a passenger car in Canada and the Osler Metro, the new S-Bahn in Berlin, new underground cars in London, the metros in Glasgow, Barcelona or Singapore. Our metrological expertise covers the areas of running gear, strength, braking, acoustics and aerodynamics of rail vehicles as well as superstructure, hydropower plants and mechanical engineering. ■

New laboratory hall at our location

Hello to our new hall! A part of us has moved. With measuring equipment bag and baggage, we have moved into a new laboratory hall, which provides sufficient space for our measuring wheel sets. Our lab team enjoys the practicality of the new working environment. In total, we have over 2,000 m² of space available at the Graz location. ■

Shift2Rail:
Technologies for sustainable and attractive freight transport in Europe

PJM is one of the 14 Austrian companies and research institutes in the VVAC+ consortium that are driving forward the technological development of sustainable and attractive freight transport. PJM's know-how is required for three projects in this major European initiative:

– The so-called Core Market Waggon, a „high-tech train" equipped with numerous latest digital technologies, has sensor technology from PJM on board and can also be seen at InnoTrans 2022 (outdoor area T04/90).
– A train of the Steirische Landesbahnen ("Styrian Rail") was equipped with extensive monitoring functions on the subject of Condition Based Maintenance (CBM). Test runs lasting several weeks have been successfully completed. The lubricant monitoring function in the axle box came from AC2T, the DataBeam from the Virtual Vehicle research centre and PJM contributed measurement technology, carriage integration and power supply know-how.
– Extensive radio tests were carried out in Sweden to evaluate different radio technologies. PJM provided technological support for the tests with the LoRa radio system, based on its many years of experience with in-train communication developed in-house.

Shift2Rail is a public-private partnership between the European Union and the European railway sector. As a research and innovation project, it is intended to secure and strengthen the competitiveness of the European railway industry and also to contribute to achieving the modal shift targets set out in the White Paper on Transport. A budget of 920 million euros is available for the project over a period of six years, of which 450 million euros come from Horizon 2020, the EU programme for research and innovation. The remaining 470 million euros are to be provided by the founding members and associated members. Austrian companies and research institutions are represented in three associate members, including the VVAC+ („Virtual Vehicle Austria Consortium+") with twelve Austrian and one Slovakian partner and the EUROC („EUropean Rail Operating community Consortium"). ■

Unique in rail maintenance:
The cooperation between the two industry specialists voestalpine Railway Systems and PJ Messtechnik GmbH creates a unique service offering for mass transit systems

Efficient maintenance of rail infrastructure using mobile measurement technology

Continuous inspection of the rails and rail maintenance based on this is essential for local transport companies, but complex and cost-intensive. Intact track systems are the prerequisite for safe driving operations. The measures around rail maintenance are complex, time-consuming and associated with high costs. In order to make this process more efficient and cost-effective for Metro Barcelona, PJ Messtechnik GmbH has developed a new technological procedure together with voestalpine Track Solutions Germany GmbH. This makes it possible for the first time to carry out rail maintenance in just three steps. The rails and tracks of entire light rail vehicles and underground trains are measured smartly and digitally in a short time, objective data material is determined and then the rail systems are processed efficiently and purposefully using high-performance milling technology. The numerous advantages (such as continuous operation or safe operation due to intact track systems) benefit local transport companies as well as passengers of public rail transport in large conurbations. ■

Europe's smartest freight train

Mercitalia and PJM put the smartest goods train on track. Thanks to the comprehensive functions, Mercitalia Intermodal benefits from shorter delivery times as well as important information in real time via condition-based monitoring. The wide range of functions includes:

- Condition Based Monitoring in real time
  Multi-diagnostic system for load weight monitoring, real-time brake analysis and brake system monitoring (correct function of the brakes in terms of pressure in the main pipe, load and cylinder pressure during stillstand and on the ride, brake energy analysis in order for early detection of defective and overloaded brake systems)
- Dynamic driving condition monitoring to identify critical driving situations and possible malfunctions
- Determination of driving comfort and safety as well as detection of longitudinal and vertical impacts
- Real-time jack monitoring for reliable and safe detection of the correct setting for trailer transports in the intermodal sector, paired with automated brake testing

The integrated in-train communication is used to transmit data to the train driver in the event of derailment, incorrect braking conditions as well as brake overloads, hot box warnings and any problems with the support frame monitoring. This technology, which is now available, serves to increase safety and avoid critical driving situations and damage, as well as to optimise operational processes.

This is the smartest goods train on track, which provides Mercitalia Intermodal many advantages: shorter delivery times, impactful condition-based maintenance and therefore savings in maintenance and repair work, more safety and greater efficiency. ■

IMPRINT

On special occasions, PJMagazine issues novelties and latest projects of PJ Messtechnik. GmbH and PJ Monitoring GmbH. Responsible for the content: Martin Joch and Günter Petschnig, CEOs of PJ Messtechnik GmbH and PJ Monitoring GmbH. Concept and realisation: Birgit Rami-Jauk, Corporate Communications. Layout: Crossdesign Werbeagentur GmbH, Graz. Photos: PJM, SBB Cargo, voestalpine Railway Systems, Voith, MOMOOD, Manuel Hanschitz, Mindconsole.
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