

In this very special innovative partnership, all the attributes of a Suisse watch, an Austrian Sacher cake and a full-bodied Italian Barolo team up. This results in a perfect interaction between precision mechanics, a high reliability of all partners and a sort of fluffy-easy cooperation.



For all the partners, the development and implementation of an automatic brake test was of utmost concern. The international cooperation started in 2017. Just two years later, the result is impressive: More than 100 wagons are rolled out and there is a lot of positive feedback. But let's summarize step by step.

The issue

Brake tests for freight trains are personnel- and time-consuming and complex. In contrast to passenger trains, the state of the brakes has to be checked manually. An employee has to check every single axle if the brake blocks had been applied. This has to be verified whenever wagons had been separated or the train had stopped for 24 hours. Given a 500 m long freight train, this check takes up to 40 minutes.

The solution

In the digitisation of rail freight transport, the patented WaggonTracker-platform has set a new standard. In the

SBB user case, the WaggonTracker was upgraded by the feature of an automatic brake test. "This feature results in a time saving of up to 30 minutes. The staff benefits from avoiding the time-consuming manual check directly at the train, which would be absolutely essential, even in adverse weather conditions", says CEO Günter Petschnig.

How does it work?

The WaggonTracker is a comprehensive monitoring system captivating with its autonomous power supply and automated processes. Highly precise measurement sensors acquire relevant data on the freight train. The data is processed and visualised on a mobile terminal in real-time.

In this user case, the PJM team designed an additional sensor system enabling an automated check of the brakes. The results and analyses are shown on the tablet of the train conductor or the person in charge. The automated brake test fulfils all safety-related regulations in terms of operation and vehicle.

The project at a glance



The project started in 8/2017 operating 20 wagons. Till the end of the test phase, the wagons will have run 1.000.000 kilometres. The brake tests will have been performed 500 times and the brakes will have been checked 10.000 times.

02/2018: The pilot train is tested in operation.



03/2019: 105 WaggonTracker monitoring systems are implemented on SBB Cargo trains. SBB Cargo are the innovation leaders in terms of rolling-out this system.

Starting from 2020, the step-by-step implementation of the whole fleet will be performed.

The project partners are SBB Cargo, PJM, RCG and Mercitalia.



For SBB Cargo, the automatic brake test is a crucial part of realising the "one-person operation". Further components are the early-warning-system of collisions and the automatic coupling.



The time-saving effect for a 500 m long freight train: up to 30 minutes.

The automated process completely replaces the mechanical and visual test procedure.



A big benefit:
Load monitoring system



Let it snow:
Tests for approving a snow blower vehicle



Fast track detection:
Vehicle behaviour of railway construction machines is tested by simulation



Tracking the track:
Monitoring system for the metro in Oslo to determine the track's stresses



Heavy Metal:
A short portrait on our multi-talent WaggonTracker



PJM Insight:
„100 % Made in Europe“ – let's take a look of our company

A big benefit:

A load monitoring system for rail freight trains providing considerable cost savings and greater safety

An automatic system monitoring the wagon's load and bogie provides great advantages. PJM, the Austrian specialist on railway systems, strengthens its pioneering positions, due to the load monitoring system. Numerous customers appreciate an optimum load capacity, which ensures higher margins, an efficient use of the freight wagons and greater safety of the load.

The challenge: To achieve higher shipping volumes by optimum load capacity

All freight transport sectors, including logistics, have to face economic pressures. There is strong international competition among companies. Furthermore, companies have to face steadily changing legal frameworks and regulations, increasing basic costs and high maintenance costs. "Increasing the efficiency", is the magic tool to cope with this. But how to achieve this? "By automating complex processes and getting an optimum load capacity. This also is crucial to the loading staff since they are responsible for the load and overloading, too. Thus, the loading staff plays safe and leaves a margin so that the official load capacity is not exceeded. The load capacity is therefore not the optimum as possible, and as a result, the carrier has to face increasing costs and sometimes even wagons being removed from trains at checkpoints," says CEO Günter Petschnig. PJM has developed a load monitoring system which automatically determines and analyses the loading process and the load. Signal lamps or the on-site visualisation on the display immediately indicate the loading situation and so the system assists the loading staff during the loading process and enables an immediate adjustment of the load.

Clear advantages

- Optimum load capacity is ensured.
- The loading staff are assisted locally thanks to an on-site visualisation method. This is a great back-up for transports with „difficult“ material loads, such as timber. On account of the variable density of timber, volume is not the ideal loading parameter for this type of payload. A loading weight monitoring system ensures that the maximum weight is loaded, regardless of the condition of the organic material - the weight difference between dry and wet or freshly cut timber is considerable.
- Maximum safety, on account of the fact that the wagon is not overloaded.
- Reduced maintenance costs. Since a weight-monitored wagon is not overloaded, the wheelsets and underframes are stressed less, and this reduces the repair costs.
- There is a trend towards lightweight wagon design. A weight monitoring system precisely meets the demands of lightweight wagons. Hence, clients benefit from an optimum load capacity.
- The weight monitoring system provides a wide range of uses: wagons used for gravel, scrap, bulk payloads, steel coils and even intermodal vehicles are perfectly suited to be upgraded with the fitting of a weight monitoring system. Especially the loading of scrap and bulk material is complex and tedious. Every wagon has to be weightchecked. If



the loading weight is below the limit, a return to the loading site to load more payload is unprofitable. The result is that the rake of wagons is not optimally loaded, and more wagons are needed to carry the complete consignment.

Functionalities at a glance

- The wear-free hub generator provides the monitoring system - and further applications - and is energy self-sufficient.
- The automatic load identification determines changes of the loading weight immediately and turns on and off the signal lamps mounted on the wagon and the digital monitoring system. The system checks the loading situation at predefined intervals and is activated automatically when any weight changes occur. In addition, the on-site visualisation is activated to identify an overload or asymmetric loading and thus assists the loading staff during the loading procedure (this also depends on the type of WaggonTracker system used). It is not possible to power such an automated system using batteries.
- On account of the simultaneous automatic data transfer into the web portal, the train driver or operator is continuously informed about the loading situation. This facilitates a better planning of loading capacity. In addition, the permanent monitoring of load and tonne-kilometres enables a better planning of maintenance intervals, maintenance stops and components required during the servicing of wagons.
- The WaggonTracker ADV, which was especially designed for wagons, determines the loading weight with a strain gauge-system which is maintenance-free and long-lasting. These strain gauges are usually mounted on the bogies. Depending on the WaggonTracker type, between one and four metering points are installed on the bogie frame. The average annual measurement accuracy is about 2.5 % per year.

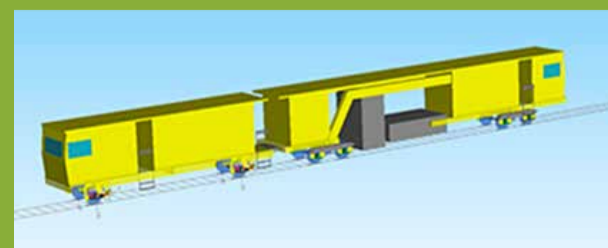
- The setting of calibration values is done in the web portal, and the data is transferred and recorded into the on-wagon system. Thus, the loading staff can always rely on the full range of functionalities and crucial data such as calibration and loading limits, even without an internet connection. In addition, the system takes into account both summer and winter season conditions, including, for instance, the weight of snow on a wagon. The required data for calibration is determined when the wagon traverses a calibrated scales. Furthermore, the manufacturer can undertake such a calibration using a bogie testing rig to simulate the weight of the carriage.
- The WaggonTracker ADV product range provides reliable information - the status of the running gear, position, direction of travel and ambient temperature are all determined and recorded. In addition, depending on the WaggonTracker requirements, it is possible to determine running safety, standardised buffing and vertical impacts. The system can be upgraded with any necessary requirements.
- To automatically determine the maximum permitted loading weight of various parts of route according to rail infrastructure classifications, geofencing is used to set the system parameters.

Last but not least: The "green aspect"

In addition to individual advantages, there is a general economic benefit. All the advantages of the transfer the traffic to rail are well-known: Road transport is degrading the quality of roads resulting in long-term higher costs of road infrastructure. Adding the environmental aspect: Less road traffic means less CO₂ emissions. "This is a win-win situation for rail. Our environment benefits from less CO₂ emissions, and the national economies benefit from a further contribution to global climate agreements", says CEO Martin Joch.

Fast track detection:

Vehicle behaviour of railway construction machines is tested by simulation



For manufacturers of construction machines, PJM performs tests by multi-body simulations. A wide range of new construction machines is based on special constructions and therefore real tests would be very complex and time-consuming. PJM tests the running characteristics and documents the evidence of conformity by means of simulations.

Heavy Metal: A short portrait on our multi-talent WaggonTracker



„Digitisation of rail freight transport“ is a frequently used term. Without any doubt, it will find its way into rail freight cargo. But how is it possible to pack a system, which provides numerous automation and monitoring functions, into one cast iron piece of metal? A short portrait of the all-rounder WaggonTracker:

Especially for shipping companies, the world of digitisation provides many possibilities and advantages. In this field, PJM has been a leading pioneer since we linked up rail freight cargo and digitisation with the patented system WaggonTracker. This platform perfectly combines monitoring and automation and is designed as a robust overall system which is very efficient and cost-saving. It provides automated processes plus crucial information about the vehicle fleet in real-time.

The components are manufactured in Graz, meeting the high requirements “Made in Austria”. Electronic and software systems are developed in Graz, too.

Energy self-sufficient

The hub generator provides the WaggonTracker platform with electricity autonomically.



WaggonTracker STD

Real-time visualisation via web-service. Steady information on the current position after shunting, in running operation and every 12th in standstill position.

- Vehicle performance
- Current position
- Last report
- Last move
- Current country
- Historic data
- Geofencing
- Direction of travel
- Management of wheelset – vehicle performance

WaggonTracker ADV

In addition to the WaggonTracker STD-functionalities, the ADV system monitors vehicle state, single components and load. When required, an alarm signal is sent.

Safe train operation by monitoring of:

- Temperature of axle bearing
- Running characteristics (ride safety and ride comfort according to EN 13749)
- Load situation (overload, asymmetric load, load of wheel sets)
- Signals / acoustic alert during loading the vehicle
- Derailment diagnosis

Cost-savings by identifying the cause of damage

- Impact detection (according to EN 12663, vertical impact monitoring)
- Monitoring of the parking-brake position
- Identification of wheel flats
- Protection against incorrect or improper use (overload, reporting of incorrect usage etc.)

The rail freight is safer by monitoring:

- Acceleration
- Moisture and temperature
- Door monitoring including alert (anti-theft protection, camera)



Monitoring system for the 85-km metro in Oslo

An increase of passengers results in higher maintenance costs. In Oslo, the metro traffic has increased by more than a half within a few years, due to a strong increase in passenger numbers. Some specific figures:

- 122 millions of passengers / year. That is an increase of more than 60% within a few years.
- 380.000 trains on 5 tracks.
- Mileage of 8.7 million kilometres / year.

The Norwegian public transportation company Sporveien Oslo A-S decided on a specifically designed on-board monitoring system which enables a reliable forecast of future maintenance work. This “predictive system” goes along with cost savings and a much more efficient maintenance. PJM designed and implemented a monitoring system to continuously gather information on the state of the track. Every day, the sensors aboard the train generate about three to five gigabytes of raw data which is processed overnight by PJM into relevant indicators of the track quality. Due to these indicators, Sporveien is capable of reliably estimating the maintenance requirements. Thus, maintenance work is planned in time and efficiently which results in cost savings and has a positive effect on the management of resources.

Apart from the well-proven project management and the metrological expertise of the PJM-team, this project had an international aspect. Håkon Line, a native-born Norwegian who joined our testing facility-team in 2018, played a key role in this project. ■



Let it snow:

Tests for approving a snow blower vehicle

Feeling some nostalgia: Our testing facility crew thought themselves back to winter – though it was in the middle of April. Bright sunshine and great weather conditions summed up to a splendid backdrop while testing the acoustics of the snow blower vehicle “Hb1100S”. Furthermore, PJM tested running characteristics, derailment safety, fatigue strength and brake systems. In the proven way, PJM determined all the details of metrology in the design phase. The entire measurement sensor system was arranged in Graz and then installed on-site on the snow blower vehicle. The tests will be run for many weeks. The evaluation of the measurement data has started, the test report will be finished in July 2019. ■

PJM Insight: „100 % Made in Europe” – let’s get a glimpse of our company



„What are the features of the product and does our company benefit from it?”, that’s the crucial question when it comes to decide on a new product or system. Particularly for bigger investments or system changeovers, the most important side issue is: The product seems to be interesting. But where does it come from? Who’s behind it?

We gladly answer this question. „We“ – our PJM-crew – do the research, we develop, design and engineer on our company site in Graz. We focus on metrology for railway systems. But there is a wide range of fields of competence and activity: mechanical engineering, mechatronics, industrial engineering, physics, acoustics, IT and manufacturing - we work interdisciplinarily. Our teams work all over the world and under all kind of demanding conditions, as in the underground (in the case of underground railways), in hot regions (e.g. in Australia) and during the cold season. It’s always our crew who gets projects on track and completes them successfully. The PJM team is a melting pot of talents, personalities and

specialists. With a large portion of humour. And an irreplaceable will to make a good job. However many obstacles we have to overcome to complete a project. Within 13 years only, PJM has developed to a medium-sized company. We are no spin-off anymore, but the working atmosphere is spin-off-like: individual responsibility, autonomous work and a collegial cooperation are the basis in our working life. Due to all of this, we are a strong partner: Our customers appreciate our expertise, our overall know-how, our profound knowledge of the railway system and our flexibility. As Martin Joch says: *„We always do a good job and we always finish our projects successfully – however hard the circumstances may be.”* ■



1-minute-portrait on PJM

- Rail way system solutions & digitisation systems for rail freight cargo
- Accredited testing facility for railway vehicles according to ISO IEC 17025
- Founded in 2006 by Martin Joch and Günter Petschnig
- R&D quota: 14 %
- Projects implemented in more than 30 countries
- Export quota: 80 %
- About 60 employees
- 100 % „Made in Graz“: R&D, product development, hard- and software development, administration and manufacturing are located in Graz
- 100 % “Made in Europe”: Single components for our high-tech measurement devices and the WaggonTracker are delivered by Austrian or European suppliers.
- Over 1.500 WaggonTracker systems are run successfully by international customers.

1-minute portrait of Graz

- Graz is a liveable and adorable city. Situated in the south of Styria, the citizens appreciate its Mediterranean atmosphere.
- Know-how and its transfer: More than 55.000 students live in Graz. 9 Universities, 2 universities of teacher education and 2 universities of applied sciences offer a huge variety of fields of study. There is a strong focus on technical education.
- Graz is a business location focusing on technical industry. 17.500 companies are located in Graz, among them world market leaders such as Andritz AG, Anton Paar GmbH, Knapp AG, Magna and Siemens.
- The old town of Graz is a world heritage, Graz is Unesco City of design and the first European Human Rights City.
- Depending on which direction one follows, there is a large variety of landscapes, just 30 minutes from Graz by car: a picturesque mountain scenery, a volcanic landscape and steep vineyards producing delicious wines.

IMPRINT

On special occasions, PJMagazine issues novelties and latest projects of PJ Messtechnik GmbH and PJ Monitoring GmbH.

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