PODCAST: INTERVIEW ABOUT THE PROJECT

"We want to create information from measurement data."

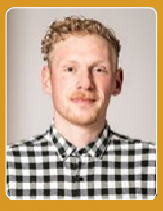
Patrick Zenker and Burkhard Schranz talk about the joint project and the added value of digitalisation in the rail vehicle sector.

OPTiMEAS

User report

Trelleborg

Smart sensors in the bogie



Patrick Zenker,
Develop Engineer Innovation
Trelleborg Antivibration Solutions, Germany GmbH

*"**optiMEAS** is a real stroke of luck for us! From the very first moment, we were a perfect match in terms of people and expertise. **optiMEAS** already had the sophisticated solution we had been looking for for a long time.*
ready in the portfolio."

Optimise maintenance & service

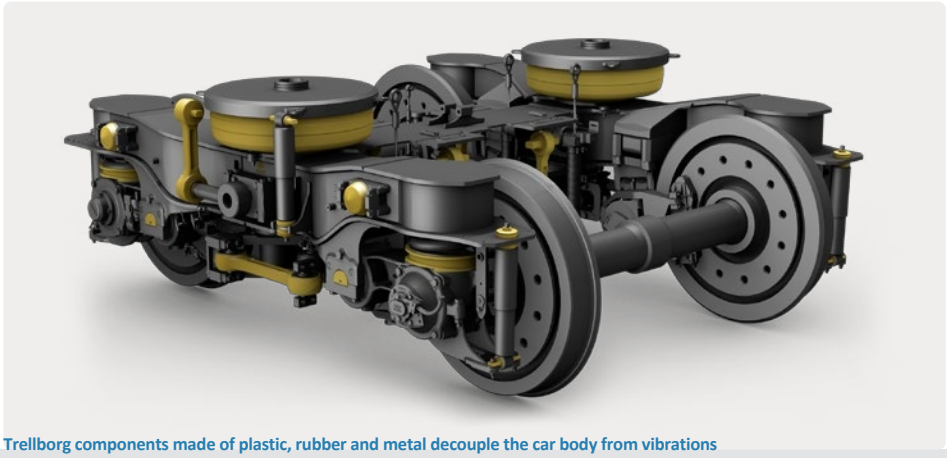
Trelleborg Antivibration Solutions is a business unit of the Swedish Trelleborg Group, a leading global supplier of polymer solutions. **Trelleborg AVS** develops and manufactures vibration control components and system solutions for critical environments. The company specialises in the rail vehicle industry as well as the agricultural and construction machinery, wind energy and marine sectors. **Trelleborg AVS** stands for quality, expertise and innovation and is a close development partner of renowned machine manufacturers worldwide. Trelleborg focuses on digitalisation in the further development of its vibration-damping railway technology components.

How IoT measurement technology improves the maintenance of railway components

The maintenance of railway vehicles is very time-consuming. Overhauling the bogies in particular requires extended downtime and incurs high costs for the vehicle operators. The right sensor technology, combined with an intelligent edge device, makes it possible to optimise maintenance intervals and strategies.

THE CHALLENGE:
LACK OF DATA ON WEAR AND TEAR PREVENTS EFFICIENT MAINTENANCE

In rail vehicles all over the world, **Trelleborg** products ensure a comfortable and safe journey. Spring systems, link and axle bearings, buffers and other vibration-damping components made of plastic, rubber and metal decouple the vehicle body from vibrations from the bogie, wheelsets and track.



Trellborg components made of plastic, rubber and metal decouple the car body from vibrations

These components are subjected to high forces, which lead to wear in the long term. Added to this is the limited service life of the rubber material, which can be damaged by climatic influences and wear.
ageing as a result of wear and tear. In order to ensure the availability and operational safety of the vehicles, bogies must be regularly maintained. However, the effort involved is immense, as the vehicles have to be taken out of service. In the depot, the vehicle body is lifted off and all wearing parts are replaced. Between 40 and
60 per cent of the total maintenance costs are attributable to the overhaul of the bogies.

The maintenance intervals are currently still fixed, regardless of the actual condition of the individual components. As a result, vehicles are serviced even though they are in good condition, taking all safety factors into account. could have continued without any problems.

Trelleborg launched an innovation project together with rail vehicle manufacturers and operators to increase the service life of the vehicles. With the help of sensor-based, industrial IoT technology should make it possible

to recognise the condition, wear and acute problems of components in the bogie during operation. In addition, a broad database should be created for further investigations and improvements. IIII

THE SOLUTION:
SOPHISTICATED MEASURING SYSTEM WITH INTEGRATED CLOUD CONNECTION

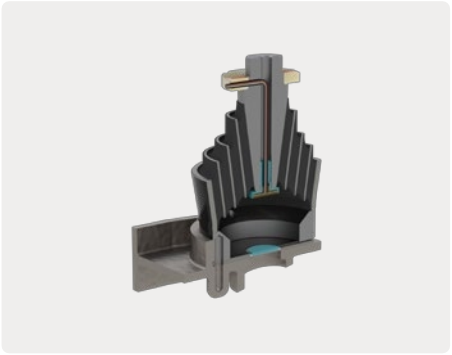
Trelleborg identified the primary cone spring as the component in the bogie best suited to the task. It sits between the track and the bogie frame, directly on the wheelset. All forces and loads acting on the train are transmitted via this path. The idea: to use the deformations on the spring to calculate which forces
on the tension in order to assess not only the wear of the spring, but also the condition of

To record the real-time loads, **Trelleborg developed** the complex ConeX3 absolute displacement measuring system with a hardware partner and chose **optiMEAS** as the technology partner for realising the IoT solution from the sensor to the cloud.

Firmly integrated into the primary cone spring, the measuring system continuously records all movements introduced. Non-contact sensors measure the static and dynamic loads and paths in all spatial directions with long-term stability.

The microcontroller of the sensor unit processes the electrical sensor signals and transmits them via a CAN bus to the **smartRAIL** IoT device, which is specially designed for the high requirements in the railway sector. Data from up to eight "smart" primary cone springs converge here. Enriched with a precise GPS signal, they are processed together, stored and transmitted to the **optiCLOUD** via mobile

smartRAIL already includes all the basic IoT functions for data storage and transmission, interfaces, remote access, GPS, intelligent functions and the connection to the cloud via its **smartCORE** firmware. Application-specific requirements are



With ConeX3, Trelleborg offers an innovative measuring system

supplemented by a "**Trelleborg module**". Among other things, it includes pre-processing close to the sensor. This means that only these relevant characteristic values need to be transmitted to the cloud and not the entire data volume.

The device offers two parallel cloud services for data transmission: one transmits data live via MQTT to a dashboard where users can view current values. The other service transmits high-resolution measurement data for in-depth analyses and model calculations.

The **optiCLOUD** not only offers extensive options for flexibly visualising the data, but also an interface for device management. Regardless of where the train is currently located, parameters can be changed from anywhere and firmware updates can be transferred over-the-air to the ConeX3 measuring system via **smartRAIL.** This means that the de

Trelleborg developers can customise and expand their system at any time. IIII

THE RESULT: TRANSPARENCY, OPTIMISED PROCESSES AND COST SAVINGS

With ConeX3, Trelleborg offers an innovative measuring system that provides customers with real added value. The system records all loads acting on the running gear of a rail vehicle during operation. This real-time data can be used in a variety of ways to improve processes and reduce costs.

The function and condition of primary cone springs and adjacent components in the bogie can be monitored and analysed live in relation to their position - an important basis for condition-based maintenance measures on vehicles, tracks and points. The analysed measured values also make it possible to detect flat spots on wheels at an early stage, which often lead to unplanned breakdowns due to the repair work that is then required. Problems with dampers are also recognised. These are, for example, particularly slow vibrations below 3 Hz, which can cause nausea in passengers.

A special feature of rubber-metal parts is the setting. The spring travel of the components decreases over time due to various physical and chemical effects. This so-called settling amount must be compensated for during maintenance using spacers
and is normally measured manually. The system records the spring travel automatically and much more accurately.

This is what field testing is all about, record as much raw data as possible, analyse signal patterns and detect anomalies. Based on this, models for the service life of the spring and neighbouring components such as dampers, couplings and bogie frames are to be developed.

The innovative ConeX3 solution, consisting of the sensor system, **smartRAIL** and **optiCLOUD**, is designed to process large volumes of data and is highly scalable. Further intelligent IoT functions are to be added gradually. IIII

ADVANTAGES AT A GLANCE:

" Recording of loads in real operation
" Information about components in the bogie, tracks, points and wheels (flat points)
" Statements on service life and useful life
" Avoidance of downtimes
" Optimised maintenance intervals
" Broad database for product development

COMPONENT USED BY OPTIMEAS:

IoT edge device **smartRAIL** with integrated **smartCORE** software
IoT cloud platform **optiCLOUD**

FURTHER INFORMATION:

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