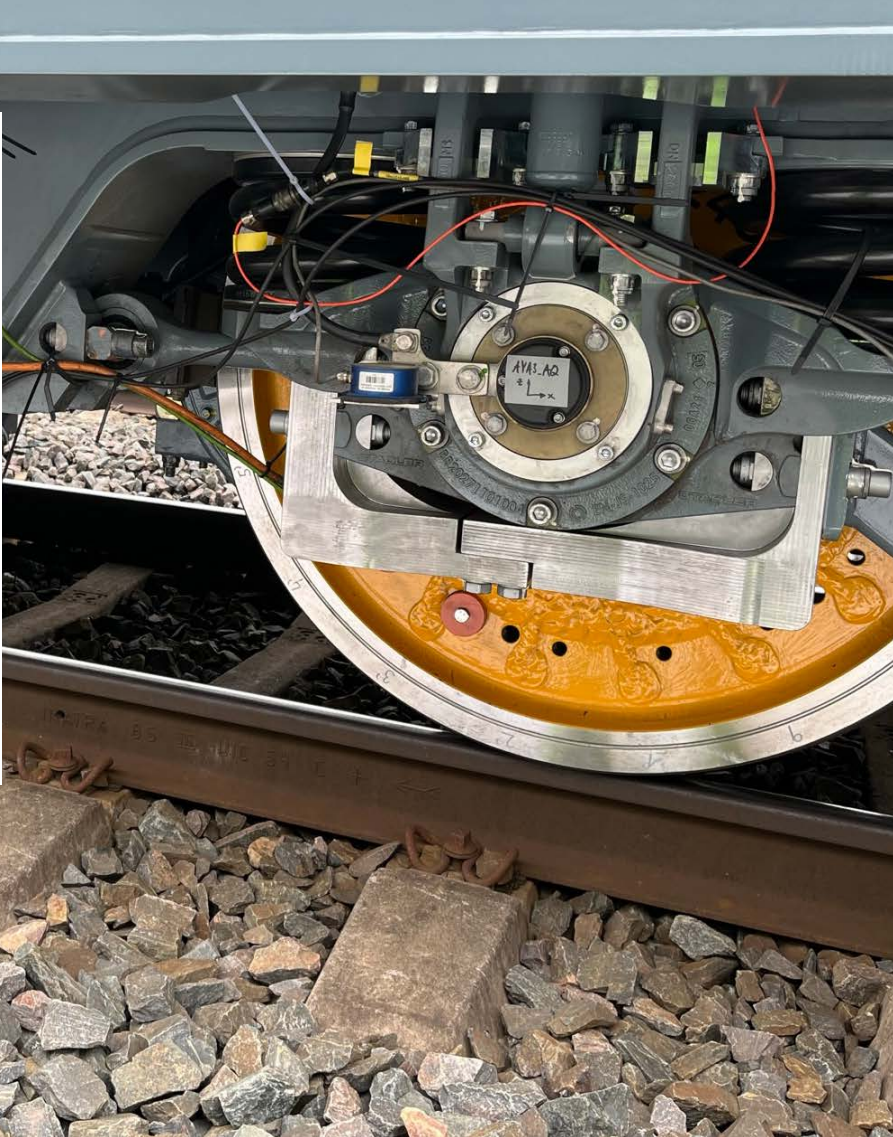




Add value.  
Inspire trust.

## Instrumented wheelset technology IWT 5

A smarter, more flexible and highly  
reliable measurement technology

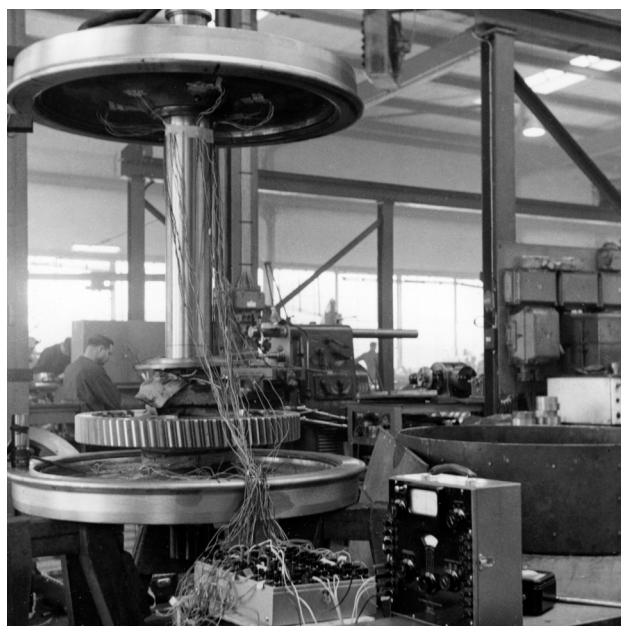


### Why is instrumented wheelset technology important?

An instrumented wheelset is a railway wheelset that is equipped with sensors to measure the dynamic contact forces at the wheel-rail interface. Historically they are primarily used to verify that new or substantially modified vehicles are not prone to derail and do not cause unacceptable levels of rail wear or damage to the infrastructure.

It is no challenge to calculate the forces arising from the static axle load. The forces resulting from the dynamic interaction between vehicle and track however are more difficult to determine. Using instrumented wheelsets, these forces can be measured directly and enable a better understanding of the dynamic interaction between a vehicle and the track. The measurement and evaluation of forces between wheel and rail is a key element in the approval process for new and modified vehicles in Europe and many other regions. Depending on the region, different testing standards are required. Europe uses the

standard EN14363 while the US standard is 49CFR-213. However, testing using IWS is also common elsewhere, like in China, Japan and India.



### What sets IWT 5 apart from other technologies?

TÜV SÜD is in a unique position as it holds the rights, and technical teams for the two world leading IWS technologies, namely the IWT4 and PROSE IWS technologies. This enormous pool of experience and competence has enabled the development of IWT5, a technology offering numerous advantages over traditional technology. Similarly to its predecessor IWT4, TÜV SÜD's fifth generation technology, IWT5 utilises the vehicles existing wheelsets without any destructive modification. This means that no special testing wheels need to be manufactured, which results in simplified project logistics, compressed schedules, reduced risks and lower project costs.

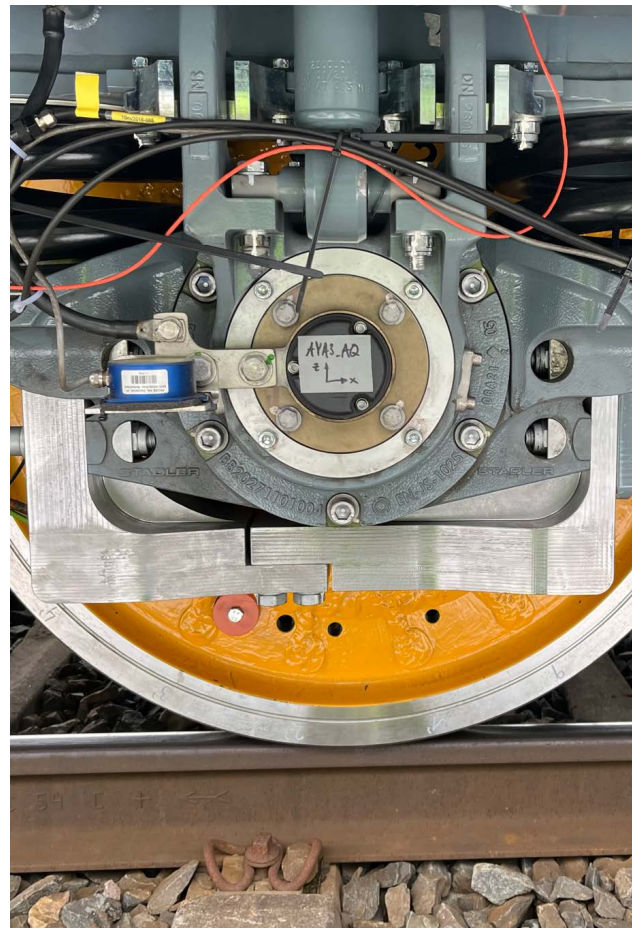
The integration of PROSE's instrumented wheelset technology allows IWT5 to provide an improved user interface alongside vastly improved connectivity options and backwards compatibility for legacy wheelsets.



While testing vehicles, vertical, lateral, and often longitudinal forces need to be measured. With IWT5, it is now possible to measure all forces simultaneously in all three directions. While vertical and lateral forces are important to evaluate vehicle dynamic performances and track condition, longitudinal forces are critical for rolling contact fatigue and wear.

IWT5 is set apart from other technologies by using a unique telemetry system. The fifth-generation telemetry system has increased performance and robustness while also using a 'plug and play' architecture that allows for

extremely fast replacement if needed. Generally, a great benefit of using telemetry systems is, that the need for slip-ring devices is removed, therefore increasing reliability and simplifying the installation of the system. As IWT5 is using an inductive telemetry system specifically developed for the railway environment, it avoids electromagnetic interference issues that are normally characteristic of radio-based telemetric systems. IWT5 does not need additional batteries, as an advanced inductive power transmission system ensures IWT5 is powered up whenever the vehicle is.



### What benefits does IWT5 offer you?

IWT5 will benefit you in various ways. The optimisations include:

- A higher reliability due to a reduced number of parts
- More flexibility due to multiple transmission and output options
- Improved performance in switches

By acquiring and integrating the IWT4 and PROSE IWS technologies and teams, TÜV SÜD has assembled the leading experts in IWT. As a client you will benefit by receiving an unrivalled level of support.

## Specifications of IWT 5

IWT5 avoids structural integrity issues, as the wheels do not need to be machined. This removes the need for any additional periodic ultrasonic inspection of the instrumented wheelsets. The interface of IWT5 impresses with its updated Measuring Wheelset Computer (MWSC), which allows for an innovative and improved user experience. It offers various configuration and diagnostics options while being visual and intuitive, hereby adding to the user experience. IWT5 opens the door to additional interfaces such as, TCP/IP, EtherCAT, CAN, digital interface to imc Cronos and HBK Quantum X, analogue voltage. Additional interfaces are available on demand.



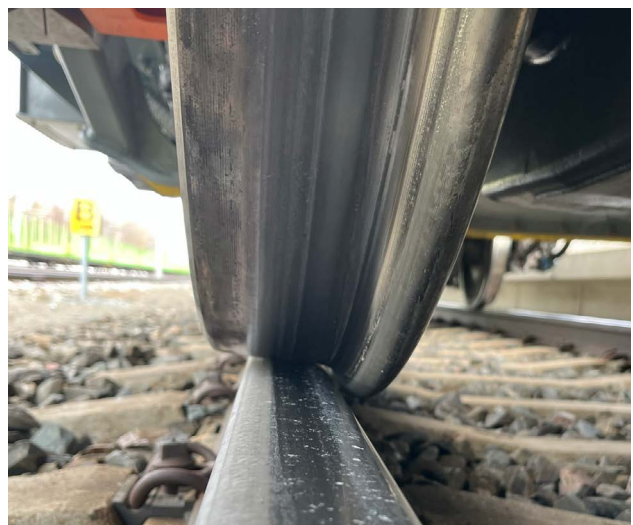
IWT5 is backwards compatible, allowing legacy instrumented wheelsets to be used for decades to come. As further development of IWT4, IWT5 wheelsets can be calibrated while mounted in the vehicles, as a newly developed mobile calibration rig enables this to be undertaken efficiently and accurately.

## Track condition monitoring

It is important to regularly monitor the railway infrastructure. This allows to take timely action when track conditions degrade rapidly. Monitoring trends gives valuable information that could help planning long term maintenance. Modern track condition monitoring is not only based on the traditional geometric measurements, but also on the measurement of the wheel-rail forces as a reaction to track irregularities.

IWT5 is capable of measuring at high frequencies while using the vehicles original wheelset. The high frequencies make it possible to locate irregularities, both singular and periodical. Collecting this data enables TÜV SÜD to clearly identify, quantify and classify areas of degradation of the infrastructure. This is specifically important as parts of the tracks might include sections where track or wheel wear is high, corrugation has developed, or poorly performing switches or crossings can be identified.

Instrumented wheelsets cannot replace track geometry measurements, but they provide a direct measurement of the impact a particular set of geometry has on wheel-rail forces.



## Friction measurement

Friction at the wheel-rail interface is a critical parameter for an effective railway. By identifying areas of the network with low friction in real-time, operators could potentially drastically reduce wheel flats on their fleet. While the measurement of high friction gives operators the opportunity to actively manage lubrication regimes and drastically reduce wheel wear.

## Technical capabilities of the instrumented wheelset technology IWT 5

- **Typical measurement uncertainty of vertical and lateral wheel-rail forces (Q, Y):** Typically, better than 3 % at 20 Hz.
- **Measurement of longitudinal creepage forces (X):** Currently measured and soon will be supplied as a fully calibrated signal.
- **Cut-off frequency for X:** Typically in excess of 10 Hz.
- **Measurement of contact point position:** Typically  $\pm 2$  mm accuracy is achievable. Accuracy is degraded during two point contact conditions.
- **Handling of two point contact:** Creates equivalent, global values for the contact forces. The individual contact forces for each of the individual points of contact are not measured.
- **Temperature:** -25 °C to +50 °C, may be increased after consideration of the specific application.
- **Special wheel disc design required:** No special requirements. Nearly all wheelsets can be used.
- **Modification of the wheelset:** No destructive modification of the wheelset is required, so the wheelsets fatigue life is preserved removing the need for additional ultrasonic inspections.
- **Signal and power transmission:** Next generation IWT5 telemetry system for wireless signal/power transmission, no modification to the axle or wheel required, no batteries required.
- **Permitted test speed:** 4 - 500 km/h. Lower test speeds are possible for special applications.
- **Traction/Braking forces:** Traction and braking forces may be applied with the exception of tread brakes and wheel mounted disc brakes. Care should be taken in all cases to avoid wheel flats.
- **Output interfaces:** Analogue connections BNC or D-Sub, EtherCAT, CAN, TCP/IP, digital interfaces to imc Cronos and HBK Quantum X. Other interfaces on customer demand.
- **Backward compatibility:** P32 Telemetry System, PROSE IWTs, IWT4 Inductive Telemetry System.
- **Calibration:** Laboratory calibration with wheelset removed. Recalibration under the vehicle using the IWT5 mobile calibration rig. (Note: vehicle lift required)

As IWT5 uses the vehicles standard wheelset, geometry and hence wheelset characteristics vary between wheel types, the characteristics given are typical values.

## TÜV SÜD is your trusted instrumented wheelset partner

TÜV SÜD's instrumented wheelset team has its roots in two technology streams, the Swedish IWT technology and the PROSE/Minden technology, and with over 50 years of development history it is at the forefront of IW technology.

In 2019, TÜV SÜD took over the IWT4 instrumented wheelset technology and key personnel from SNC-Lavalin (Formerly Interfleet). From developing the first generation of instrumented wheelset technology in the 1950s, to optimising it on to IWT4 and IWT5, our experience and knowledge base is vast.

With the acquisition of PROSE Instrumented Wheelset technology in 2021, TÜV SÜD's IWS competence is unrivalled, enabling the provision of a cutting edge and field hardened technology and ability to deliver prompt and competent support.

## Add value. Inspire trust.

TÜV SÜD is a trusted partner of choice for safety, security and sustainability solutions. It specialises in testing, certification, auditing and advisory services. Through more than 25,000 employees across over 1,000 locations, the company adds value to customers and partners by enabling market access and managing risks. By anticipating technological developments and facilitating change, TÜV SÜD inspires trust in a physical and digital world to create a safer and more sustainable future.

### Related services

TÜV SÜD provides the following related services:

- Dynamics simulation for rolling stock vehicles
- Rail vehicle and component testing
- Rolling stock services