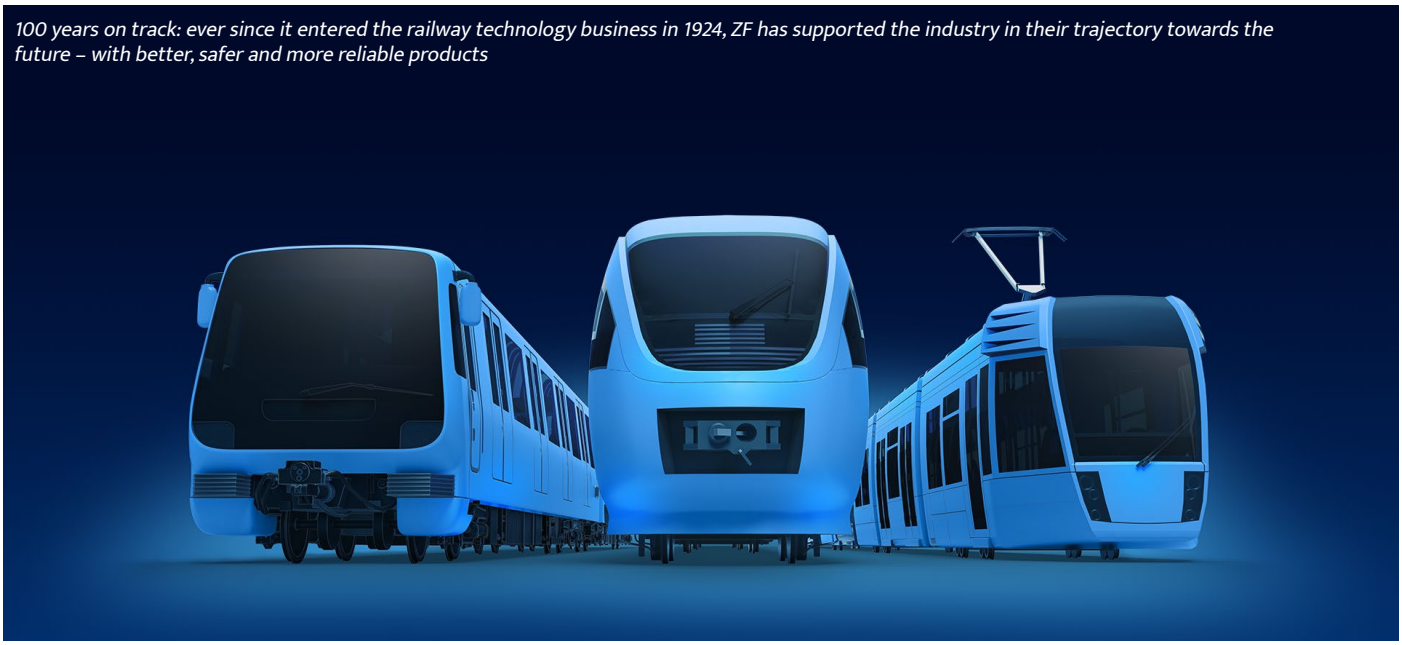
ZF Friedrichshafen AG

Over a Century on Track: Railway Technology by ZF



100 years on track: ever since it entered the railway technology business in 1924, ZF has supported the industry in their trajectory towards the future – with better, safer and more reliable products

Since the adaptation of the TS18.5 Soden transmission for railcars in 1924, ZF has been driving innovation in railway technology.

What began as a pioneering step in Friedrichshafen, Germany, has evolved into a global success story. Over the decades, ZF has grown into one of the world's leading technology groups, becoming also a preferred partner for rail vehicle manufacturers and transport associations worldwide. Today, ZF's rail solutions are synonymous with proven reliability, efficiency and forward-thinking engineering.

At the heart of ZF's success lies its core strength: technology transfer. From its earliest days, ZF has leveraged innovations across its vast and diverse portfolio – automotive, agriculture, construction and even wind energy – to enrich its rail offerings. This cross-sector synergy allows ZF to deliver solutions tailored to the unique demands of rail transport. Rail companies benefit from this approach through access to proven technologies produced at scale, even for niche applications.

Impressive Innovations, Extensive Portfolio

Over the course of the decades, ZF has bolstered its portfolio by strategic acquisitions. As a result, the rail technology segment of the ZF Group has grown into an overall supplier of driveline, chassis and safety technology for a wide range of rail vehicles. Whether you are looking at metros, trams, electric multiple units, high-speed trains, diesel multiple units, locomotives or special vehicles – chances are, if it's running on tracks, it does so with the help of ZF components.

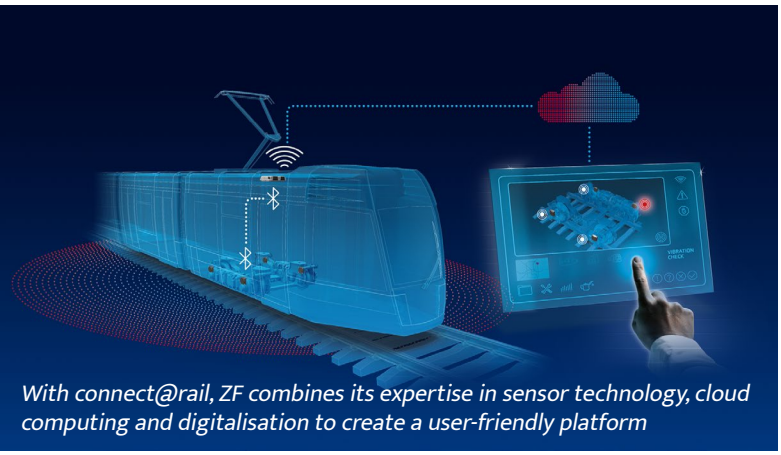
From trams and metros in major cities across the world to high-speed trains that connect Britain to mainland Europe – it does so with the help of ZF technology

Digital Intelligence on Track: connect@rail

In an era where rail transport must be smarter, safer and more sustainable, ZF's connect@rail platform sets new standards in digital condition monitoring. Originally launched in 2018, connect@rail has evolved into a modular, scalable system that enables predictive maintenance for both rail vehicles and infrastructure. At its core, connect@rail combines ZF's expertise in sensor technology, telematics, cloud computing and data analytics. The system uses robust wireless sensors – known as Heavy Duty TAGs – to monitor vibrations and accelerations at the wheel-rail interface. These sensors detect anomalies that may indicate damage to wheels or tracks, and transmit the data via VCU Pro Onboard Units, ZF's powerful telematics gateways adapted from commercial vehicle applications.

Once in the cloud, the data is analysed using tailored algorithms. For wheel monitoring, connect@rail uses damage-specific crawlers to identify typical fault signatures such as flat spots or cracks. For track monitoring, ZF employs AI-based pattern recognition that continuously learns from historical data and feedback, improving its accuracy over time.

With connect@rail, ZF combines its expertise in sensor technology, cloud computing and digitalisation to create a user-friendly platform that enables condition-based maintenance planning for vehicles and rail networks



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From Data to Decisions: Tangible Benefits for Operators

The result? A system that not only detects faults early but also helps operators plan maintenance more efficiently, reduce downtime, and extend asset lifecycles. The connect@rail dashboard serves as a central hub, visualising all relevant data in a user-friendly interface. Operators can manage alerts, track maintenance history and even integrate third-party monitoring solutions – all within one platform.

Thanks to its modularity and OTA (over-the-air) update capability, connect@rail is future-ready. It can be retrofitted to existing fleets with minimal effort and is compatible with all common vehicle types – from trams to highspeed trains. Even underground systems like subways are being considered, with pilot projects underway to overcome GPS-related challenges.

With connect@rail, ZF empowers rail operators to move from reactive to proactive maintenance strategies. It's a key enabler for the digital transformation of rail transport – and a testament to ZF's commitment to innovation, reliability and sustainability.

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Your next connection: connect@rail

The intelligent condition monitoring system connect@rail demonstrates how integrated sensors and advanced data analysis tools can further improve efficiency, reliability and safety in rail transport.

For more information please visit
www.zf.com/connect-at-rail