



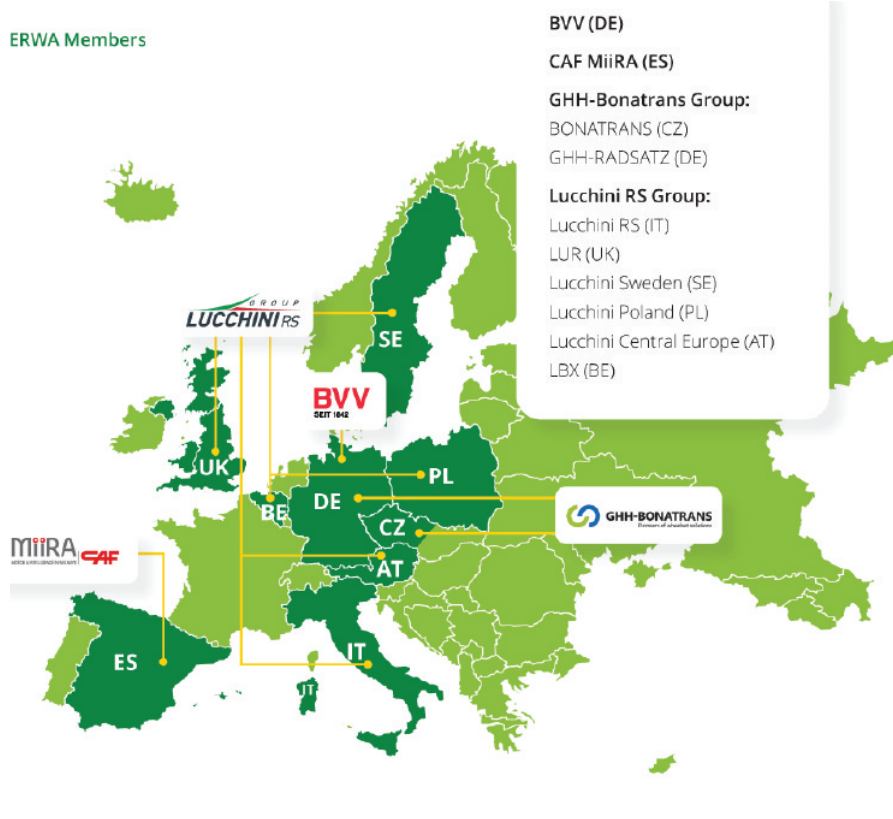
Leading the wheelset industry: from tradition to innovation

Riccardo Pasinetti and *Steven Cervello* explain how members of the European Railway Wheels Association (ERWA) have advanced railway wheels, wheelsets, and axles and how continued improvement is important for further developments.

FIGURE 1

MAP OF ERWA MEMBERS.

ERWA Members



*As an industry leader,
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and wheelsets.*

RAILWAY WHEELSETS, wheels, and axles play a critical role in the safe and efficient operation of trains. In recent years, there have been significant developments in the usage benefits, lifecycle cost reduction, and standardisation of such components and assembled systems. In this context the European Railway Wheels Association (ERWA), is active to contribute to the development and advancement of the products manufactured and served globally by its members companies, composed of four industrial groups BVV¹, CAF MiiRA², GHH-BONATRANS Group³ and Lucchini RS Group⁴ (see Figure 1).

[@GlobalRailway](#)

Research and development

As an industry leader, ERWA is always focused on facts to intercept the needs of the market and drive innovation in the field of railway wheels and wheelsets. One of the main ways ERWA manufacturers achieve this is through their focus on research and development. The association works closely with its member companies and other industry stakeholders to identify the key challenges facing the railway industry. This includes the development of new materials and manufacturing techniques, as well as the testing and validation of new designs. One major development in the last 10 years has been the use of improved materials in the manufacturing of railway wheels and axles. For example, the use of high-strength steel and lightweight alloys has led to a reduction in wear and in the weight of wheelsets, resulting in lower lifecycle costs and lower energy consumption. One outstanding case is the development of special steel grades to solve practical issues that rail operators were facing in their daily maintenance works, such as wheel tread damages due to rolling contact fatigue phenomena that in many service conditions were drastically limiting wheel service life. A successful example is the steel grade classified as ERS8, which was introduced in the latest revision of the EN13262:2020 standard after



RICCARDO PASINETTI

Riccardo has been part of the European Railway Wheels Association (ERWA) on behalf of Lucchini RS since 2004. He initially began in the Technical Committee, then moved into the ERWA Development Committee in correspondence of his responsibility as Commercial Director of the Railway Division for Lucchini RS corporate.

FIGURE 2

IMAGES TO REPRESENT THE PROTECTION OF AXLES AND THE WAYS TO PROLONG LIFESPANS AND RELIABILITY: THE IMAGE ON THE LEFT IS FOR AXLE SEATS BY MOLYBDENUM COATING, AND THE IMAGE ON THE RIGHT IS FOR AXLE BODY BY CLASS 1 HIGH-THICKNESS COATING.



STEVEN CERVELLO

Steven is Innovation and Design Manager at Lucchini RS. He graduated in Aeronautic Engineering at the Politecnico di Milano University, and in 2000 he was Head of the Research and Testing Department for Railway Wheelsets where he gained a specific knowledge in the railway noise and vibration phenomena, setting up a specific laboratory for the characterisation and development of low noise solutions for wheels; then extended his interest to other fields of mechanical-structural testing such as fatigue, crack propagation, railway dynamics. He is a past Chairman of the ERWA Technical Committee and has been working for several European funded R&D projects such as Hyperwheel, Widem, Silence, Euraxles, Rivas, Sustrail related to improvement and innovation of railway products. He is a member of CEN/TC256 WG11, the working group of experts for wheelsets standards.

long-term positive feedback collected from the from various European operators. This evolution also shows how proactive the ERWA association is in the CEN Standardisation working group (WG11) in contributing to the modernisation of European Standards that today finally open the possibility to more easily introduce new technical solutions not yet standardised to the market but compliant with defined safety requirements, providing chances to further develop service and durability performances.

Another relevant case is represented by the development of resilient tyred wheels for tramway applications, specifically developed with wheel centres made of forged aluminium alloy instead of steel with a clear scope of reducing vehicle loads and energy consumption.

Also, the introduction of advanced manufacturing techniques in the area of hot works, Non Destructive Testing precision machining, and surface treatments has allowed the production of wheelsets with improved accuracy higher performance and reliability which made ERWA manufacturers lead the market for wheelsets for high-speed and very high-speed applications.

Another area of focus has been the participation in UNIFE to ERA (the European Union Agency for Railways) working groups developing and revising the Technical Specification for Interoperability (TSI) for what concerns the interfaces and technical requirements that need to be certified in order be used in a unified European railway network.

This was a vivid example about how ERWA members actively engaged with regulatory bodies, such as ERA, to ensure that rules were in line

with industry needs and were conducive to the development and advancement of the products. In terms of regulations, the European Union has also implemented regulations on the maximum permitted noise level for trains rolling, which has led ERWA manufacturers to the development of noise damping systems for wheels and wheelsets.

Combined experience and knowledge

Our members have also combined their extended experience and knowledge on axle coating solutions with the final aim of increasing the performance of standard axle protections. The clear objective of this was to improve the quality, reliability, and overall cost efficiency of railway wheelsets. To achieve this, ERWA has developed a guideline that proposes qualification tests to be performed in order to enhance the performance of the coating solutions. The guideline refers specifically to coating to protect railway axles manufactured and qualified according to the EN13261 standard. The tests outlined in the guideline are designed to evaluate the performance (durability) of the coating solutions under different conditions and environments that have an effect on the aging process, such as exposure to moisture, salt, and temperature cycles. The guideline also includes recommendations on the types of coating solutions that are best suited for different types of applications, as well as information on the proper application and maintenance⁵.

The guideline developed by ERWA is an important tool for manufacturers and railway operators looking to improve the quality, reliability, and cost-efficiency of their wheels and axles.

By following the tests and recommendations outlined in the guideline, manufacturers and operators can be confident that the coating solutions they use will provide the necessary level of protection for their axles and help improve the reliability in service of their railway wheelsets. In other words, ERWA's guideline on axle coating solutions represents the combined experience and knowledge of our members in the railway wheel industry.

Projects

ERWA members are also actively involved in some ongoing UIC projects such as:

- Axle Surface Treatment to Improve Mechanical Properties (ASTIMP) which aims to define technical specifications for various available surface treatments that can improve the fatigue resistance or the corrosion protection of wheelsets components
- Brake Block Wheel Interaction, which is studying the thermomechanical behaviour of wheels with different brake block types in order to update the design and experimental validation procedure
- Wheels With holes in the Web (WWW) which is defining a more accurate method for modelling wheels with brake discs mounted on the web.

Continued developments

Performance and reliability

Looking to the future, research and development efforts will continue to focus on improving the performance and reliability of railway wheels and wheelsets. This will include the development of new materials and manufacturing techniques, as well as the testing and validation of new designs.

Regulations

Additionally, there will be a continued focus on standardisation and the development of regulations to ensure the safe and efficient operation of trains.

Digitalisation

One important aspect of this is the digital development of our products and related services. This allows us to provide efficient and accurate tracking to our customers, such as real-time monitoring and diagnostics, condition-based maintenance (CBM), as well as improved inventory management and forecasting.

Sustainability

Another key aspect of our philosophy is environmental sustainability. We understand that reducing the carbon footprint of our products is becoming increasingly important to decarbonise the transport sector, the second largest emitter »

FIGURE 3

AN EXAMPLE OF METRO-APPLICATION NOISE ABSORBER, SO REDUCTION OF ROLLING AND SQUEALING NOISE FROM THE WHEEL-RAIL CONTACT IN URBAN TRANSPORTATION.

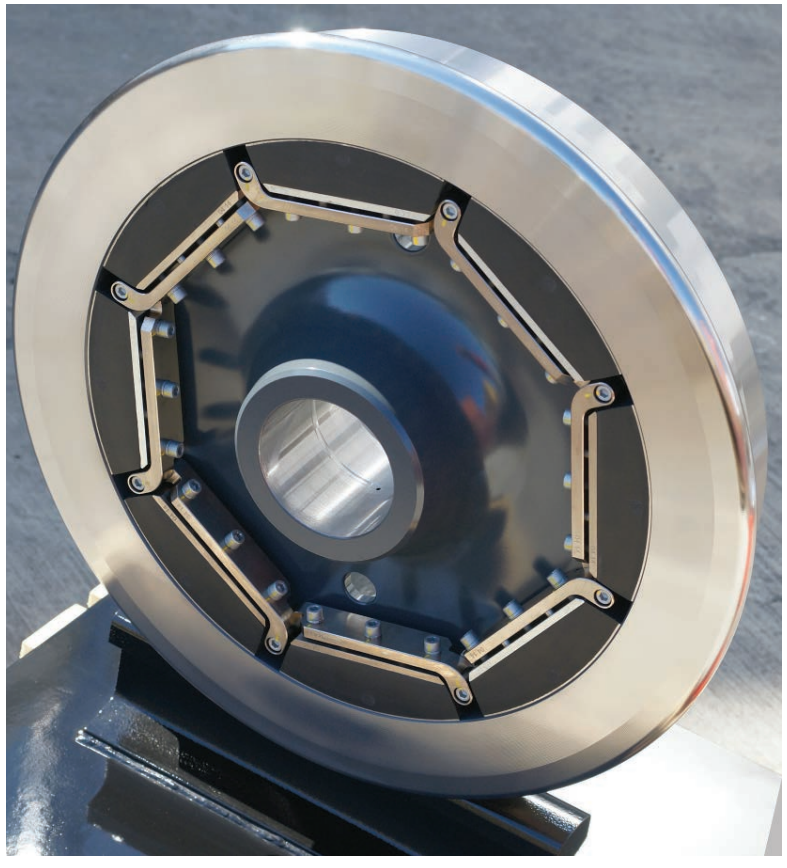
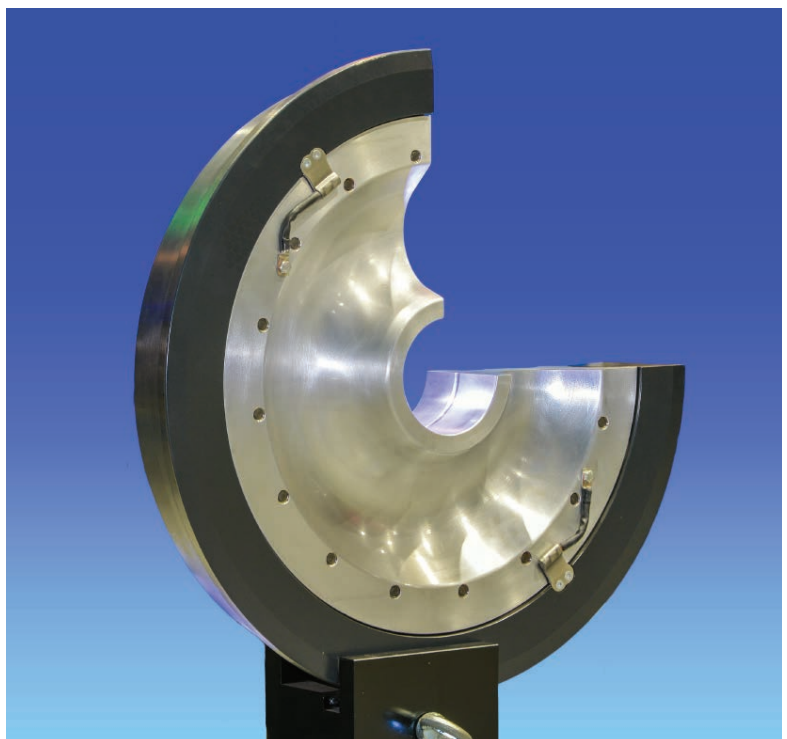


FIGURE 4

RESILIENT WHEEL FOR TRAMS WITH ALUMINUM CENTRE.



REFERENCES

1. www.bochumer-verein.de/en/bvv-hochgeschwindigkeitsrad
2. www.cafmiira.com
3. www.ghh-bonatrans.com
4. www.lucchinirs.com
5. www.unife.org/committee/erwa
6. www.iwc2023.com

after energy sector. We are actively working to measure and reduce the carbon footprint of our products, from steel manufacturing to machining operations. This can also be part of a dedicated certification.

The International Wheelset Congress (IWC)

ERWA, together with UNIFE, also organises international events such as the International Wheelset Congress (IWC) to share information and discuss new developments in the railway wheel industry. The first edition of the congress was organised in Italy back in 1963 and, since then, it has travelled across the world with successful

editions. Following the last remarkable edition held in Venice, the congress is back in the United States of America for the 20236 edition in Chicago; the last edition in North America was held in Orlando in 2004.

In conclusion

The ongoing developments in the usage benefits, lifecycle cost reduction, and standardisation of railway wheels and wheelsets are helping to improve the performance and reliability of trains and support the growth of the railway industry. The future holds more research and development, standardisation, and regulations to ensure the safe and efficient operation of trains. As ERWA, we are active in all aspects of the development of the products and correlated services. Our member manufacturers are committed to providing the highest level of service to the train manufacturers and to the final users, the train operators. 

EXPERT VIEW

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GROUP
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TO WHAT EXTENT DO YOU AGREE THAT **MONITORING** AND **MAINTENANCE** OF BOGIES AND WHEELSETS REMAINS A COMPLICATED ACTIVITY FOR OPERATORS, AND HOW CAN **INSPECTION** AND **TESTING** PROCESSES BE MORE **STREAMLINED**?

Bogies and wheelsets are safety critical components of trains, and this means that the monitoring and maintenance of such parts can be a complex activity for railway operators due to the need to ensure the safe and reliable operation of a fleet. However, there are various methods and technologies that can be used to streamline the inspection and testing processes.

The current approach is the use of automated systems for monitoring and diagnostics, such as ultrasonic testing, eddy current testing and automated vision magnetic particle inspection, which can detect defects and damages in wheelsets and bogies without the need for manual inspections. This approach can be improved by using condition-based maintenance strategies, which rely on real-time monitoring of equipment performance and condition, and can help to

optimise maintenance schedules, reduce the need for unnecessary inspections and ultimately increase the availability of trains for the service.

The more recent approach is to use machine learning and predictive analytics to analyse data from monitoring systems and identify patterns and trends that indicate potential issues. This can help to identify potential problems before they occur and schedule maintenance more efficiently.

Overall, there are many ways to improve the efficiency of inspection and testing processes, but it is important to consider the specific needs and constraints of each railway operator, as well as the conditions of tracks where trains are running. 

For further information, visit: lucchinirs.com