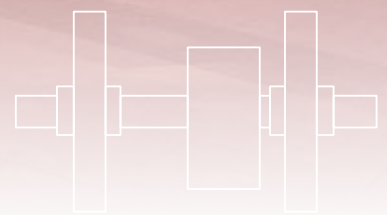


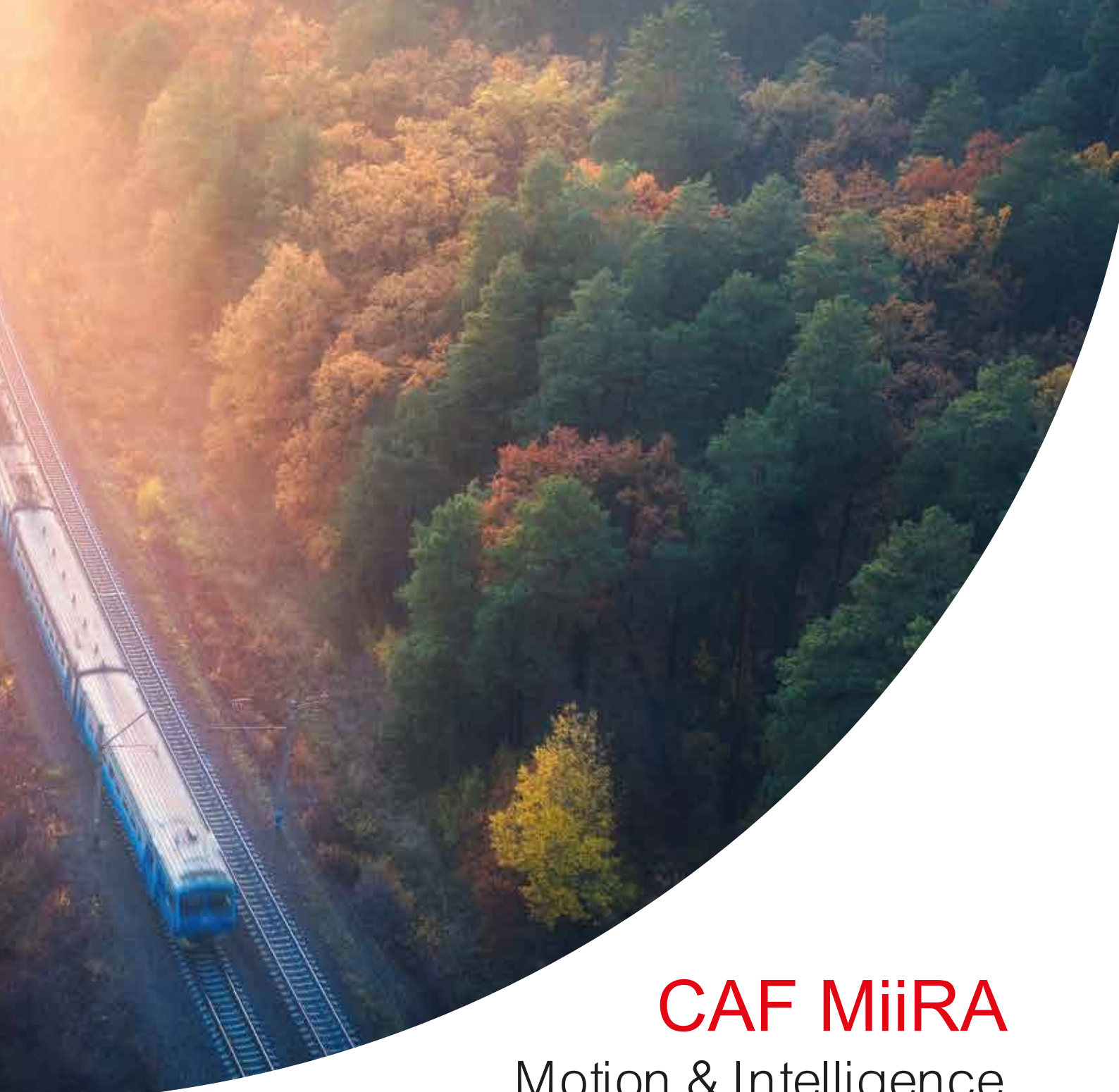
Trams & LRV





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CAF MiIRA

Motion & Intelligence in Railways

Almost a century of experience and state-of-the-art technology have made us world leaders in manufacturing railway wheels, axles, gearboxes, resilient wheels and complete wheelsets.



32/10t





Multinational group with over 100 years of experience in the supply of comprehensive transit solutions positioned at the forefront of technology for high value added sustainable mobility.



Over 70 subsidiaries



Portfolio Solutions



ENGINEERING

Products' & materials' design

Modernizations

ECO Design

SUPPLY

Products | Wheels
Axles
Wheelsets
Resilient wheels
Gearboxes

Green Steel
Green e-Energy

Value added elements | Protection systems
Noise reduction solutions

Integration on supply chain

ECOconsumption

SERVICE

ECOmitted

Technological assessment | Maintenance plans' optimization
Failure analysis
Service inspections

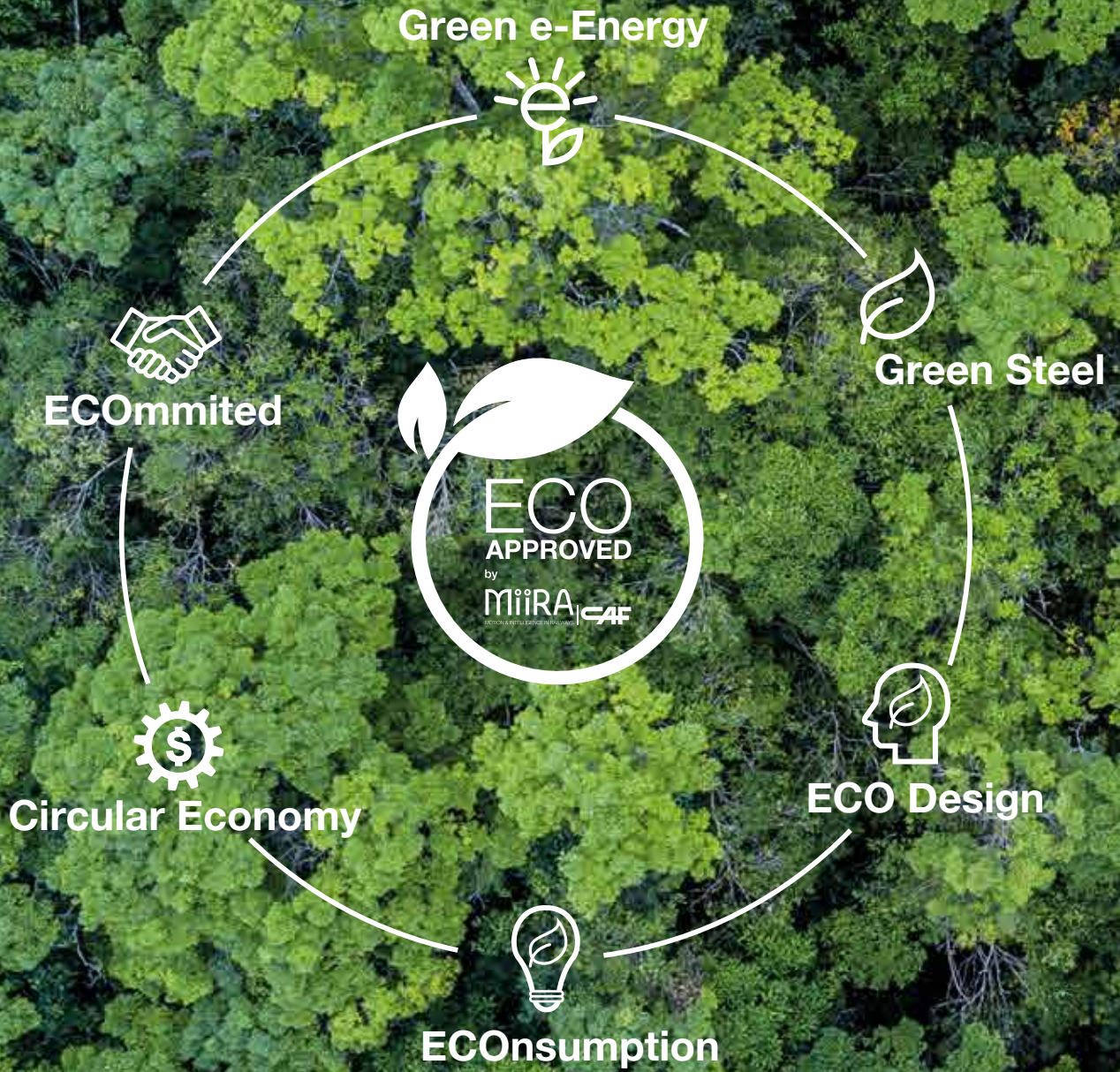
Integral maintenance management

Life cycle optimization

Circular ECOconomy

Green future

Time for action



Green e-Energy

100% renewable certified e-Energy, produced by wind turbines.

Sustainable. Infinite.

Green Steel

Green Steel wheels and axles.

Our steel is below European Standards in terms of generated GHG intensity and below industry average.

Responsible. Green.

ECO design

More efficient designs that are lighter, require less maintenance and offer longer lifetimes.

Complete wheelset and gearbox designs that eliminate compatibility related problems, maximizing the reduction of total weight.

Efficient. Lightweight.

ECOconsumption

Lightweight designs that require less material and generate less waste.

Production and supply of complete wheelsets generate less carbon footprint: we avoid unnecessary operations and transports.

Integral. Clean.

Circular ECOconomy

100% of the scrap generated by our products is used to produce the steel we use. No additional external resources needed.

Reusable packaging system.

Recyclable.

ECOmmitted

Part of SBTI ((Science based targets initiative) and Race to Zero, European initiatives against climate change aligned with the Paris Agreement.

Focus on continuous improvement to reduce carbon footprint throughout the entire life cycle of our products.

Endless improvement.

Certificates

Railways and Standard homologations

- ### CAF MiiRA Certifications
- ISO 14001
 - ISO 9001
 - OSHAS 18001
 - ISO-IEC-17025 certified metallurgical Laboratory
 - ISO / IEC 27001

- ### Railways Certifications
- IRIS
 - AAR
 - RISAS
 - GOST
 - VPI
 - RENFE (Spain)
 - SNCF (France)
 - DB (Germany)
 - OBB (Austria)
 - TRENITALIA (Italy)
 - SNCB (Belgium)
 - SBB (Switzerland)
 - CR (PRC)
 - NS (Netherlands)
 - Korail (South Korea)
 - MTR (Hong Kong)
 - MTA (USA)



Resilient Wheels

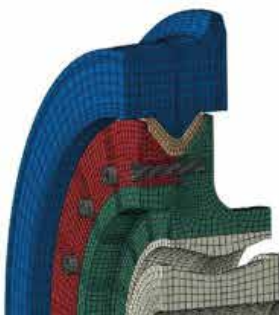
As part of a train manufacturer, CAF MiiRA has a very strong position in the sector, with technological advantages, accreditations and approvals that exceed the capabilities and benefits of competing products. We have supplied more than 17.000 resilient wheels to the market.

Thanks to solutions with the state-of-the-art technological features and strong experience in such highly demanding sector, CAF MiiRA stands out among its competitors.

Our resilient wheel solution is designed to meet the most demanding specifications and is easily adaptable to all tram and LRV solutions in the market.

The design has been developed based on our know-how and features the following characteristics.

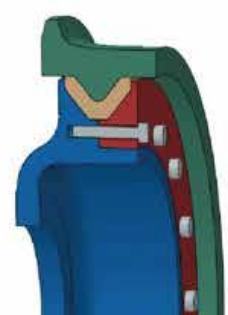
- ◉ **Wheel design adaptable to any interface and diameter required.**
- ◉ **V-shaped rubber blocks.**
- ◉ **Easy tire replacement.**
- ◉ **High axial stiffness.**



Tram Wheel
Birmingham



LRV/Metro Wheel
Honolulu



LRV/Special Interface
Cagliari



Noise absorbing system:

Our resilient wheel solutions can include an interface that will allow assembling damping plates on it. These damping plates are noise absorption systems that are mounted on the resilient wheels to mitigate, especially, the squeal noise (axial modes).

They are composed by metallic and rubber layers and designed by FEM calculations to damp the critical wheel modes. According to field test performed with these type of systems, 25 dB reduction values has been reached at the frequency of interest (around 800 Hz), eliminating at all the squeal noise. The reductions obtained on the rolling noise (radial modes) are in a lower level.



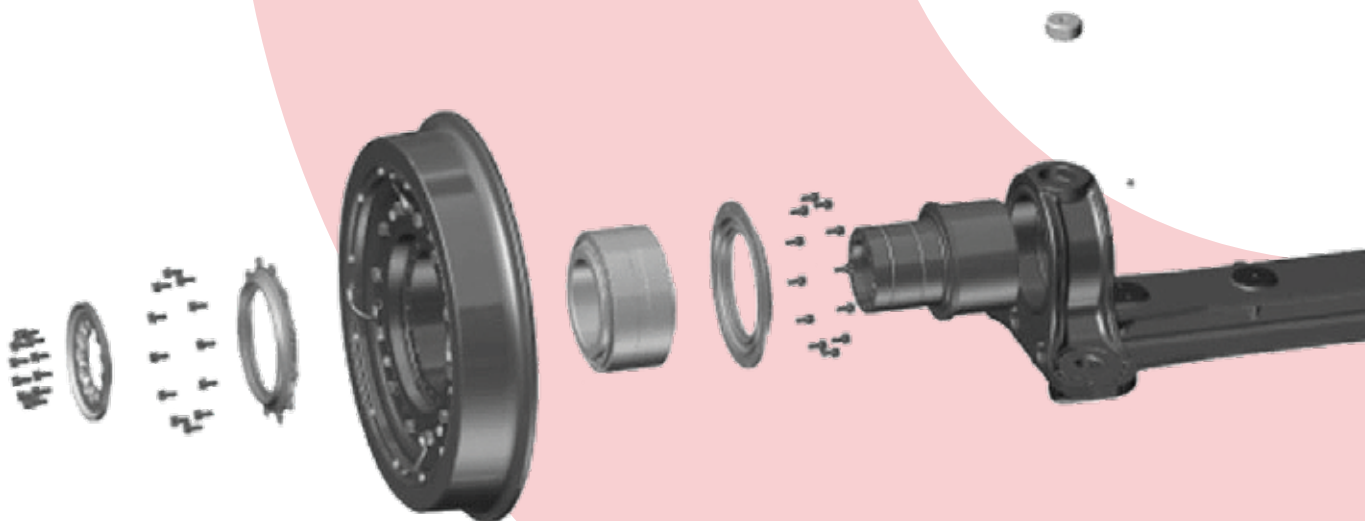
After sales solution

Spare parts supply

CAF MiiRA has a long experience in service with more than 7000 portal axles in service since 2011.

We provide complete kit solution for tyre change with all the necessary parts, as well as all the necessary know-how to our clients.

Our kits assure a good performance just same as the original resilient wheel as the exactly the same patented solution is applied in both cases.

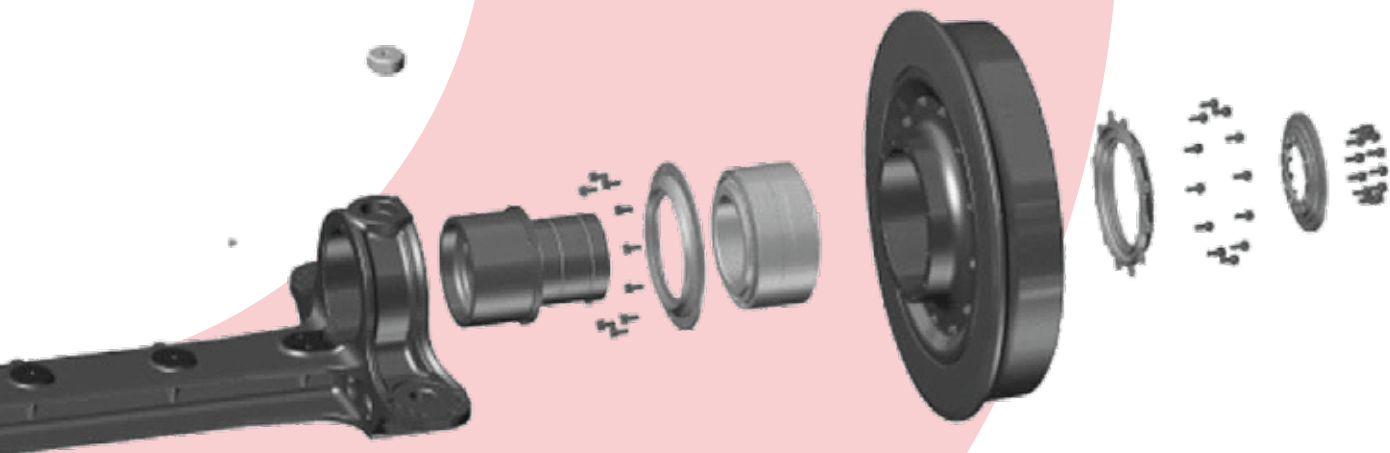


Our experience has allowed us to design an automatic tyre replacement tool to optimize the timing and necessary equipments for tyre changing.

Benefits of CAF MiIRA's automatic replacement tool for our clients:

- **Reduce replacement time**
- **Assembly reliability: position and fit ensured**
- **Increase safety during the replacement process**

We can provide both in-bogie tooling solutions and out-of-bogie tooling solutions.



Complete Portal Axle and Wheelset solutions

The CAF Group is a leader in the tram and LRV segments, which has allowed CAF MiiRA to accumulate extensive experience in this field, having developed its own solutions for all types of trams and LRV's.

CAF MiiRA designs, manufactures and maintains state-of-the-art portal axles and wheelsets 100% tested by CAF that meet the most demanding specifications.

Our trams solutions are easily adaptable to all tram and LRV solutions in the market. MiiRA stands out among its competitors thanks to its experience in such demanding application that require large investments and new technological developments. A look at the future with smart advanced solutions that develop more sustainable environments.

Being part of CAF Group is an advantage due to the access we have to the knowledge and return on experience of all Group companies that design and manufacture different train components such as traction, communication, simulation, etc. We can get the required support from them to improve our own solutions.

Our complete portal axle and wheelset solutions including gearboxes can be adapted to different gauges and they can include grounding, braking equipment and speed sensors.

Benefits of our solutions:

- Portal axle with reduced weight (100kg less than a forged one).
- Leaders in low floor trams solutions. Our Gearbox solutions solve the various challenges of this type of vehicle where space is very limited. They are designed to ensure optimal maintenance intervals, which have been tested in the group's own vehicles.
- Integral design, supply and maintenance of the portal axle and the gearbox, which allows us to reduce the final total cost to our customers by:
 - Reducing lead times and increasing the efficiency on planning and logistics to our customers.
 - Reducing total weight of the complete solution in a higher amount than doing it separately to each component.
 - Reducing carbon footprint generated in the complete portal axle or wheelsets.
 - Reducing risks with the responsibility in one source.



Complete portal Axle & Wheelset engineering

Complete portal axle and wheelset engineering

- CAF MiiRA has its own engineering department dedicated to developing tram and LRV solutions to comply with specific needs and requirements of each customer. In addition to the latest development and simulation programs, CAF MiiRA has its own design tools, providing the most complete service
- A highly qualified team works focused on improving and optimizing not only the projects but also the design and calculation methods used for them.

Customer supply chain integration

"Lean Manufacturing" strategy allows us to continually optimize eliminating waste with our skilled people and leveraging in our state-of-the-art facilities. Thus, we offer a high-value, competitive service with reduced lead times.

We respond to requests with the desired amounts and conditions, in the right place at the right time:

- Adaptation according to demand
- Minimum stock at the customer
- Small delivery batches
- Minimum lead time
- Fewer emergencies, with immediate attention and resolution
- Integration into the management system for customer traceability



Technological Assessment

CAF MiiRA is a world reference in the supply of critical and integrated solutions highlighted by a highly experienced engineering team and the provision of technology support adapted to each project.

- Analysis of requirements and identification of customized solutions.
- Assistance in the definition and/or improvement of existing designs.
- Definition of specific material and processes for each specific application.
- Engineering services for the analysis and improvement of the performance of the material in service.
- Definition of maintenance operations, including the development of NDT and inspection procedures.

Off the shelf solutions

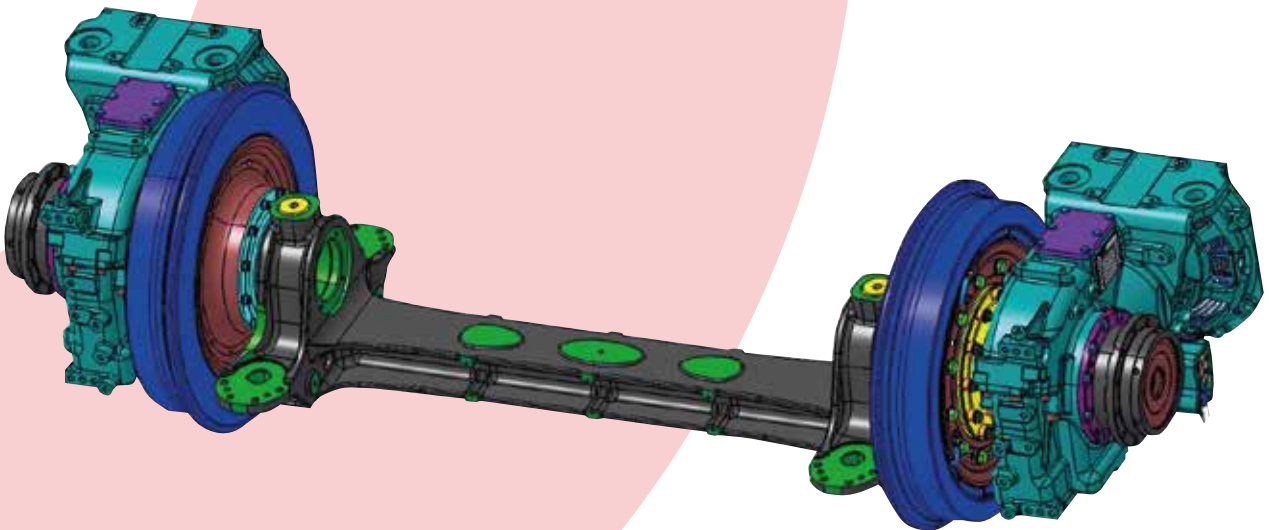
URBOS 100 Platform

Product main characteristics

- 100% low floor platform
- Independent wheel traction
- Fully suspended 1 stage drive
- Modular wheelset:
 - Metric & International gauge, including grounding, braking equipment and speed sensors

Main technical data

- 80km/h design speed
- Wheel \varnothing = 630/510mm
- Up to 14,4Tn/axle load
- 650Nm tractive torque, $i=5,44$
- Service proven design



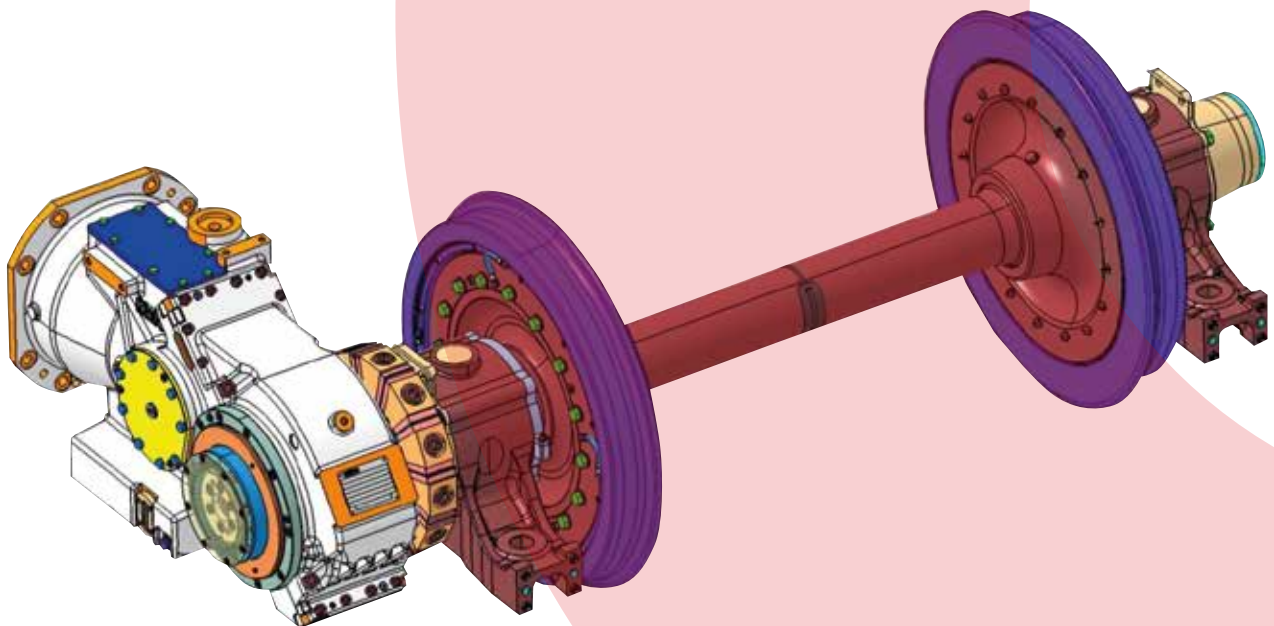
URBOS 100X Platform

Product main characteristics

- 100% low floor platform
- Traction per wheelset
- Fully suspended 2 stage drive
- Modular wheelset:
 - Metric & International gauge
 - Different gear ratios to optimize traction equipment efficiency

Main technical data

- 90km/h design speed
- Wheel \varnothing = 640/510mm
- Up to 12,5Tn/axle load
- 1185Nm tractive torque, $i = 6,25$



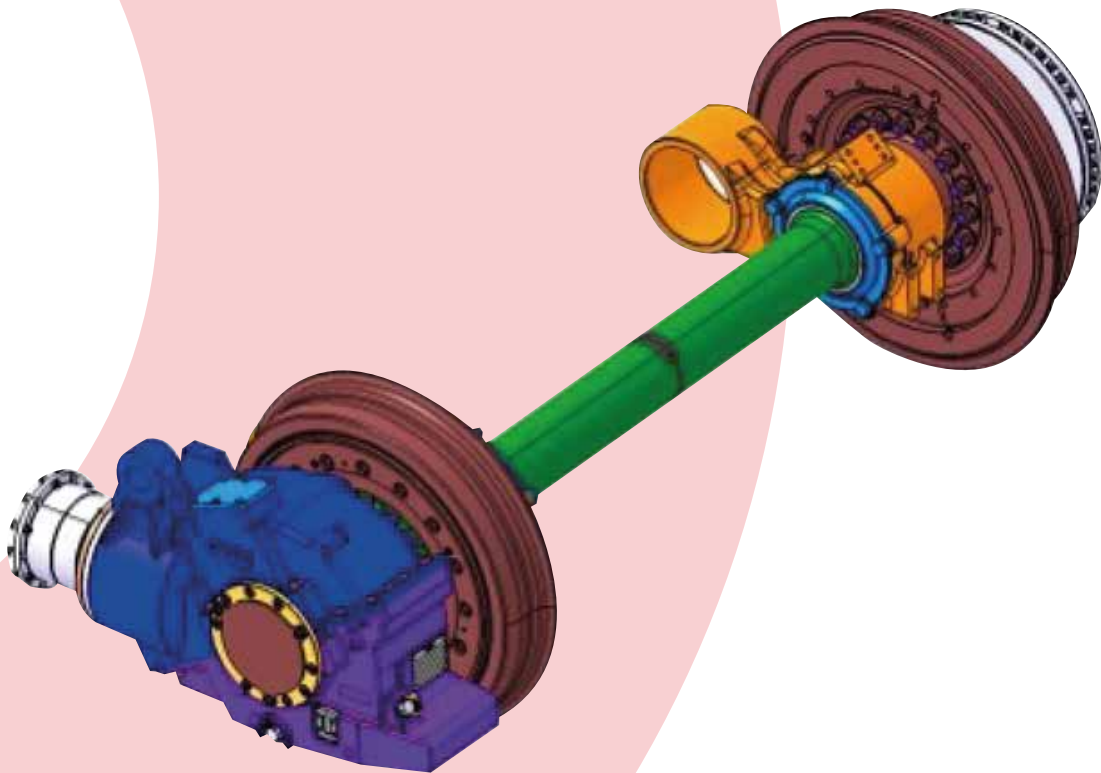
URBOS AXL

Product main characteristics

- 70% low floor platform
- Traction per wheelset
- Non suspended 1 stage drive
- Direct power transmission:
 - Gearbox→wheel
- Inboard bearing

Main technical data

- 110km/h design speed
- Wheel \varnothing = 680/550mm
- Up to 10Tn/axle load
- 789Nm tractive torque, $i= 5,44$

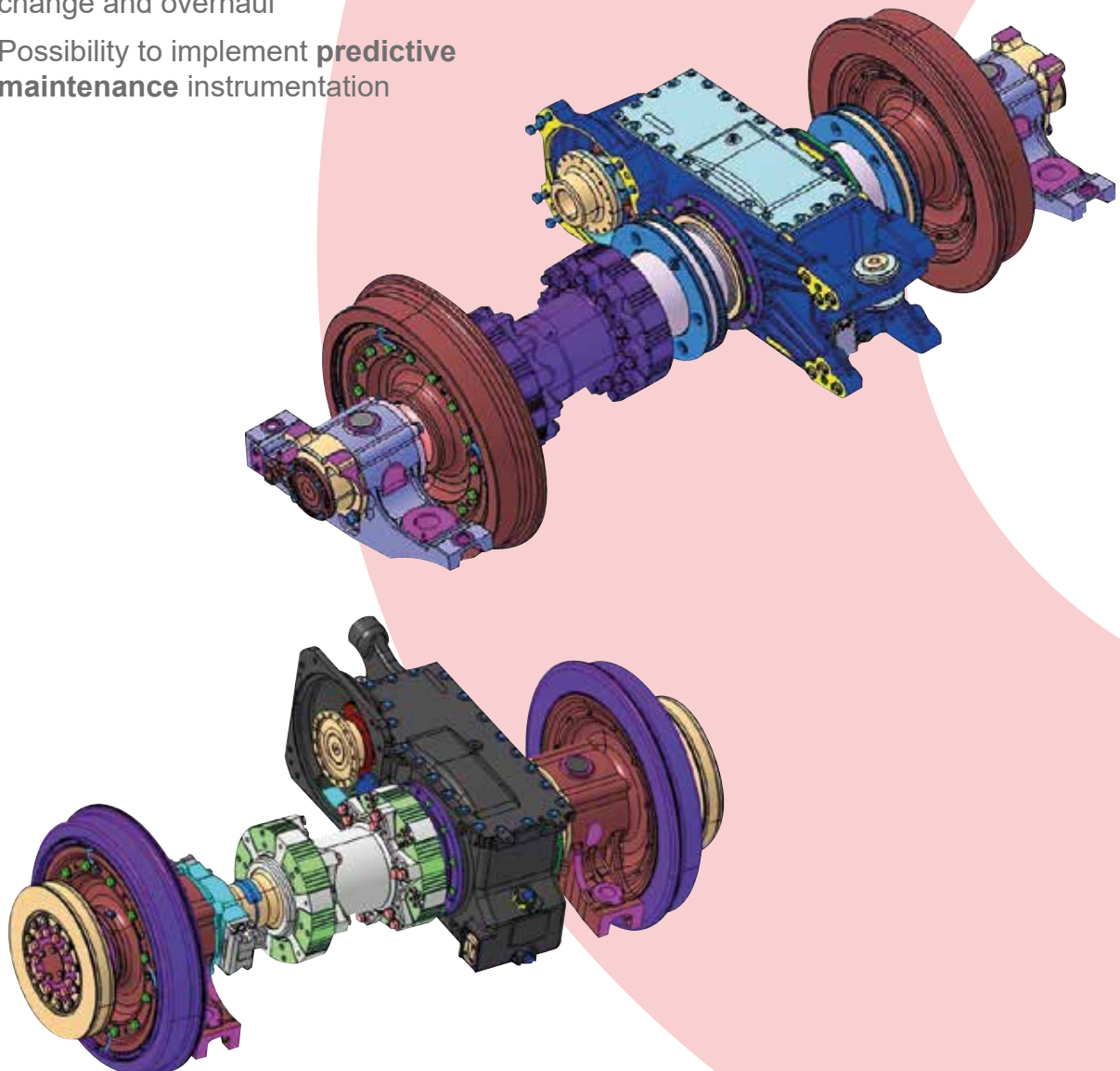


Light Rail Vehicles

Light Rail Vehicles

Product main characteristics

- 70% low floor solution
- Traction per wheelset
- Very common in USA
- **High level of standardization** using proven designs increasing the reliability
- Modular designs for **cost reduction** and **short delivery times**
- **Long maintenance intervals** for oil change and overhaul
- Possibility to implement **predictive maintenance** instrumentation



References

Satisfied clients

Europe

- Vitoria
- Seville
- Bilbao
- Zaragoza
- Saint Etienne
- Amsterdam
- Utrecht
- Luxemburgh
- Freiburg
- Tallin
- Budapest
- Debrecen
- Cagliari
- Lund
- Oslo
- Lieja
- Delijn
- Brussels
- Brimingham
- Edinburgh
- London

Africa

- Mauritius

USA

- Houston
- Cincinnati
- Kansas
- San Francisco
- Honolulu
- Boston
- Maryland
- Seattle (Brookville)

Canada

- Edmonton

Asia Pacific

- Beijing Metro
- Kaohsiung
- Manila
- Sidney
- Canberra
- Newcastle
- Parramata (Australia)

Middle East

- Eskisehir
- Jerusalem

LATAM

- Cuiaba

◦ LRV



Maryland
USA



Cincinnati
USA



Boston
USA



◦ Trams



SKODA

Eskisehir

Supply of CAF MiiRA's resilient wheels



CAF

Freiburg

Supply of complete motor wheelsets with CAF MiiRA's resilient wheels and gearboxes



HITACHI

Honolulu

Supply of CAF MiiRA's resilient wheels



◦ Trams



CAF URBOS
100 Platform
Sydney

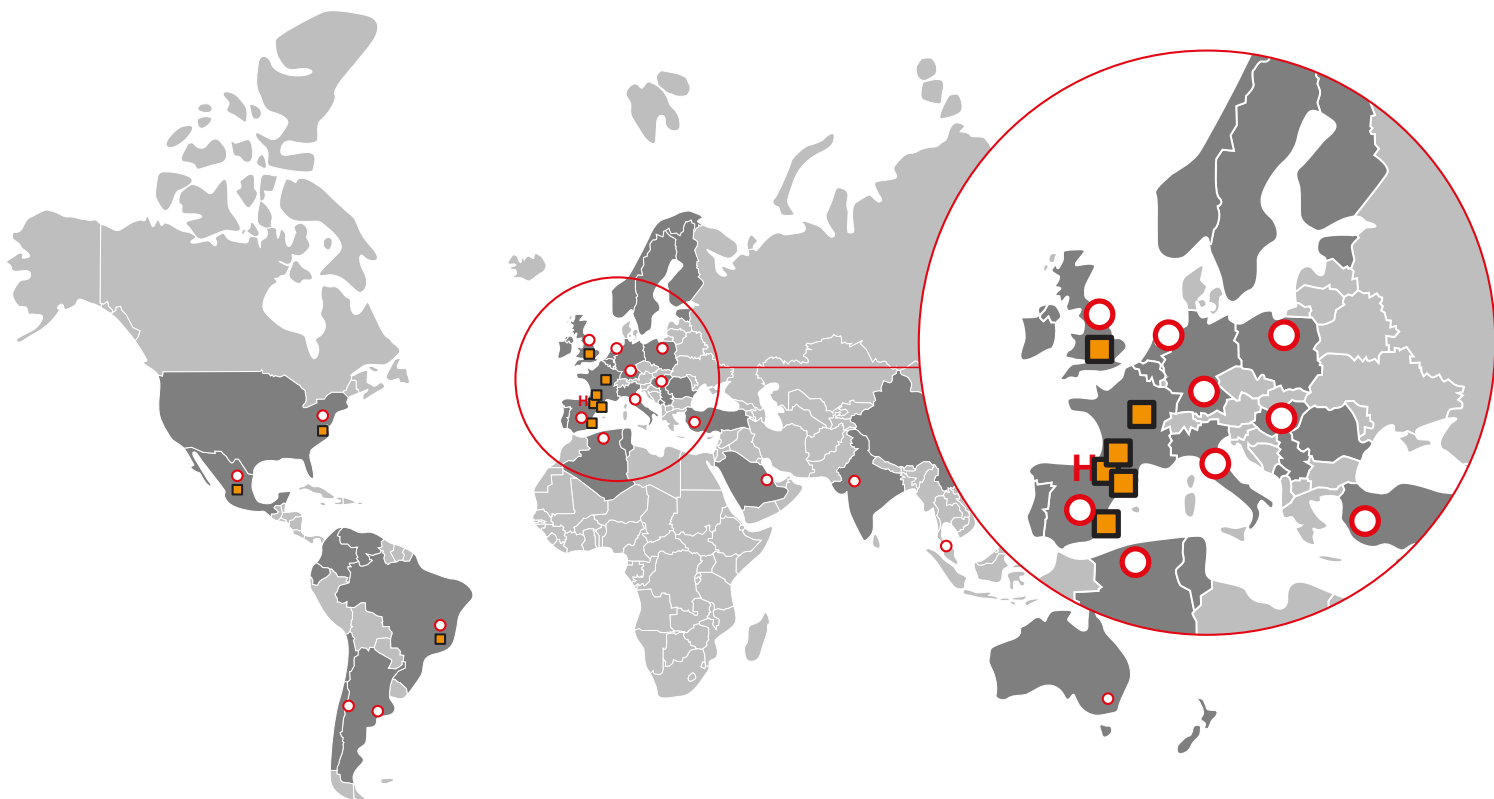


CAF URBOS
AXL
Stockholm



CAF URBOS
100X Platform
De Lijn





- H** | Headquarters
- | Production Plants
- | Offices
- | Countries with ongoing projects

Headquarters:

- SPAIN

Production Sites:

- SPAIN • FRANCE
- USA • BRAZIL
- MEXICO • UK

Subsidiaries:

- MADRID • PARIS • LONDON
- MUNICH • WASHINGTON D.C.
- NEW DELHI • MEXICO D.F.
- ROME • SYDNEY • WARSAW
- SAO PAULO • BUENOS AIRES
- ISTANBUL • ROTTERDAM
- DOHA • KUALA LUMPUR
- SANTIAGO DE CHILE
- BUDAPEST



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