



MAFEX

Mafex corporate magazine
Spanish Railway Association

Issue 31. July 2022



Circular economy and railway, a further step towards sustainable transport

RAILLIVE!

RAIL LIVE! 2022

Rail Live! 2022 will be held in person from 29th November - 1st December 2022 in Malaga.



MAFEX INFORMS

Mafex renews its Management Committee for the next four years, expands the number of partners and reports on an intense action plan for 2022



IN DEPTH

30 years of high-speed in Spain.



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SUSTAINABLE FINANCE AND INVESTMENTS AT THE HEART OF THE THIRD SECTORAL FORUM OF THE YEAR ORGANISED BY MAFEX

The meeting reveals that sustainability must be addressed as a key competitiveness factor for the future.

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The Spanish railway industry seeks to expand trade relations and to participate in new infrastructure investments

MAFEX RENEWS ITS MANAGEMENT COMMITTEE FOR THE NEXT FOUR YEARS, EXPANDS THE NUMBER OF PARTNERS AND REPORTS ON AN INTENSE ACTION PLAN FOR 2022

The event was attended by the 100 partners of the Association and institutions such as Adif or Renfe.

MAFEX ORGANISES IN BILBAO THE III TECHNICAL SEMINARS: "URBAN TRANSPORT SYSTEMS – CERCANÍAS, METROS AND TRAMS

Authorities and urban transport operators from countries such as Bangladesh, Bulgaria, Colombia, Ireland, or Turkey announce their present and future plans for railway investments and developments.

UC-MAFEX, THE GATEWAY TO THE RAILWAY WORLD

The Master in Railway Engineering is organised by the University of Cantabria and by Mafex.

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Circular Economy and railway, two great allies towards sustainable mobility



We talk about all of them in detail in the current issue of Mafex magazine, where we also review the 30 years of high speed in Spain, a milestone that marked a before and after in our country in terms of railway infrastructure and mobility. That first Madrid-Seville line, inaugurated on 21st April 1992, was the largest railway engineering work carried out in Spain until now and marked the beginning of a high-speed network that, currently, reaches 3,728 kilometres in length that place us at the head of high speed in Europe and in the second position worldwide, only behind China.

Beyond the revolution in passenger transport, high speed was another major milestone. This is because it placed Spain on the international scene and meant a transformation at a technological and industrial level. Undoubtedly, it was a great revulsive for the Spanish railway industry, which today is a world reference and has imported its know-how to countries around the world in terms of infrastructure, innovation and sustainability.

All these topics are analysed in issue 31 of the magazine Mafex, which also includes current news from more than 35 partners. We also offer a summary of what was our recently held General Assembly of partners, where a renewal of its Management Committee for the next four years took place, the number of members was expanded, and it informed of an intense action plan for 2022. Among these action plans it is worth noting the Spanish grouped coordination of more than 60 companies at the InnoTrans fair and the new edition of 2022 of Rail Live! It is the reference event of the sector in Spain and with a marked international character that we co-organise in Malaga from 29th November 29 to 1st December.

Sustainability travels on rails, with a promising future for a mobility model where there is full confidence in the railway.

The railway is a key element in the race towards more environmentally friendly mobility, one of the main challenges facing the transport sector. Beyond the initiatives carried out by institutions and official bodies to achieve emission-free transport, other concepts come into play such as the Circular Economy, one of the pillars of the economic and environmental policy of the European Union and which is committed to a more sustainable production and consumption model.

In Spain, the Ministry for the Ecological Transition, and the Demographic Challenge (MITECO) launched in June 2020 the Spanish Circular Economy Strategy 'Spain 2030' (EEEC), which aims to promote a new model of production and consumption in which resources are kept in the economy for as long as possible.

And the railway also plays its part in this paradigm shift. Not in vain, the railway sector is present in different sections of the First Action Plan within the Spanish Circular Economy Strategy, thanks to the collaboration of the Railway Infrastructure Manager who contributed 6 different initiatives within the different axes that make up the strategy.

DIRECCIÓN:

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Mafex celebrates the second of the sectoral market forums dedicated to the potential of the French railway market

Pedro Fortea, the General Director of Mafex, the Association of the Spanish Railway Industry carried out during the morning 10th February the opening of the second of the sectoral Forums focused on international markets, and specifically, in France.

The day was structured in several blocks. In the first of them, Joan Gasol presented the study carried out on France and the opportunities it offers for Mafex partners. Next, Luis Fernández, Director of Sales and Business Development of Ground Transportation Systems at Thales France, presented Thales' vision of the French railway market. The following block counted on the participation of three Mafex partner companies. Specifically, Mikel Torrecilla, Area Export Manager of Geminis Lathes, Gustau Castellana, Commercial Director of La Farga


THE ASSOCIATION OF THE SPANISH RAILWAY INDUSTRY HAS CELEBRATED THE FIRST OF THE FORUMS THAT WILL BE LAUNCHED THIS YEAR WITH THE AIM OF SERVING AS A KEY MECHANISM OF SECTORAL DYNAMISATION, AND THAT ARE EMERGING AS A MEETING PLACE BETWEEN THE ORGANISATIONS THAT MAKE UP THE VALUE CHAIN OF THE RAILWAY SECTOR. ON THIS OCCASION IT HAS BEEN FOCUSED ON INTERNATIONAL MARKETS AND, IN PARTICULAR, IN AUSTRALIA.

YourCopperSolutions and Ricardo Corral, Commercial Director of Mieres Rail, have shared their experience in the country emphasising the importance of identifying and knowing well the objectives to be addressed to offer value-added products and services that are appropriate when positioning themselves as the best option.

The French railway network is the second largest in Europe, only behind the German, and it is a mature,

stable, high-volume market with a well-defined project calendar.

During the session, the "Grand Paris Express" project, considered the largest infrastructure project in Europe, was presented, as well as the urban projects planned in various cities.

This interest and commitment of the railway industry to the aforementioned market has been reflected in the participation of more than 35 representatives of companies in the sector. 

New Mafex partners

The number of companies joining Mafex continues to rise. These are the 4 new partners:

THE SPANISH RAILWAY ASSOCIATION CONTINUES TO GROW WITH THE RECENT ADDITION OF 4 NEW PARTNERS. WITH THESE ADDITIONS MAFEX HAS A TOTAL OF 100 COMPANIES AND ENTITIES THAT REPRESENT ALL THE SUBSECTORS OF A LEADING INDUSTRY THAT IS MAKING ITS WAY AROUND THE WORLD.



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Acygs is an engineering services consulting business dedicated exclusively to the railway sector and specialised in all the consulting and engineering services associated with a rolling stock maintenance workshop.

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Cellnex manages a portfolio of more than 130,000 sites – including forecast roll-outs up to 2030 – in Spain, Italy, the Netherlands, France, Switzerland, the United Kingdom, Ireland, Portugal, Austria, Denmark, Sweden and Poland. Cellnex's business is structured in four major areas: telecommunications infrastructure services; audio-visual broadcasting networks, security and emergency service networks and solutions for smart urban infrastructure and services management (Smart cities and the "Internet of Things" [IoT]).

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Mafex

<http://magazine.mafex.es>



Sustainable finance and investments at the heart of the third sectoral forum of the year organised by Mafex



The General Director of Mafex, Pedro Fortea, has carried out during the morning of 5th April the opening of the third of the Forums that the Association will launch this year. On this occasion, the Forum has been focused on sustainability and specifically on "Sustainable Finance and Investments". Fortea has pointed out that "Everyone is aware of the fact that the railway is the most sustainable mode of collective transport, but, as an industry, we must not only pay attention to environmental and pollution reduction criteria when we refer to sustainability, but also to social and governance aspects. Our clients incorporate more and more sustainability criteria into their strategies and their relationship with their suppliers. We must therefore address sustainability as a key competitiveness factor for the future where the Spanish railway industry must be properly positioned to increase its competitiveness and attractive-

THE SPANISH RAILWAY INDUSTRY ASSOCIATION HAS HELD THE THIRD OF THE SECTORAL FORUMS OF 2022, WHICH AIM TO SERVE AS KEY MECHANISMS FOR SECTORAL DYNAMISATION AND WHICH ARE EMERGING AS A MEETING PLACE BETWEEN THE ORGANISATIONS THAT MAKE UP THE VALUE CHAIN OF THE RAILWAY SECTOR. ON THIS OCCASION IT HAS BEEN FOCUSED ON "FINANCE AND SUSTAINABLE INVESTMENTS".

ness. Sustainable finance certainly presents an opportunity and a key factor to consider." During the session, Ana Puente Pérez, S.G. of Securities and Financial Instruments Market Legislation from the Ministry of Foreign Affairs, European Union and Cooperation, and Alex Saz-Carranza, Head of Public Sector Financing, from the European Investment Bank (EIB) had the opportunity to learn about sustainable financing in a context of consolidated global growth and where, in addition, Spain holds the top positions in terms of issuance of green bonds and linked to sustainability, among others.

In addition, Andrea González G. Vega, Deputy Director General of Spainsif - Sustainable and Responsible Investment, and Rafael Matos Martínón, Director of Sustainability and Impact of Cofides explained the advances in financial regulation and taxonomy or how the inclusion of sustainability criteria and governance in financial decision-making is key to the transition to a carbon neutral economy.

To end the session, the round table on "Finance and sustainable investment in the railway sector" by Manuel Fresno Castro, General Director of Finance and Management Con-



trol of Adif, Rebeca Estévez, Financial Director of Metrotenerife and Inés Ferguson, Director of Business

Development of Tyspa explained what challenges and opportunities sustainable financing presents when

being addressed from within a company, how it is carried out, its positive impact and the importance of having a portfolio of railway projects aligned with sustainable finance, from the point of view of engineering businesses. This is in addition to highlighting "the importance of preparing projects well, following standardised metrics and creating an ecosystem of reliable and comparable data, to generate trust and attract investment to the sector" in the words of the latter.

This interest and commitment of the railway industry has been reflected in the participation of more than 35 companies in the sector, in addition to the presence of entities such as the Ministry of Economic Affairs and Digital Transformation.

Middle East Rail: Spanish rail strengthens its presence in the Middle East

The Spanish railway industry has once again set a new course for the Middle East, where it seeks to expand commercial relations and participate in new infrastructure investments.

For this reason, attendance at Middle East Rail represents for Mafex an ideal platform to publicise the new Spanish technologies and to esta-

blish contacts with the main actors that shape the future of transport in this market.

The Spanish Railway Industry Association (Mafex) has again coordinated the grouped participation of eight companies in the Middle East Rail congress and exhibition which took place in Abu Dhabi between 17th and 18th May 2022.

In this edition, companies such as Aquafrisch, Consultoría, Ingeniería y Arquitectura, Caf, Danobat, Ineco, Idom, MainRail, Sener and Zitron have been present. Two of the main objectives of Spanish companies is to position themselves and to look for new opportunities, as they already appear as a technological reference in the countries within the area and where they have already contributed their solutions in the main projects of recent years.



Mafex renews its Management Committee for the next four years, expands the number of partners and reports on an intense action plan for 2022

THE SPANISH RAILWAY INDUSTRY ASSOCIATION (MAFEX) INFORMED AT THE GENERAL ASSEMBLY OF MEMBERS, HELD AT THE SPANISH CONFEDERATION OF BUSINESS ORGANISATIONS (CEOE) IN MADRID, OF THE RENEWAL OF THE MANAGEMENT COMMITTEE, THE INCORPORATION OF NEW MEMBERS AND THE EVOLUTION OF THE ACTIVITIES 2021-2022.



The Spanish Railway Industry Association (Mafex) informed at the General Assembly of Members, held at the Spanish Confederation of Business Organisations (CEOE) in Madrid, of the renewal of the Management Committee, the incorporation of new members and the evolution of the activities 2021-2022.

Mafex held its twentieth General Assembly on 24th May. The event was widely attended by its 100 current partners. In addition, the public session was attended by institutions such as Adif, Renfe, Icx, España Exportación e Inversiones, Fundación



de los Ferrocarriles Españoles (FFE), Plataforma Tecnológica Ferroviaria Española (PTFE), Metrotenerife and the Public Works Agency Junta de Andalucía.

During the first part of the meeting, a balance was made of the more than 200 actions organised and / or coordinated by Mafex during the past year, also highlighting the 25% increase in the last four years in the number of members and the important progress in terms of innovation actions, with the participation of the Association currently in various projects, mostly at European level.

In addition, the Management Committee was renewed for the next four years, consisting of representatives from the following companies: Alstom, Amurrio Ferrocarril y Equipos, ArcelorMittal Spain, Caf, Comsa, Icon Multimedia, Idom, Indra, Ineco, Ingeteam Power Technology, La Farga Your-

CooperSolutions, Metalocaucho, Patentes Talgo, Sener, Sice, Siemens Mobility, Stadler Rail Valencia, Tecnival, Thales España and Tyspa. Furthermore, the technology centres Citef and Gaiker Foundation join as members.

On the other hand, the actions that will take place during the second half of the year were also presented, among which InnoTrans fair from 20th to 23rd September stands out, where Mafex coordinates the active participation of more than 60 companies in the Spanish pavilion along with Rail Live! Congress from 30th November to 1st December in Malaga, the national reference platform of the Spanish railway sector with a marked international character and which has the support of the entire sector. It is worth noting that within the framework of this meeting, 7 of the 12 companies that have joined Mafex since



the previous year's session and that were able to attend the general assembly were also welcomed: ABB,

Ariño Duglass, Intertek, Nertatec, Simulations and Projects, SQS and Teldat.



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Mafex organises in Bilbao the III Technical Conference: "Urban Transport Systems – Commuters, Metros and Trams"

The Spanish Railway Industry Association has gathered in Bilbao, from 6th to 8th June, a group of 13 authorities and operators of urban transport system from countries such as Bangladesh, Bulgaria, Colombia, Ireland, Italy, Norway, Sweden, and Turkey to introduce their ongoing and upcoming investment plans of investments as well as their railway developments in their respective countries and organisations.

This event, with the support of the support of ICEX España Exportación e Inversiones Investment, has represented a unique opportunity to set new grounds of collaboration and to learn about the innovative and technological capabilities of the Spanish rail industr.

The launch of the first day was welcomed by Asier Abaunza, Councillor for Public Works, and Urban Planning of Bilbao City Council, who stressed the recovery of a post-industrial city like Bilbao and the important role that urban railway transport has played in it.



In these two days of the event, our international guests announced more details about the transport plans they have in place. 130 bil-



teral meetings have been held in parallel between these guests and representatives from more than 25 Spanish companies in order to learn about their products and solutions and analyse possibilities for collaboration.

Finally, a technical visit to Metro Bilbao and Tranvía de Bilbao has been organised by Euskotren, where the essential aspects of both services have been exposed and the control center have been shown.

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III Edition of the Master in Railway Engineering UC-Mafex, the gateway to the railway world

The Master in Railway Engineering is organised by the University of Cantabria and the Spanish Railway Industry Association – Mafex, which currently brings together 100 companies that represent the entire value chain. The Master has an important team of collaborators, who provides added value to the programme and contents.

The main objective of the master's degree is to train professionals in different areas of the railway sector. In this sense, a curricular itinerary has been designed under a multidisciplinary approach in order to complete the training of an industrial, telecommunications, electrical, civil engineer, a graduate in science, business administration or economics, covering the different aspects of railway engineering as a whole.

From this perspective, the student receives valuable training, providing knowledge on issues related to rolling stock, facilities and signaling, with the study of the behavior of

the railway superstructure, the design and simulation of railway operations, the management of human resources and the regulatory framework, among others.

With the aim of adapting to the needs of the students, the master's degree, of 1 year's duration, is organised in 4 modules, which can be taken independently, offering specific contents in each of the four major areas of knowledge of the sector. The completion of the 4 modules will grant the title of Master in Railway Engineering. These modules are:

- University Specialisation Course in Railway Systems.
- University Expert Degree in Railway Design, Construction and Maintenance.
- University Specialisation Course in Railway Rolling Stock.
- University Specialisation Course in Railway Planning and Operation.

The subjects have been endowed with an eminently practical content, encouraging learning from experimentation related to real-life conditions and situations explained by professionals in the sector with extensive experience. These concepts are reinforced with the completion of paid external internships with a duration of 6 months in the collaborating companies of the master's degree.

All the speakers of the master's degree belong to companies of recognised national and international prestige in the railway sector, making available to our students their high experience and knowledge.

In addition, they will tutor the student in the development of their master's thesis, being able to expand their knowledge under their supervision in a much broader and more extensive way in the area of their interest. The high "know how" of all of them together with the scheduled visits and the aforementioned internship programme will help to acquire the necessary experience to focus their professional future on one of the most productive sectors not only of our country but of the whole world, the railway.





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Rail Live! 2022 will be held in-person from 29th November - 1st December 2022 in Malaga



Rail Live! 2022 will be held in Malaga on the 29th November - 1st December to bring together high-level industry leaders who are driving sustainable development, investment and digital transformation in the Global rail sector.

The organizing entity Terrapinn, that has the support and collaboration of Mafex – Spanish Railway Association, is excited to present the 2022 Congress edition where new trends in railway transport and the main challenges that the sector will face are to be addressed for three days.

With 7 different conference tracks representing the different aspects of the rail system including Freight,

RAIL LIVE! 2022, THAT WILL BE HELD IN MALAGA, HAS AGAIN THE SUPPORT OF MAFEX, THE SPANISH RAILWAY ASSOCIATION, IN THE ORGANIZATION OF THE EVENT. AMONG THE MAIN INTERNATIONAL SPEAKERS THERE ARE ALREADY CONFIRMED TO DATE, CARLO BORGHINI, EXECUTIVE DIRECTOR OF EUROPE'S RAIL AND LUCIE ANDERTON, HEAD OF SUSTAINABILITY OF UIC.

Mega Projects, Finance and Funding, Metro Rail, Light Rail, Digital Train Control & Telecommunications, Sustainability & Energy, BIM and Digital Transformation, there's something for everyone.

Digitalization, sustainable mobility and liberalisation are some of the topics that will be addressed by the more than 250 speakers. Attendees will also be able to learn more about the latest tech-

nological advances in the exhibition area.

Under the heading "THE RIGHT TRACK FOR A ZERO CARBON FUTURE", the event will host an agenda full of panels, presentations, and round tables. The agenda covers all current issues for the future development of the industry, such as: Freight, Mega Projects, Metro Rail, Light Rail, Digital Train Control & Telecommunications, Sustainability & Energy, BIM and Digital Transformation and more.

In addition to these summits the Spanish Symposium will be an opportunity for the industry to be updated on developments and initiatives from key Spanish networks and operators including Renfe, Adif and Metro de Malaga.

Rail Live is pleased to announce a strong international speaker faculty who will be attending the event face-to-face. Some of the confirmed speakers so far are: already confirmed, to date, Mauro Alabuenas, President of Subterranos de Buenos Aires, Herbert Hui, Finance Director of MTR Corporation, Dyan Crowther, Chief Executive Officer of HS1, Lucie Anderton, Head of Sustainability of UIC, Carlo Borghini, Executive Director of Europe's Rail.

The event will also count on the presence of top international com-



Around 2,500 people from 40 countries will attend this international event where more than 100 companies will announce their latest innovation and technological developments

panies in the sector. The wide national participation stands out, as well as the participation as sponsors of companies such as Grupo CAF, NGRT, STADLER, ABB, Schneider, SIEMENS, teltronic, CYLUS, and many more.

The participation of more than 100 companies is expected, and they will introduce their latest innovation and technological developments.

Rail Live! 2022 has again the support of Mafex, the Spanish Railway Association, in the organization of the event. Renfe, Adif, as well as the Junta de Andalucía, Ayuntamiento de Málaga, Metro de Málaga, the Spanish Railways Foundation, the Spanish Railways Technological Platform, and ICEX collaborate in the development of the event. Other organizations such as UNIFE, EIM, Europe's Rail, Railway Innovation Hub and in-move by Railgrup will participate in the event and have supported its dissemination.

More details about the congress and fair, the speakers and the participating companies on the following website: TERRAPINN.COM/RAILLIVE/MAFEX-NEWS.

All current issues for the future development of the industry will be addressed by the more than 250 speakers



Learn about the "Goods on the train" campaign, which calls for the transport of goods by rail

The town hall square of Valencia was the centre of the main activities of the first day of the Goods on the train campaign. This location is where the large green container protagonist of this initiative was placed to convey the main messages of the campaign to the population, and various activities were carried out around it.

Many authorities gathered to support this European initiative that seeks to raise awareness about the need to create a supply chain free of CO2 emissions, where the train is the backbone. Transporting goods by rail reduces CO2 by up to 80%. It reduces external costs by up to 50%, resulting in fewer deaths on the roads and it consumes 6 times less energy.

Nowadays less than 4% of goods travel by train in Spain. According to the projections, there will be 30% more goods transported by 2030. If no action is taken, those goods will also continue to be moved by road, and therefore there will be 30% more CO2 emissions into the atmosphere. For this reason, the campaign aims to promote the combination of the train and the truck, the first one for long distances, and the second one to reach the customer's door. This type of intermodal transport is key to reducing CO2 emissions from the transport sector, which today account for 27% of the total in Spain.

The event in Valencia was attended by, among others, Inmaculada Rodríguez Piñero, Group of the Progressive Alliance of Socialists and Democrats in the European Parliament, the Government Commissioner for the Development of the Mediterranean Corridor, Josep Vicent Boira, the Deputy Mayor of Valen-

THE OBJECTIVE OF THIS INITIATIVE IS TO VALUE THE TRANSPORT OF GOODS BY RAIL AND TO BE ABLE TO MOVE MORE FREIGHT TO THE TRAIN TO REDUCE THE AMOUNT OF CO2 EMISSIONS FROM THE LAND TRANSPORT SECTOR IN OUR COUNTRY.

THIS TRAVELLING PROJECT STARTED IN SPAIN IN 2021, AFTER HAVING ALREADY BEEN LAUNCHED IN GERMANY OR THE UNITED KINGDOM, ON THE OCCASION OF THE "EUROPEAN YEAR OF RAIL" AND IT HAS ALREADY BEEN THROUGH VALENCIA, ALICANTE, AND BARCELONA.

cia, Sandra Gómez or the General Director of Planning and Evaluation of the Railway Network, Casimiro Iglesias Pérez.

The city of Valencia was chosen as a starting point due to its strategic location as an international logistics node and also to focus on the Mediterranean Corridor, one of the ten main infrastructures of the Trans-European Transport Network (TENT-T).

The next stop took place in November in the city of Alicante.

The presentation of the campaign included the visit from Ximo Puig, president of the Generalitat Valenciana (Valencia Regional Government), an essential area for exports of diverse articles and products such as fruits and vegetables, toys, cars, among others, which will be very important in the design of future and more sustainable logistics chains.

Rail Live 2021 had a stand within the campaign "Goods on the tra-

in" where it brought together professionals from more than 70 countries, who met at the sector fair, with the important role that freight railway will have in the future of sustainable transport and it offered the opportunity to join the campaign in Spain as sponsors or collaborators to those companies or institutions that wished to do so.

The president of Adif, María Luisa Domínguez González, and the Minister of Transport of the Community of Madrid, David Pérez García, among other personalities, expressed their support of the campaign "Goods on the train" during their visit to the stand.

The last stop of the campaign has been the city of Barcelona. The Port of Barcelona hosted a conference in which more than 10 speakers discussed climate change and how intermodality can be key to combating it. It was also the location chosen to position the emblematic green container, flagship of the campaign, which for the first time hosted an exhibition inside it. This stop was attended by a multitude of personalities including Da-

mià Calvet i Valera, President of the Port of Barcelona, and Xavier Flores García, Secretary General for Infrastructures of the Ministry of Transport, Mobility and Urban Agenda of the Spanish Government.

During the three days in which the "Goods on the train" container was exhibited, not only could a freight container be seen at street level, outside its usual location, but it was also possible to access its interior, where visitors could find an exhibition open to the public and free where they could find out about the advantages of transporting goods by rail through images and a brief but shocking film about the importance of this medium in the ecological transition.

The "Goods on the train" container not only carried sustainability on its exterior with its message, but it also purified the air of the place where it was installed with the paint that covers it.

This decontamination is possible thanks to a range of intelligent paints that combines aesthetic and protective solutions and that, in addition, forms a clear, lasting, and fine mi-

neral film of 40 nanometres that provides durability, cleanliness and air purification. It does so through photocatalysis, nature's own principle to achieve decontamination.

Throughout 2022 the campaign will visit more Spanish cities that will be announced soon.

A campaign with great support

The campaign has been very well received by companies and institutions that see in the train the solution to decarbonise transport.

It has been promoted by the railway company DB Cargo and its arrival in Barcelona has been sponsored by its subsidiary in Spain, Transfesa Logistics, as well as Port de Barcelona, Eurocontainer, Ermewa and Medway.

Other organisations collaborating in the campaign include: Renfe Mercancías, Puerto de Valencia, Stadler Valencia, Adif, Anecooc, Ayuntamiento de Valencia, AM FRESH Group, the European Parliament, the Spanish Railways Foundation, the Ministry of Territorial Policy, Public Works and Mobility of the Generalitat Valenciana, Martinarro, Logitren, Low Cost Rail, Rail Equip, Railsider Logistics, Rail Live, SanLucar, The Climate Reality Project Europe, Tobsine España S.L., VTG, Puerto de Alicante, Mafex, ECODES, Equimodal, J. Lanfranco, IN-MOVE, by Railgrup, Navlandis and TMS.

The initiative is open to all businesses, organisations or non-profit associations that want to get on the sustainability train by collaborating or promoting the campaign at its different stops to raise awareness of the importance of increasing the share of transport of goods by rail in the fight against climate change. If you would like to join this initiative contact: comunicacion@transfesa.com.



Zitrón takes part in the Silvertown tunnel project in UK

ZITRÓN

Zitrón will supply the tunnel ventilation equipment for Silvertown tunnel project. This tunnel will connect the Greenwich peninsula and the Silvertown district, relieving local congestion of the area. The project is worth more than £ 1 billion and will include a 1.4-kilometre twin-bore road tunnel under the River Thames as well as 0.6-kilometres of access ramps. Design and construction of the project will be delivered by a joint venture with Ferrovial Construction, BAM Nuttall and SK E&C.

Zitrón's contract includes the design, manufacture, testing, supply

and intallation of 24 jet fans of 1250mm diameter and 55 kW.

Zitrón ha a branch in London that

will be in charge of project management, installation work, start-up, maintenance service, as well as assistance to the project.



SENER joins the US High Speed Rail Coalition to help advance High Speed Rail in America

SENER

SENER has joined the Executive Committee of the US High Speed Rail Coalition, that fosters the U.S. high-speed rail industry.

"On behalf of the Coalition and the

entire Association, we're proud to welcome SENER to the Executive Committee," said USHSR President Andy Kunz. "SENER is a global engineering and construction leader in delivering world-class high speed rail systems. Their extensive experience is highly valuable in the development of the U.S. high speed rail network. We welcome them to our Coalition."

SENER has 30 years of engineering experience building more than 2,000 miles of new high-speed rail projects and is currently participating in major high-speed contracts in Spain, the United Kingdom and the USA. In the USA, SENER is working on several high-speed contracts in California, for California High Speed Rail Authority.



TRAINS
BUSES
SIGNALLING
COMPONENTS
SERVICES
TRANSPORT SYSTEMS

Well prepared, with an acute vision... This is our way of looking at global transport. This is our way of designing, developing, manufacturing, installing and integrating all the parts that make up an inter-connected mobility system. We do it your way, adapting to your needs and preferences, making it sustainable, safe and comfortable for the people and cities of the future all around the world.

Your Way
TO FUTURE MOBILITY

Photo: Kaohsiung Tramway System - CAF Turnkey Project



The Port of Algeciras increases its capacity in railway/maritime transport system

INECO
Ineco has started the drafting of the projects for the improvement of the RAILWAY capacity of the "LAST MILE" and the RAILWAY CONNECTION WITH THE PORT FACILITIES LOCATED IN THE PORT OF ALGECIRAS BAY. Projects that aim to provide the Port's current

railway infrastructure with different elements to improve operational management and at the same time promote intermodality.

With these actions, Algeciras will be able to handle 750-meter freight trains at the Isla Verde Exterior railport terminal by extending the lengths of useful track available at the terminal. In addition, the construction of a technical facility outside the current port area

for the classification and parking of convoys is planned, which will avoid the interruption of rail traffic both at the Algeciras passenger station and at the port itself.

o provide access to the facility, it is also planned to double the existing track from the Algeciras passenger station to the location chosen for the facility, which will be used exclusively for freight traffic to/from the port.

INGETEAM, 50 years electrifying a sustainable future

INGETEAM
Ingeteam celebrates its 50th anniversary this year, whilst playing a key role in the energy transition. In the railway sector, INGETEAM has now supplied more than 600 traction converters. In 2022, relevant projects have been finished: the supply of traction equipment for EMUs to be operated in Czechia, High Speed Vehicles in for Spain & Uzbekistan and freight locomotives for Poland. The company is also working on new developments, with the objective to improve INGE-TRAC converters competitiveness, efficiency and modularity.

ticipates the creation of 1,000 jobs, more than 100 in R&D and a 44% growth in turnover. Ingeteam's range of products, systems and services

covers the growing electrification of society via its technological solutions, playing a key role in the energy transition, with an international structure.



INGETEAM presented recently the 2022-24 strategic plan The plan an-

ICF supplies axle counters with bus connection in Chamartin station

ICF
ICF, a Spanish railway signalling company, put into service last March, the AC-900 Axle Counter System at Chamartin Station, the nerve centre of railway transport in Spain,. This system has been developed and validated 100% by ICF. It is entirely manufactured and verified in Spain and exported all over the world.

The major remodelling project of the station includes the modification of the safety installations by installing 53 axle counters to replace the existing track circuits, a basic SIL4 safety element of railway signalling.

The AC-900 system is the first in the world that allows the connection of the axle sensors by bus, resulting in



savings of up to 80% in cable, civil works and engineering, with the

consequent reduction in execution times.



We have been reinventing ourselves
FOR OVER 100 YEARS





Vitoria-Gasteiz Jundiz multimodal logistics centre: strategic hub for logistics operations and freight transport in Spain

TPF GETINSA

UTE MULTIMODAL VITORIA, the joint venture made up of the consulting companies TPF GETINSA EUROESTUDIOS, S.L. and TRN TARYET S.A., has successfully

lly completed the detailed design for the construction of the Vitoria Jundiz multimodal logistics centre, phase 1, including a standard-gauge link to the atlantic corridor, and the functional design for the implementation of a rolling highway.

Future hub for the interchange of freight traffic between broad-

gauge and standard-gauge rail networks, Vitoria Jundiz Multimodal Logistics Centre will be able to handle 750 m trains when the envisaged upgrade is finished. In addition, the planning of an adjoining Rolling Highway Terminal will contribute to increasing the modal share of rail freight transport while reducing greenhouse gas emissions.

Electrans signalling systems for the new line 10 of MetroValencia

ELECTRANS

We are pleased to announce the recent inauguration that took place on May 17 of the new line 10 of Metrovalencia. Five kilometers long, it connects the city center and the Nazaret neighborhood through three underground stations and five on the surface.

The consortium of which ELECTRANS is a part has performed the design, supply, installation and commissioning of the signalling system, the centralized traffic center and the operation assistance system.

ELECTRANS has provided the complete signalling solution developed under the most demanding safety standards according to CENELEC regulations and the ATP system, which allows speed control and su-



perision, protection of restrictive aspects of signals, track occupation detection and route requests guaranteeing the SIL-4 safety integrity level.

The current signalling allows reaching a frequency of passage between 5 and 10 minutes and completing the entire route in 16 minutes, ensuring maximum safety

level thanks to the SIL-4 certification of the systems and the high availability of the ensemble.

It is a great satisfaction to have successfully completed this reference project due to its high technical demands and that it currently has the most advanced signalling systems in the iconic City of Arts and Sciences.

Ladicim verifies the superstructure of the lima metro line 2

LADICIM

Following its transfer activities to the international market, the UC's Materials Science and Engineering Laboratory (LADICIM), accredited by the National Accreditation Entity (ENAC), has verified the dynamic behaviour of the track on Line 2 of the Lima and Callao Metro's Basic Network. Prior to the inauguration of the line, the displacements of the rail, the displacements of the concrete slab of the slab track, as well as the stresses of the rail during the passage of rolling stock in the test phase were determined. This work com-



plements the study and validation of the prototypes previously tes-

ted at LADICIM on a laboratory scale.



Inse Rail to draft the project for the construction of a maintenance workshop for Adif Alta Velocidad locomotives and trains

INSE RAIL

This will be Adif and Adif Alta Velocidad's first facility of this kind, and with it, the rail infrastructure manager aims to provide first-line maintenance of the twenty-two standard-gage locomotives and inspection trains that it has to ca-

rry out maintenance, examination and inspection work on the network.

The workshop will be built in Adif's Madrid-Sur infrastructure maintenance sub-base and will be connected to the conventional line. It will also have the capacity to carry out the different maintenance operations on both standard and conventional-gage rolling stock.

Specifically, it will initially accommodate the twenty-two standard gage locomotives that Adif Alta Velocidad acquired in November 2019 to carry out examination, rescue, snow-plowing or maintenance work support functions on high-speed lines.

However, the workshop will also be sized to handle the maintenance of the inspection trains and will be equipped with pits, longer bays and wheel turning equipment.



New CAF LRVS contract for the city of Bonn in Germany

CAF has been selected by the companies Stadtwerke Bonn Verkehrs GmbH (SWBV) and Elektrische Bahnen der Stadt Bonn und des Rhein-Sieg-Kreises GmbH (SSB), operators of the transport services in the city of Bonn and its outskirts, to supply 22 LRV units, and also the spare parts for this fleet. Likewise, the agree-

ment contemplates the possibility of increasing the number of units by a further 10.

These high-floor bi-directional units have a length of 28 metres and are similar in design and dimensions to the units called "Stadtbahnwagen B", a vehicle type that has been in service for many years now on a number of networks in the German state of

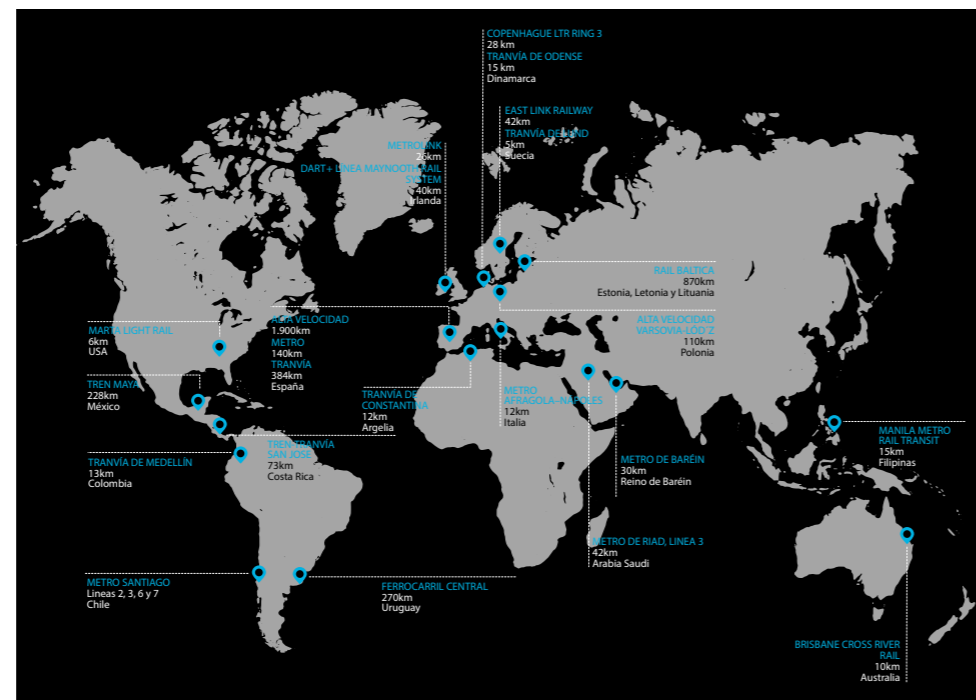
North Rhine-Westphalia. In this case, beyond the design similarities, the CAF vehicles feature the latest innovations with regard to comfort and safety, for this type of urban transport unit.

This project is on top of the one to supply 51 LRVs to operator Ruhrbahn GmbH for the nearby city of Essen, awarded to CAF in June 2021.

IDOM, more than 50 years leading the railway sector

IDOM has accumulated experience over more than 50 years, designing metro, light rail, bus rapid transit, and high-speed railway projects. During this time we have developed more than 7,000 km of railway lines, 1.200 Km of tramways, and about 400 km of Metro lines.

Among our latest projects there are the urban light rail of Odense (Denmark), the metrolink in Dublin (Ireland), the mega project of Rail Baltica crossing Latvia, Estonia and Lithuania and various metro lines like the one in Santiago del Chile and Metro Manila in the Philippines. We have carried out projects in many different countries across Europe, South America, Middle East and Asia.



At IDOM we work with our sights set on a sustainable future, providing

our clients with bold and innovative engineering solutions that guaran-

tee financial, social and environmental sustainability.



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[siemens.com/innotrans](https://www.siemens.com/innotrans)

SIEMENS

Amurrio provides technical assistance on the central railroad in Uruguay

AMURRIO

A technical assistance team from Amurrio has travelled to Uruguay in recent months to facilitate the implementation of the turnouts manufactured by the company in the port of Montevideo and along the Central Railway line, up to the city of Paso de los Toros, in the center of the country.

This action is included in the contract awarded to AMURRIO in 2020, consisting of the manufacture of 124 state-of-the-art turnouts, which will allow the circulation of freight trains at 80 km/h. and 22.5 tons per axle, with a significant reduction in travel time.

The reform of the Central Railway coincides in time with the arrival in Uruguay of the Finnish pulp



giant UPM Metsä, which will invest US\$4 billion in the city of Paso de los Toros for the construction

of a plant with which it expects to make a leap in competitiveness in the sector.

QA&TEST Conference organised by SQS: Testing and QA for embedded systems

SQS

Software Quality Systems, (SQS), organises QA&TEST, the international conference on software testing and quality focused on embedded systems. This year celebrates its twenty-first edition on the 19th, 20th and 21st October in Bilbao.

Companies from different sectors (railways, electronics, aeronautics, medical devices...) will meet at QA&TEST to learn about the latest techniques, methodologies, technologies and tools that facilitate and improve the processes of verification and validation of embedded software, testing and QA. The programme will be available at <https://embedded.qatest.org/>, and tickets are already on sale.



Indra strengthens its leadership as ticketing provider in Egypt

INDRA

Indra has strengthened its position as a leading company in fare collection solutions in Egypt after being awarded a contract to implement its ticketing technology for the two

lines in Cairo's Monorail.

The company is responsible for the design, development and supply of, automatic ticket vending machines, ticketing systems and access control systems from its Mova Collect line of own solutions, based on both contactless card and

QR code and mobile phone technologies for the first time in Egypt.

Indra has implemented its technology on Cairo Metro lines 1 and 2, as well as the ticketing control center, which it will be responsible for maintaining, making it a leader in Fare Collection solutions in Egypt.



Stadler consolidates its position as the European leader in the Train-Tram segment.

STADLER

In an increasingly urbanized world, Stadler's metro, light rail vehicles and trams offer great comfort to passengers and cost-effective customized solutions to operators. Our LRVs set trends in terms of performance, universal accessibility, reliability, safety, comfort and

cutting-edge technology. As an example, the CITYLINK, a modular, barrier-free, light rail vehicle family specially designed to connect the city center with its metropolitan area without transshipments, providing a safe, quiet and highly comfortable journey.

The CITYLINK covers from tramway applications to full train regional operations at 100km/h. Its biggest success is the recent

VDV-Tram-Train contract involving the supply of up to 504 vehicles to a consortium of six operators in Germany and Austria. In 2022, an order for 19 CITYLINK train-trams, plus 27 optional ones, has also been signed for the Chemnitz region and Hungary's first train-tram has been commissioned in Szeged. Another important milestone was the arrival in the UK of the first hybrid CITYLINK (E+Bat) for testing.



Thales continues its commitment to Egypt National Railways and delivers three key stations Tanta, Al Ousayrat and Sedfa

THALES

As part of the ambitious plan to transform Egypt's railway infrastructure driven by the country's

Ministry of Transport, Thales has once again delivered on its commitment by delivering the new key stations, Tanta, Sedfa and Al Ousayrat. The latter two are located on the line linking the towns of Asyut and Nagh Hammadi. Tanta is on the Cairo-Alexandria line.

All these stations are part of the

rail corridor from Alexandria to Aswan via Cairo.

"We are very pleased to deliver three new stations to ENR. It is a source of pride for the entire Thales team who have been working for years on the modernisation of this line" - Fernando Ortega, Thales Spain Transport Director

CAF RS Equipment and Components wins a new contract in the Luxembourg tram

CAF RS EQUIPOS Y COMPONENTS

This contract represents a great challenge as it involves the coordination of the Supply of Spare Parts and Maintenance of Equipment and Components business lines to supply fleet spare parts, repair damaged parts and carry out preventive maintenance of brake systems for the next 5 years.

It will be necessary to have a local team whose mission will be to guarantee the supply of components, analyzing the reasons for failures with the client and thus seeking a solution to each of the problems that may arise.

On the other hand, it should be noted that it is a pioneering project within the CAF Group in terms

of sustainability, since the environmental footprint will be measured both in transport and in the packaging of goods before and during

the project, to measure its evolution and implement actions to reduce it.



The digital transformation of the railway sector, as seen from Ceit technology centre

CEIT

In recent years, the railway industry has jumped on the innovation bandwagon, developing new technologies and applications to modernise the sector and provide greater value to users. Digitalisation and automation are the necessary levers to achieve the smart transformation of the sector.

However, there is still plenty of room for manoeuvre to boost the competitiveness of companies by digitising the maintenance of infrastructures and logistics operations or developing new materials through cutting-edge technologies such as additive manufacturing.



EU-Rail, the new R&D&I alliance in the European railway sector.

Thanks to its more than 35 years of experience in collaboration with the most outstanding companies on the national and international scene, Ceit has become one of the main European players in the sector, as exemplified by its appointment as one of the 25 founding members of

This scenario offers the industry a great opportunity to innovate and develop the railway of the future. Through this ebook, Ceit exposes the main challenges that the railway industry must face in order to put the train on track as the sustainable transport of the future.



Siemens Mobility to improve the rail connection between Extremadura and Andalucía

SIEMENS

Siemens Rail Automation, in a joint venture with FCC Industrial and Infraestructuras Energéticas, will carry out the removal of the telephone blockade between Zafra, Badajoz and Los Rosales, Sevilla. This implies the implementa-

tion of a Single-Track Automatic Blocking between Cazalla, Seville and Los Rosales and a Single-Track Automatic Release Blocking between Cazalla and Zafra.

Specifically, Siemens Rail Automation will renew the existing interlockings on the route (not including the stations of Zafra and Los Rosales), the supply and installation of some on-site ele-

ments such as axle counters, LED signals with their respective ASFA Digital beacons, drives, among others.

This project, valued at more than 24 M€, has an execution period of 22 months and will mean a qualitative leap in the improvement of the traffic control, the reliability of the facilities and, in general, the quality of the service.

Alstom celebrates the 30th anniversary of the first high-speed train in Spain

ALSTOM

April 21 marked the 30th anniversary of the arrival of high-speed trains in Spain, a milestone in which Alstom Spain played a key role. In 1992, the first train to run at more than 300 kilometers per hour on Spanish railway lines was the model called Series 100, designed, built and maintained by Alstom in Spain. This AVE was also the first railway system in the world to make a commitment to passengers to maintain punctuality, with a promise to refund the ticket price if the delay was more than five minutes.

The Madrid-Córdoba-Seville AVE currently has an accumulated number of nearly 85 million passengers. Since it was put into service, the volume of passengers on this line has tripled, from 1.3 million users in its first year of operation to an average of 3.5 million passengers per year, according to



the usual offer before the health crisis.

the usual offer before the health crisis.

Lantania acquires Polish subsidiary of Balzola and construction company DSV

LANTANIA

Lantania grows and improve their



skills with the acquisitions of Balzola Polska and the Spanish railway construction company DSV. The acquisition of Balzola's Polish subsidiary gives the company

entry into the high-potential Polish market, while the purchase of DSV completes and improves Lantania's competencies in railway works. Both companies will become part of the Lantania Group, keeping their brands and their respective management teams.

Specialised in the execution of railway and road civil road works projects, Balzola Polska has extensive experience in the construction of tramway infrastructure as well as in all types of urban development works. The Warsaw-based company achieved a turnover of 150 million pln (32.3 million euros) last year. DSV, has its origins in the former Dorsalve and is a leader in railway tracks maintenance and new track assembly works. Its portfolio includes 20 active works, mainly for Adif.

Nokia and ICON Multimedia sign a global alliance to promote the digital competitiveness of railway operators

ICON

ICON Multimedia and Nokia, one of the innovative and technology leaders across mobile, fixed and cloud networks, have signed a global distribution agreement that promotes the competitiveness of railway operators, and the digital transformation of the stations.

This strategic alliance allows the two companies to tackle worldwide projects by integrating the digital passenger experience solutions that ICON Multimedia develops, within the Telecom Integration Package Services that Nokia offers and deploys for its clients.

At Nokia's headquarters in Espoo, Finland both companies will



design a digital transformation showroom, in which leading-edge technologies will be incorporated, demonstrating the impact

for customers and the improvements to the user experience in both smart stations and smart cities..



CAF Signalling, first company to pass the new European on-board ERTMS tests in the Netherlands

CAF SIGNALLING

CAF Signalling, together with its parent company CAF Group, has become the first on-board ERTMS supplier to successfully execute the new European process for compatibility tests in the Netherlands. These tests, led by CAF Signalling, have been carried out in accordance with all ETCS compatibility checks defined in Commission Implementing Regulation (EU) 2019/776 of 16 May 2019. ProRail, the railway infrastructure manager in the Netherlands, and Ricardo Rail, specialised company in critical and complex

railway systems, gave a positive assessment, meaning that Nederlandse Spoorwegen's SNG trains can now run with ERTMS on the Amsterdam-Utrecht line. The next challenge for CAF Signalling is for the SNG fleet to become the first in the country with an ESC Type.

railway systems, gave a positive assessment, meaning that Nederlandse Spoorwegen's SNG trains can now run with ERTMS on the Amsterdam-Utrecht line.

The next challenge for CAF Signalling is for the SNG fleet to become the first in the country with an ESC Type.

Ardanuy Ingeniería participates in the recently inaugurated Metrovalencia Line 10

ARDANUY

Valencia metro network has recently opened its line 10. Its route connects the city centre of the capital city with Nazaret maritime district, traversing the City of Arts and Sciences tourist area. This construction had the participation of Ardanuy Ingeniería, since FGV has awarded two contracts to it.

On one hand, the control and supervision services for the works related to the overhead contact line of Alicante-Nazaret section within the contract for the construction works supervision and technical assistance to the detail design of electrification, substations and power connections.

On the other, the construction works supervision, Health and



Safety coordination and technical assistance of the design and execution for the signalling, ATP

and SAE-CT systems of Lines 4, 6, 8 and 10 of Metrovalencia tramway.

Metrotenerife celebrates 15 years in service with more than 200 million passengers

METROTENERIFE

2 June marked 15 years of operation of the Tranvía de Tenerife (the Tenerife Tramway), with more than 200 million passengers transported and 21 million kilometres travelled. The system is the culmination of a complex town planning renovation,

both above and below ground, and contributes to improving environmental quality by avoiding 2 million journeys in private vehicles every year.

The service has reached 97% of the pre-pandemic demand rate. Moreover, punctuality, environment and accessibility are some of the aspects most valued by passengers,

who have ranked the service as outstanding since it began operating.

Metrotenerife, in addition to running the tramway operation, has managed to successfully position the company on the international stage. What is more, in 2021, it was the first company in the Canary Islands to issue Green Bonds.



IRIS Standard – ISO/TR 22163:2017 - Railway Sector Management System

INTERTEK

IRIS is a standard developed by the Association of European Railway Industries with the aim of developing and implementing a recognized common system for the evaluation of the quality management system of companies in the railway sector.

The IRIS Certification system is based on the ISO/TS 22163:2017 standard and the IRIS 2017 rules. The ISO/TS standard incorporates enhanced industry requirements.

The main benefits are:

- Quality improvement
- Identification of risks and reduction of costs
- Reduction of audits
- Entry into new markets



Both Standards are based on ISO 9001 and include requirements such as:

- Obsolescence and project management
- Article 1st inspection (FAI)

- Reliability, Availability, Maintenance, Security (RAMS)
- Life Cycle Cost (LCC)

Intertek offers trainings by experienced Auditors to help correctly interpret the requirements of audits.



Pretenorte builds a new plant in Betoño and continues its investment and specialisation plan in the railway sector

PRETENSADOS DEL NORTE

Pretensados del Norte (Pretenorte) continues its specialisation in the railway sector. Specifically, in the manufacture of Prestressed Steel for railway sleepers. As Íñigo Quincoces, Director General of the company admits, this commitment to specialisation requi-

red "important changes and the adaptation of the entire organisation, demanding significant growth in industrial and engineering capacity." All this is part of the company's investment plan, channelled through an investment plan of more than seven million euros.

The project involves at the current stage raising its production capacity from 9,000 tons / year to more than 26,000 and al-

most doubling the workforce, to about 60 workers. This increase in manufacturing will be possible thanks to the construction of a new plant in Betoño, near its headquarters, with 5,000 m2 of surface, which will be dedicated exclusively to manufacturing and laboratory.

This second plant is already built and in the process of installing machinery to begin production on 15th July.

Circular economy and railway, a further step towards sustainable transport

THE RAILWAY IS A KEY ELEMENT IN THE RACE TOWARDS A MORE SUSTAINABLE AND MORE ENVIRONMENTALLY FRIENDLY MOBILITY. IN ADDITION TO THE PROJECTS AND INITIATIVES THAT PUT IT AT THE CENTRE TO ACHIEVE EMISSION-FREE TRANSPORT OR INVESTMENTS IN R&D&I FOR THE DEVELOPMENT OF SUSTAINABLE TECHNOLOGIES, OTHER CONCEPTS COME INTO PLAY SUCH AS THE CIRCULAR ECONOMY, WHICH ESTABLISHES A MORE SUSTAINABLE PRODUCTION AND CONSUMPTION MODEL, WHERE RAW MATERIALS ARE KEPT IN THE PRODUCTION CYCLES FOR LONGER. AND THE RAILWAY HAS ALSO MUCH TO CONTRIBUTE IN THIS LINEAR TO CIRCULAR PARADIGM SHIFT.

Europe as a whole is working towards a new model where sustainability is at the heart of everything. The warnings issued by organisations such as the United Nations (UN) are clear and give little room for action: there is a need to combat climate change, one of the greatest challenges of today's society, and it must be done now, since the year 2030 is the deadline to mitigate the numerous environmental consequences that reflect in 95% of the cases the impact of activities generated by human factors.

The transport sector plays a decisive role in this joint fight, since it

represents a third of the end-use energy and a quarter of the total greenhouse gas emissions, as pointed out by the European Environment Agency. That is why international organisations highlight the role of transport in a sustainable development economy and insist on the importance of committing to mobility models that contribute to reducing the environmental footprint as much as possible. The European Union works along these lines, with projects and initiatives towards a green transition to help achieve the proposed objectives: to be the first climate-neutral continent by 2050.

International organisations highlight the role of transport in a sustainable development economy to reduce the environmental footprint

DID YOU KNOW? THE CIRCULAR ECONOMY IN FIGURES

- 01 The Recovery, Transformation and Resilience Plan for Spain (PRTR) foresees that 40% of the funds will be directed to the "green transformation". Specifically, the Plan provides € 850M to support the implementation of waste regulations and the promotion of the circular economy.
- 02 All the Autonomous Communities have adopted regional strategies, roadmaps, or waste management plans for the promotion of the circular economy, as well as specific legislation with regards to the Circular Economy.
- 03 In the last 5 years, the EU has experienced some improvement in the efficient use of resources, although to a lesser extent than in the years following the economic crisis.
- 04 In 2019, the circular use of materials in Spain was only 10%. That is, only 10% of the total material requirements were met by recovered material. In the EU-27 this figure reached 12%.
- 05 The Circular Economy has the potential to create some 700,000 jobs in Europe, of which at least 10% could be generated in Spain.

Source: Cotec AND Ministry for the Ecological Transition and the Demographic Challenge.



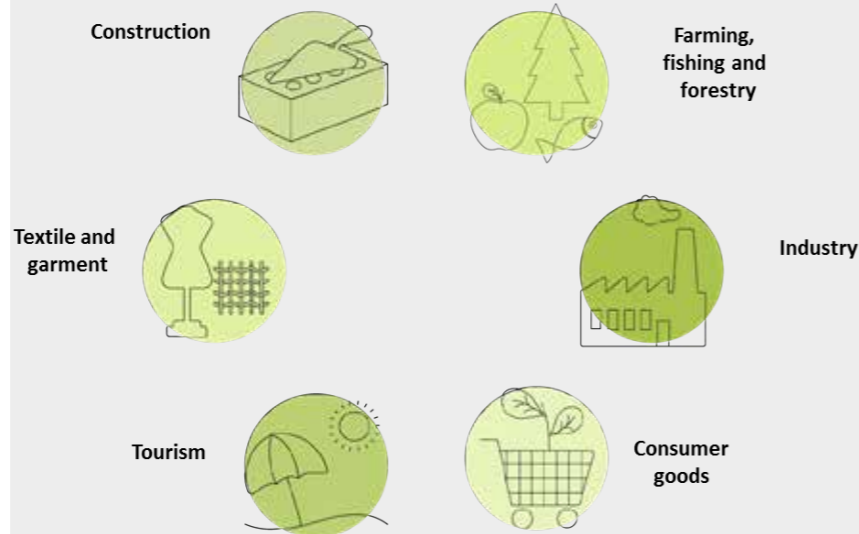
On transport alone, the EU estimates that a 90% reduction in transport-related greenhouse gas emissions is needed by 2050. And it is at this point that railway transport, the mode of collective transport with lower emissions per passenger, comes into play. It emits less CO2 per kilometre travelled, it produces less local pollution and congestion in urban areas, it uses less energy, and its energy is more efficient. Its many advantages from the environmental, structuring and capacity point of view make it key to face challenges such as climate change and the much-needed decarbonisation of transport, both of passengers and goods.

A clear advance for sustainability not only in the railway industry, but in the rest of the sectors, as well as in society as a whole, is the commitment to the Circular Economy, one of the pillars of the economic and environmental policy of the European Union. In addition to the benefits of a paradigm shift from a linear economy to another one where resources are kept for as long as possible, the circular economy has the potential to create some 700,000 jobs in Europe, of which at least 10% could be generated in Spain, according to data from the Ministry for the Ecological Transition and the Demographic Challenge (MITECO).

Indeed, this Ministry launched the Spanish Circular Economy Strategy 'Spain 2030' (EEEC), " which aims to leave behind the linear economy and promote a new model of production and consumption in which, in the Ministry's own words, "the value of products, materials and resources are kept in the economy for as long as possible, in which the generation of waste is minimised and where full use is made of waste whose generation could not have been avoided". "Meeting the challenge of achieving the transition towards the

Main activity sectors of the Spanish Circular Economy Strategy 'Spain 2030'

The Spanish Circular Economy Strategy identifies six (seven?) activity priority sectors in which to incorporate this challenge: construction, agri-food, fishing and forestry, industrial, consumer goods, tourism, and textiles and clothing. It also mentions the following policies as key to make progress in circular economy: economic; taxation; employment; R&D&I; consumption; industrial; water; agricultural, and development of rural areas.



Source: Ministry for the Ecological Transition and the Demographic Challenge.

circular economy requires the collaboration, participation and involvement of the whole society, not only of the Public Administrations, but also of all economic sectors (manufacturing, production, distribution and waste management), which must incorporate innovation as a key element for the achievement of the proposed objectives. Furthermore, the Strategy foresees that the social players and, especially, consumers and citizens, will play a central role", explains the Ministry.

This way, the EEEEC is a starting point to contribute to Spain's efforts to achieve a sustainable, decarbonised, resource-efficient, and competitive economy. With its sights set on

2030, the initiative was born with the following objectives:

- To reduce by 30% the national consumption of materials in relation to GDP, taking 2010 as the reference year.
- To reduce waste generation by 15% compared to what was generated in 2010.
- To reduce the generation of food waste in the entire food chain: 50% per capita reduction at the household and retail consumption level and 20% in the production and supply chains from 2020, thus contributing to the Sustainable Development Goals (SDGs).

La movilidad DEL FUTURO viaja en *tren*



Circular Economy and Railway

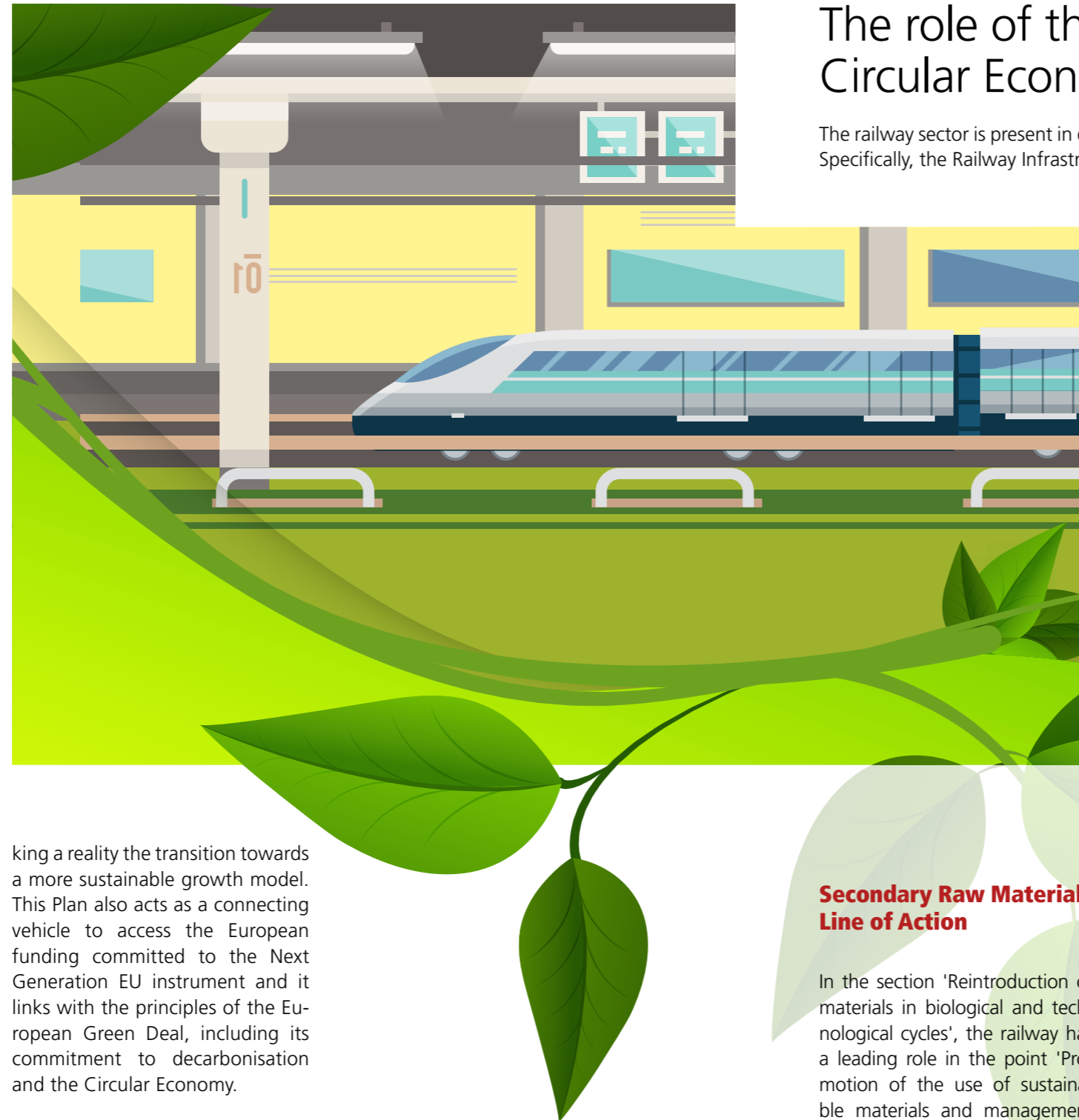


- To increase reuse and preparation for reuse to reach 10% of the municipal waste generated.
- To improve water use efficiency by 10%.
- To reduce the emission of greenhouse gases to below 10 million tons of CO2 equivalent.

These objectives, to be met by 2030, aim to respond to the following challenges: protection and improvement of the environment; preventive action; decarbonisation of the economy; the principle of "the polluter pays"; health protection; rationalisation and efficiency; cooperation and coordination between Public Administrations; public participation; sustainable development, solidarity between people and territories; integration of environmental aspects in the decision making; improving the competitiveness of the economy and generating quality employment.

The Spanish Circular Economy Strategy will be carried out through the implementation of different three-year action plans. The first of these, the First Circular Economy Action Plan 2021-2023 (CEAP 2021-2023), mainly includes the actions of the Central Government to make progress towards this new model.

Besides, the period of action coincides with the measures adopted for the recovery of economic activity after the crisis caused by COVID-19, where the Recovery, Transformation and Resilience Plan (PRTR) has become the instrument that articulates the set of reforms and investments aimed at facilitating an economic recovery. Such economic recovery must, among other matters, contribute to ma-



king a reality the transition towards a more sustainable growth model. This Plan also acts as a connecting vehicle to access the European funding committed to the Next Generation EU instrument and it links with the principles of the European Green Deal, including its commitment to decarbonisation and the Circular Economy.

La Estrategia Española de Economía Circular se llevará a cabo mediante diferentes planes de acción trienales. El primero, el I Plan de Acción de Economía Circular 2021-2023

The role of the railway industry in the Spanish Circular Economy Strategy

The railway sector is present in different sections of the First Action Plan within the Spanish Circular Economy Strategy. Specifically, the Railway Infrastructure Manager has collaborated with 6 initiatives within the different lines of action.

Consumption Line of Action

The Ecomilla Project is a commitment to sustainable mobility in urban environments that aims to promote intermodality and facilitate the door-to-door journey of the traveller to or from the station, and also for this route to be made with an energy-efficient means of transport with low CO2 emissions.

'Development of a catalogue of environmental and social criteria for procurement in the field of railway infrastructures'. ADIF is working on the creation of a catalogue with social and environmental criteria (lower environmental impact; water saving and efficient use of it, energy, and materials; environmental cost of the life cycle; generation and management of waste; usage of recycled, reused, or ecological materials; greater use of energy from renewable sources, reduction of GHG emissions, carbon footprint; etc.) to be applied during the different phases of the public procurement process. The objective? To facilitate the inclusion of good environmental and social practices in public procurement processes, and in line with the changes introduced by the new Public Sector Contracts Act.

'Comprehensive programme for the social recovery of disused railway assets, generating value through entrepreneurship or public service projects'. The objective of this point is to encourage reuse for them to re-enter the productive cycle of the more than 400 disused buildings that ADIF has, such as old stations or warehouses.

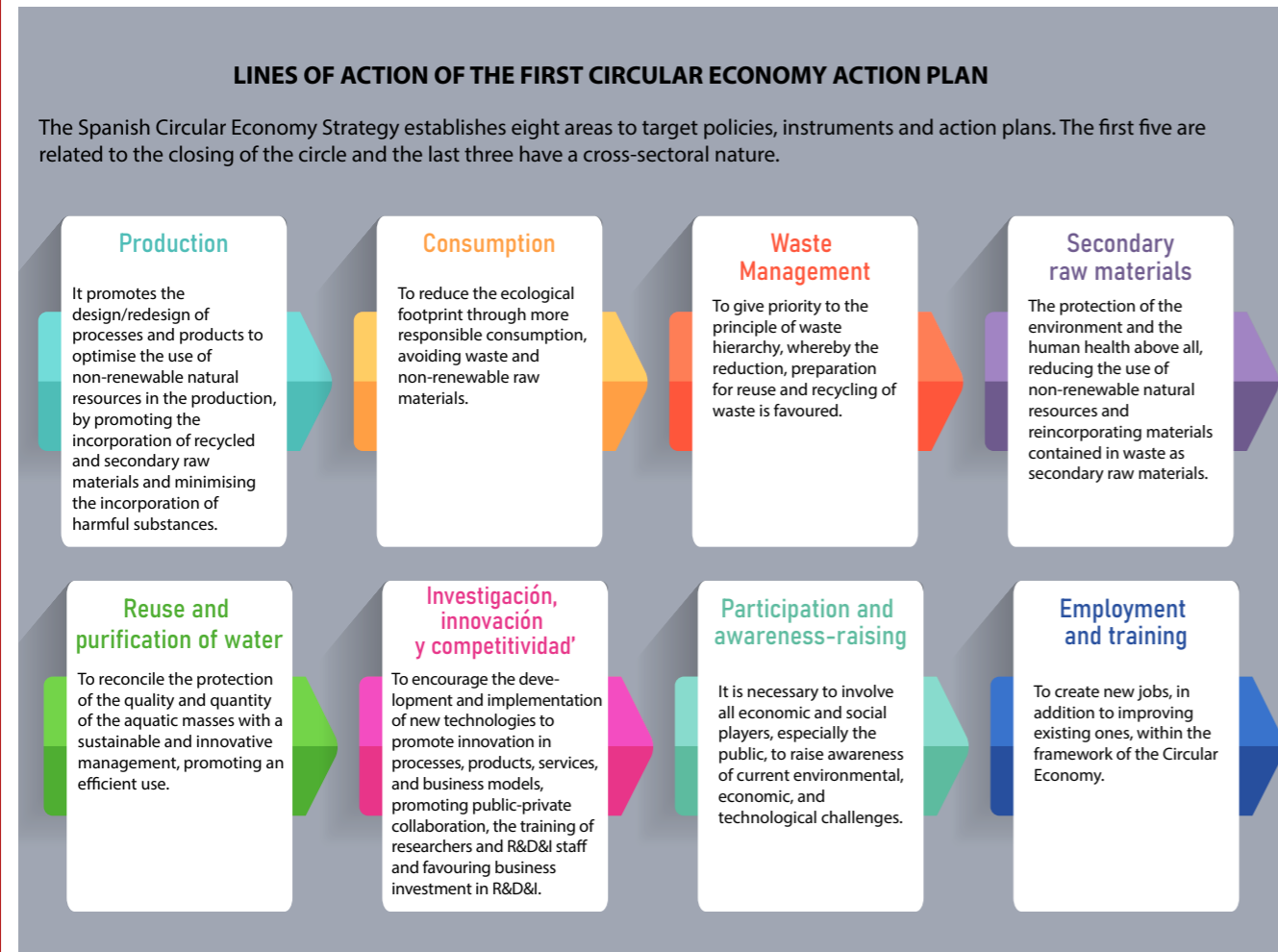
Waste Management Line of Action

Within the section 'Measures to improve the prevention and management of waste streams', there is talk of an effective management of surplus land from railway infrastructure works to favour the environmental recovery of degraded environments or their reuse in other works. Thus, it is explained that some works carried out by ADIF and ADIF Alta Velocidad generate a high volume of surplus land that cannot be used in the work itself and are considered construction and demolition waste. What this section wants to promote is the reuse of surplus land for the conditioning of degraded surfaces, in works of ADIF or a nearby environment, in accordance with Order APM/107/201720, thus contributing to savings and efficiency in the use of natural resources.

Along the same lines, there is another action to develop measures to increase the reuse of topsoil in the restoration and landscape integration work resulting from railway projects'. Thus, with the aim of using this topsoil, a slowly renewable natural resource, ADIF establishes a series of premises to be adopted according to the execution phase of the works, both in the construction projects of the railway infrastructure and in the environmental monitoring programmes of the works. This way, at the beginning of the works the existing topsoil will be collected from all the surfaces to be occupied by the works, either definitively or permanently. During the execution, these topsoil stockpiles will be kept in the appropriate conditions for their conservation. Following completion of the work, it will be reused for the restoration and landscape integration of the auxiliary areas.

Secondary Raw Materials Line of Action

In the section 'Reintroduction of materials in biological and technological cycles', the railway has a leading role in the point 'Promotion of the use of sustainable materials and management techniques in railway stations'. It indicates that the Railway Infrastructure Manager, Adif, "will promote that in the architecture projects of stations sustainable materials and management techniques be used based on the following requirements: use of proximity materials, use of recycled materials, use of recyclable furniture and materials, and that the wood or any forest product used must be certified".



Source: Ministry for the Ecological Transition and the Demographic Challenge.

On the other hand, and to comply with the objectives of the Spanish Circular Economy Strategy for the year 2030 and to position Spain as an international benchmark in the waste management, recycling and reuse, last March the Strategic Project for Economic Recovery and Transformation (PERTE) of Circular Economy was approved, an initiative proposed by the Ministry for the Ecological Transition and the Demographic Challenge (MITECO). The objective of PERTE is to accelerate the transition towards a more efficient and sustainable production system in the use of raw materials, as well as to increase the competitiveness of industrial sectors and business in general. Every productive sector has a place in PERTE, whose planned investment includes aid worth 492 million euros and with which it is expected to mobilise resources of more than 1.2 billion until

In March 2022, the Strategic Project for Economic Recovery and Transformation (PERTE) of Circular Economy was approved

2026. A large part of this amount of money will go to sectors that address sustainability challenges, such as textiles, plastics, and capital goods for renewable energies, as well as to promote eco-design, waste management and reuse, and the digitalisation of companies to improve competitiveness and innovation.

PERTE is focused on 2 lines of action that host 18 instruments of action. These lines are divided into actions on key sectors: textiles, plastics, and capital goods for the

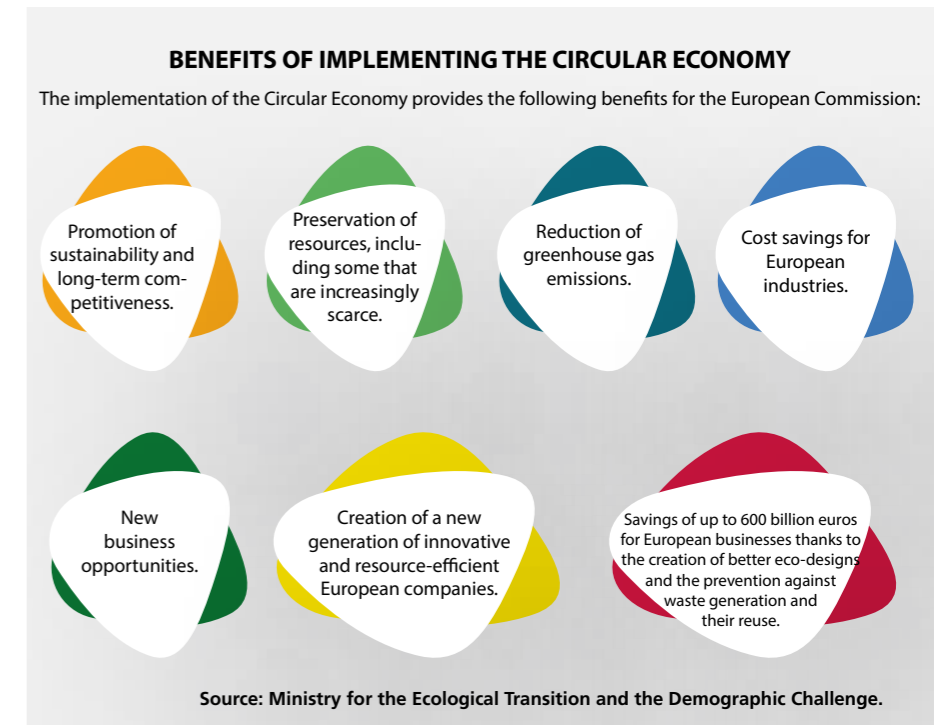
renewable energy industry. And cross-sectoral actions to promote the circular economy in business, which includes aid aimed at projects to promote the circular economy in any sector that requires support to complement its efforts.

On the other hand, initiatives with a wider scope of action also find in the Circular Economy an indispensable area of work. This is the case of the Safe, Sustainable and Connected Mobility Strategy 2030, es.movilidad, which will guide the actions of the Ministry

of Transport, Mobility and Urban Agenda (MITMA) in terms of mobility, infrastructure and transport in the next 10 years.

There are three pillars or basic principles that underpin the Mobility Strategy. Safety, to guarantee greater protection of people and goods, improving standards and reducing accidents; connectivity, understood from 3 aspects: digitalisation and technological progress, connectivity with Europe and the world and multimodal connectivity; and sustainability in the social, economic, and environmental areas, prioritising daily mobility, economic-social equity, energy efficiency, and the fight against climate change.

It is precisely in this third point where the circular economy has a place. This is because the promotion of



clean modes, climate resilience and universal mobility, together with the circular economy, play a prominent

role to minimise the contribution of passengers and goods transport to polluting emissions.



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Reuse Report:

Circular Economy applied to the railway sector

LA UNIÓN INTERNACIONAL DE FERROCARRILES (UIC) HA IMPULSADO EL INFORME REUSE, UN DOCUMENTO CON EL QUE HACE UN BALANCE DE LAS PRÁCTICAS DE GESTIÓN DE RECURSOS SOSTENIBLES EN EL FERROCARRIL EUROPEO PARA PROPORCIONAR UNA SELECCIÓN DE ENFOQUES PROBADOS Y ESTRATEGIAS QUE MEJORAN LOS RESULTADOS Y CON EL OBJETIVO DE REDUCIR EL IMPACTO MEDIOAMBIENTAL DE LAS ACTIVIDADES INDUSTRIALES FERROVIARIAS.

Among the outlined initiatives to promote the circular economy in the railway, the 'REUSE Report' stands out, a project of the International Union of Railways (UIC). It is a document in which the association takes stock of sustainable resource management practices in the European railway to provide a selection of

proven approaches and strategies that improve outcomes.

The context under which the report is drawn up is the foreseeable future scarcity of natural resources needed for railway undertakings, as well as the increase in their prices, which may change traditional business models and require new systems to manage waste, waste streams, end-of-life materials, and emissions.

Not surprisingly, if by 2017 a global use of natural raw material resources of almost 90 billion tons was expected, everything indicates that this figure could double before 2050. As indicated by the UIC itself, this increase is marked by population growth and consumption trends, with a shift in demand from renewable to non-renewable resources, towards new technolo-

gies, urban growth, and industrialism.

In this context, REUSE aims to provide an inventory of practices related to the sustainable use of resources and the circular economy, in order to:

- Help them anticipate future shortages and price increases

that could be very costly for railway companies.

- Reduce the environmental impact of industrial railway activities, reducing waste and pollution.

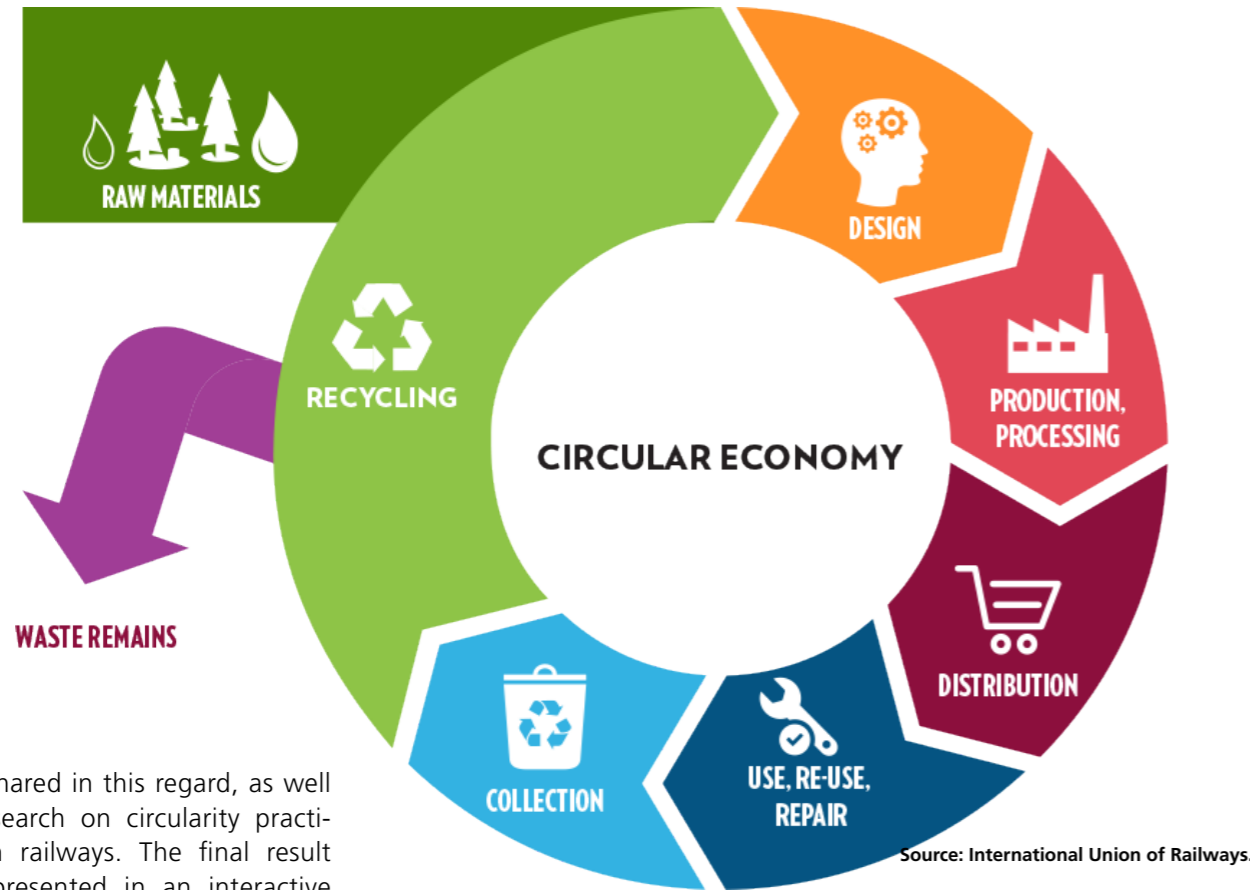
The 2-year project included a working group in which knowledge



Source: International Union of Railways.



This guide captures cost savings and innovative applications of Circular Economy principles to studies of real-life and proven cases in the European railway



was shared in this regard, as well as research on circularity practices in railways. The final result was presented in an interactive webinar (15th April 2021), and it includes a final report. During the seminar on circular economy practices in the sector, some 80 representatives (project partners, circular economy experts from the UIC, sustainability directors, external stakeholders) from 19 railway sector stakeholders based in 35 different countries around the world were brought together. The discussions provided an additional source of information that was included to complete the final report.

The final report, entitled 'REUSE: Circular practices in the railway and ways forward', is a user-friendly reference guide for UIC members that allows them to better understand circular economy concepts and strategies. Among other aspects, this guide to good practices captures cost savings and innovative applications of circular economy principles to studies of real-life and proven cases in the European railway. The report also highlights lessons and good practices that can be found in

REUSE emphasises that sustainability in transport goes beyond mobility itself; the impact of infrastructure construction and renewal activities also comes into play

other sectors and modes of transport.

One of the main points that REUSE emphasises is that, in terms of mobility sustainability, railway always tends to be compared to road, aviation and maritime transport and that studies focus on the environmental cost of moving people and resources from point A to B (i.e., air quality, CO2 emis-

sions, noise, water pollution...). "However, it is important not to ignore the impact of the underlying infrastructure construction and renovation activities due to the large amount of material used. Most emissions occur during the production of materials and therefore it is necessary to adopt a life cycle perspective to assess emissions from transport infrastructures," the document explains.

Good practices for the recycling of railway components

Based on the studies carried out, REUSE determines that the best practices of circular economy and recycling in the railway sector can be classified into four categories: material processing logistics; reuse and recycling for the main group of railway materials (ballast, sleepers, rails, and needles); rolling stock; and support materials (computer equipment, fluids, or clothing).



Materials for the tracks. Reuse and recycling for the main group of railway materials

This section includes best practices in the recycling and reuse of three major railway components.

- Ballast. Some of the ideas contained in the report, such as this one from DB, explain that "the ballast can be recycled and returned to the existing track network. Grains that cannot be reused are sorted and sold to be recycled elsewhere, for example as an aggregate in road construction.
- Sleepers. Among the examples of good practice, REUSE highlights the idea of TRAFIKVERKET, who "has obtained positive results from its process of acquiring sleepers 'Design, Bid, Build'. One case study included a procurement covering 400,000 sleepers a year. A clause in the tender called for a 20% reduction in emissions over the period 2018-2022, and although it did not explicitly indicate how the target should be achieved, it clearly established the requirement to use the LCA methodology. Preliminary results show a 26% reduction in CO2 emissions and a 14% reduction in costs. Following this good practice, all new projects with a budget of more than €5 million call for an 18% reduction in CO2 emissions compared to traditionally produced sleepers."

Rolling material

This is an element that, at first, was not addressed in the initial questionnaire of the project. However, the reuse and recycling of rolling stock was exposed by the participants as an important piece to achieve the objectives of circularity.

In addition to good practices such as sustainable procurement and improved product quality, interviewees pointed to another possible environmentally friendly approach: the dismantling and sale of all or certain parts of ageing rolling stock that is no longer suitable for renovation.

Material processing logistics

At this point, as specified in the report, it was important to establish as clear a division as possible between the concepts of reuse and recycling. Interviewees and participants argued that, although they knew well the fundamental differences from a theoretical point of view, in practice it is difficult to distinguish between the two. However, it is important to differentiate since "a completely different set of rules must be taken into account in the event that materials are recycled in some way or reused". In this respect, and since the materials must be inspected in detail, tested and, finally, assessed by experts, it must be verified that, even after the transformation, the materials are of the same quality as the initial raw materials. In this sense, the centralised collection of waste turns out to be an example of good practices.

Among the ideas highlighted in this section, these stand out:

- On the one hand, PRORAIL, which indicated "that it would be a good idea to have a common European market, especially for the smallest and most expensive specialised parts. Because as some elements are not standardised, even a small technical detail can make them incompatible and, therefore, unfit to be exchanged between countries."
- Meanwhile, SNCF RESEAU raised the issue of the organisation of construction and reconstruction in terms of location. Since transport is a contributing factor to both costs and environmental footprint, the centralised approach must be carefully planned during the design phases. It is necessary to carry out an inventory of the potentially reusable products in the donor project and, at the same time, identify the recipient projects that are close both geographically and temporarily."

Support materials (computer equipment, fluids, or clothing)

We are not wrong to state that railway companies are generally large organisations. Consequently, any action taken translates into an environmental benefit. In this sense, the participants in REUSE mentioned plastic as the most outstanding material. "The challenge of limiting the use of disposable plastics was particularly highlighted. Among the good practices worth mentioning are the request to purchase cleaning products with returnable containers, the replacement of water dispensers by drinking water sources, etc.

Another particularly important way to reduce single-use plastics is the abandonment of trilaminated banknotes. Irish Rail, for example, reported environmental savings of 5,319 kg of CO2 and cost savings of €70,000 per year with no impact on performance," the report explains.



At the forefront of Rail Solutions

ArcelorMittal Rails & Special Sections has rail production facilities in Poland, Luxembourg and Spain that offer a wide portfolio of products, covering rails for subways, trams, trains, light rails, crane rails, crossings and rail accessories. The company is a specialist in rails for high-speed rail networks, with over one million tonnes produced and is present in infrastructure projects in over 30 countries. Its high technologic quality allows ArcelorMittal to participate in the more demanding tenders all over the world.

ArcelorMittal's main trending topics for railway:

- **RailCor®** a new range of Corrosion Resistant Rails: a completely new range of corrosion resistant rails available in 4 specific solutions to meet the most demanding customer requirements.
- **Climate Action: XCarb™** will bring ArcelorMittal's reduced, low and zero-carbon products, steelmaking activities, wider initiatives and green innovation projects, into a single effort focused on achieving carbon neutral steelmaking.
- **R&D:** ArcelorMittal operates a dedicated rail research and development unit which includes pilot plants and prototyping facilities. Its Rail Excellence Centre also includes a dedicated welding unit which can provide advice and support for current and future grades for its customers.
- **Digitalisation:** ArcelorMittal Rails & Special Sections is extending its 4.0 transformation with the launch of several digital tools. New Rail Tool available.
- **Increasing the length of rails:** in order to provide further track safety, welding, track laying and maintenance cost savings.
- **Increasing the service life of rails:** with the most appropriate solution related to different applications; LCV (Low Carbon Vanadium) for tramway or new hardness grades for heavy haul rails.



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Circular Economy and Railway: materials and parts reused to promote sustainability

The main pillar on which the Circular Economy is based is 'the four R's: reduce, reuse, repair and recycle. The objective? To establish a circular cycle that avoids the waste of natural resources. With this pillar in the background, the commitment of the circular economy is to reuse materials when their useful life is exhausted, carrying out this re-

covery process in the most environmentally friendly way.

This philosophy in favour of caring for the environment has also come to the railway sector to stay. Materials, parts and even the use of surplus energy are some of the initiatives that are carried out in this regard.

Reused materials for railway sleepers

But not only train materials and products serve to give them another use, but certain products can be reused for the manufacture of railway elements. For example, railway sleepers through the use of tyre powder. An Italian company manufactures this type of sleepers 100% sustainable and manufactured with a mixture of 50% rubber from out of use tyres and 50% recycled plastic. For each kilometre of sleeper, up to 35 tons of tyres are reused, the equivalent of the rubber of 5,845 out of use tyres, so each kilometre of track involves an environmental saving of practically 192,000 Kg of CO₂, 61,300 litres of oil and 5,130,000 litres of water.

Reusable materials and parts

Throughout the two years of work of the Reuse Project, participants identified a series of products that have been made with used and recycled materials from different parts of the trains. In this regard, the report highlighted, among others: beach bags made with old train seat covers, ping-pong and football tables made with floors, stylish speakers made of broadcast speakers, tables made with the train boarding steps and furniture made of the train floors, desks and chess table made with floors and stirrups, planters made of dustbins or notepads, timesheets and lamps made of yellow travel information panels.

Reuse of surplus energy

In August of last year, the Railway Infrastructure Manager, Adif, received aid valued at 1.02 million euros from the Institute for Energy Diversification and Saving (IDAE), originating in the Energy Efficiency National Fund (EENF), for five reversible substation projects. With this economic boost, Adif has implemented a system to recover the energy from the regenerative braking of trains. The objective of the projects is to prevent the surplus energy generated by braking from being wasted, and to help its recovery so that it can be returned to the high-voltage electricity grid. This recovery has different advantages: energy savings, economic savings, and reduction of greenhouse gas (GHG) emissions, thus contributing to the fight against climate change.

Another example in this regard is the 'Ferrolineras' project, also by the Railway Infrastructure Manager. It is a system that uses the direct and alternating current railway networks to power the recharging points of electric vehicles, which will use the kinetic energy generated by the trains when braking and that would otherwise be wasted.

Metro de Madrid also works along the same lines. Also recovering the energy from the braking system of the convoys, the so-called reversible cells have been launched, electrical equipment that allows this braking energy to be reused and employed in auxiliary services of the stations or other types of facilities. Other uses include vending machines, fans, or escalators.

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Europe's Rail (EU-Rail)

Among the innovation and research programmes within the railway sector stands out Europe's Rail Joint Undertaking, the new European partnership for railway research and innovation established within the framework of Horizon Europe (2020-2027) and the successor to shif2Rail. The initiative has become the largest research programme in the railway sector within Europe, with funds reaching 1.2 billion euros (including a contribution of €600 million from Horizon Europe). The aim of this initiative is to support both the development of R&D projects such as the adoption and deployment of the different solutions generated as well as to offer, through an integrated system approach, "an integrated high-capacity, flexible, multimodal and reliable European Railway Network, removing obstacles to interoperability and providing solutions for full integration, for European citizens and freight", as can be read on the programme's own website. EU-

Rail will provide technological and operational solutions to lead the transformation of the railway sector, working towards Europe's dual green and digital transition.

In addition, Europe's Rail will support the application of much more flexible approaches to railway service traffic planning and management. "Through the development of cutting-edge technologies designed to be implemented across the EU rail network, EU-Rail will help increase capacity and support smart and cost-effective railway connectivity, key to future sustain-

able mobility systems. EU-Rail's results are expected to help improve the efficiency of the railway system and reduce overall life cycle costs, even on least used lines. This will be achieved contributing simultaneously to a more sustainable transport and mobility system", they explain from the project.

The project has a large Spanish participation among the 25 founding members, such as the Railway Infrastructure Manager (Adif), Construcciones y Auxiliar de Ferrocarriles (CAF), Talgo, Indra, Ceit Centro Tecnológico or CEMOSA.

Europe's Rail is the successor to Shif2Rail. The initiative has become the largest research programme in the railway sector in Europe



THE SPANISH RAILWAY INDUSTRY AND ITS COMMITMENT TO THE CIRCULAR ECONOMY

► SIEMENS

From Siemens Mobility, in our commitment to rail as the backbone of present and future mobility, we believe that the circular economy should be a fundamental pillar to achieve our sustainability goals, since, by applying its principles, we can extend our products' lifecycles by focusing on repairability, reusability, or refurbishment.

Likewise, aware of the limited availability of natural resources, we strive for their efficient use throughout the value chain and develop eco-efficient solutions with the aim of decoupling economic growth from resource consumption. In short, our eco-design principles aim to increase the efficiency of materials, the proportion of



recycled materials and avoid the use of toxic materials. An example of the application of these would be the production of complex spare parts through 3D printing,

which allows us to improve material efficiency and product weight while applying the concept of circularity and reducing the carbon footprint.



► IDOM

Rethinking, reducing, reusing, recycling and recovering resources are the principles that IDOM uses in its railway designs.

Rethink. This is the case of the Lund tram (Sweden) where, instead of approaching drainage from a conventional perspective, IDOM went further by designing with the philosophy of sustainable drainage.

Reduce, reuse, recycle. Based on criteria of Near Zero Energy Building (nZEB), IDOM's design for the Odense tramway (Denmark) depot, workshop and office building stands out.

Recover. For high-speed and rapid transit projects (Rail Baltica or the DART in Dublin, Ireland) and metro projects (MRT4 Manila in the Philippines, Metrolink in Dublin, Metro Santiago in Chile), IDOM designs and sizes networks for regeneration of energy between lines, as well as on-board storage systems on vehicles or reversible substations.

► URETEK

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Geoplus® resins have a long service life, which allow us to collaborate with

the circular economy. Furthermore, our system helps to preserve the existing structures avoiding their replacement.

In this way we avoid the use of new materials, lengthening the life of existing materials.



THE SPANISH RAILWAY INDUSTRY AND ITS COMMITMENT TO THE CIRCULAR ECONOMY



► ALSTOM

The solutions developed by Alstom are conceived with a focus on sustainability throughout the entire life cycle, from the choice of raw materials and the manufacturing process to their operational efficiency, with special emphasis on reducing energy consumption, waste reduction and final recycling.

Alstom began more than a decade ago to introduce eco-design criteria in engineering processes to reduce the environmental footprint of its solutions. Today, more than 100 experts (eco-designers, acoustics and materials experts, energy engineers, etc.) are dedicated to ensuring the best environmental performance for each solution.

Weight, for example, has been drastically reduced in recent years thanks to the redesign of parts, and the use of new composite materials has enabled Alstom to develop components with longer service life. Recycling of end-of-life equipment has also increased. Progress in this area has enabled Alstom to design trains that are 95% recyclable and 97% recoverable.

► AMURRIO

The BIRHAKOM project, launched by AMURRIO FERROCARRIL Y EQUIPOS in 2019, investigates the recovery of foundry sand and its regeneration through a joint composting process with pruning

remains and manure from nearby farmhouses.

The result is a material that can be used as an agricultural fertilizer or as a high value-added filler material in geother-



mal installations.

BIRHAKOM is an acronym for "birziklatu harea kompos", "recycle sand compost" in Basque. A descriptive name for a project whose ultimate goal is to recycle sand by composting, preserving the environment, reducing the use of raw materials and seeking ecological and sustainable solutions.

The project thus promotes the circular economy, following a model in which waste becomes a resource at the end of the product's useful life.

BIRHAKOM is subsidized by the HAZITEK aid program of the SPRI, with the collaboration of TECNALIA as a subcontracting center and technological partner.

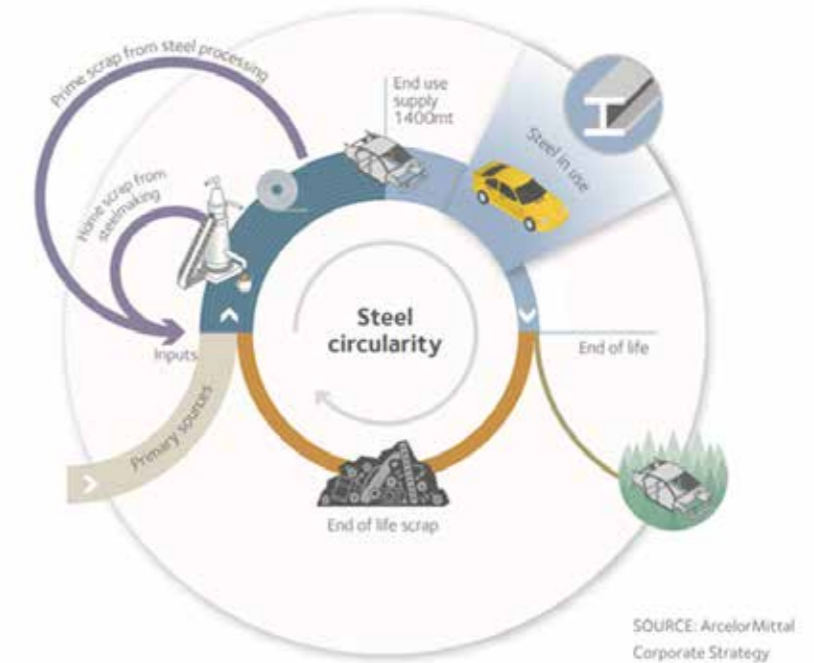
AMURRIO is the first company in the Basque Country to recycle foundry sand by composting.

► ARCELOR

As the leading global steel company, we are engaged in the most important challenge faced by the industry – that of producing all the steel the world needs in an environmentally sustainable way.

ArcelorMittal Europe has committed to reduce CO2 emissions by 35% by 2030, with a further ambition to be carbon neutral by 2050, in line with the EU's Green Deal and the Paris Agreement. XCarb™ is the new brand name for ArcelorMittal's ongoing global programme of steelmaking innovation targeted at carbon-neutral steel by 2050. The initiatives that are part of XCarb™ aim to reduce the carbon footprint of ArcelorMittal and of our customers.

Steel's circular advantage as a permanent material – and one that is infinitely and fully recyclable with no loss of quality in most cases – steel is an important material



group and fundamental to achieving a truly circular economy. Today, already 85-95% of steel reaching its end of life is re-melted to

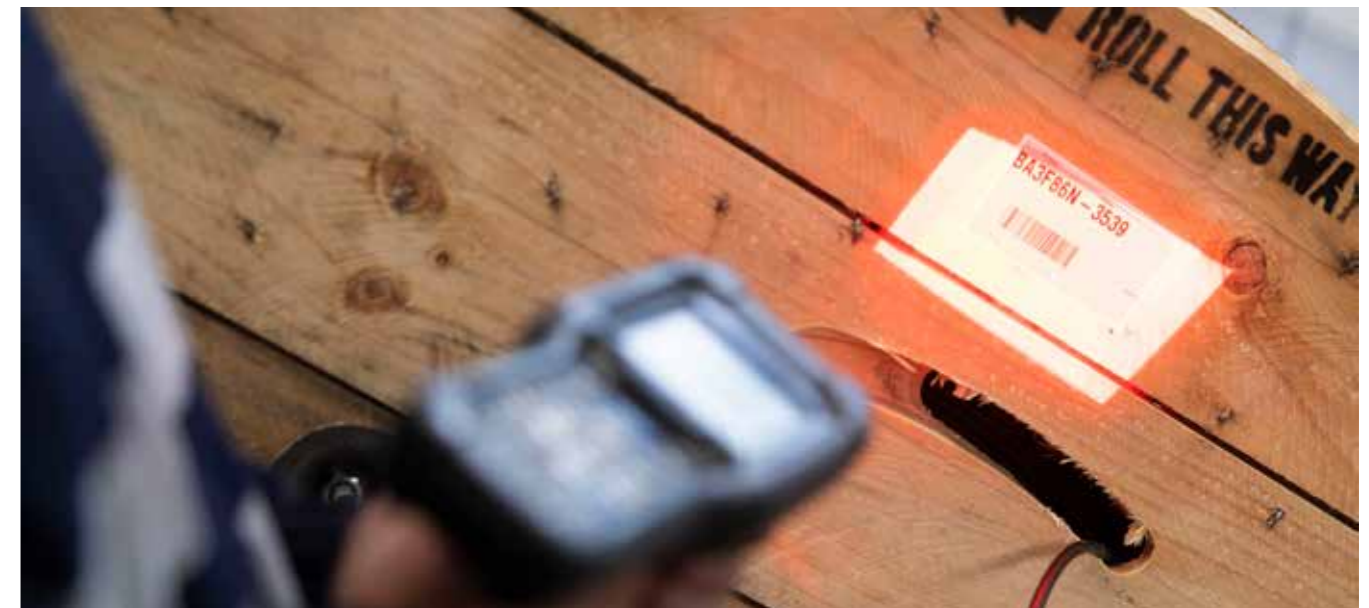
produce new steel products. These circularity credentials are unmatched by the other key material groups.

► CABLESCOM

Currently, the stakeholders interacting with companies, including customers, the Administration and society, demand and expect the industrial sector to embrace the principles of sustainable development. At Cablescom, we assume these principles, committing to a growth model based on Circular Economy:

- Prioritising the return and reuse of containers and packaging sent to customers, extending their lifespan and therefore reducing the generation of waste.
- Recovering plastic waste from packaging of raw materials or generated in the production process, reincorporating them as reinforcement materials in the

- construction of the cable.
- Measuring the environmental footprint of our products to detect the most critical elements on which to take action. To this end, we have certified different types of cables by means of Environmental Product Declarations, in accordance with ISO 14025.



THE SPANISH RAILWAY INDUSTRY AND ITS COMMITMENT TO THE CIRCULAR ECONOMY



CAF
CAF, in its firm commitment to the environment, offers sustainable mobility solutions with great added value for its customers

The railway plays an essential role in the fight against climate change as it is the mode of transport with the lowest emissions per passenger. In addition, it stands out for its high capacity efficiency as it can

transport a large number of people with low impact.

CAF, in its firm commitment to the environment, offers sustainable mobility solutions with great added value for its customers. Thanks to constant investment in innovation, the company has developed different solutions in the field of recoverability and recyclability of materials, energy recovery

and storage technologies, and energy efficiency, among others.

In this context, hydrogen has gained relevance in the decarbonisation of transport. CAF participates in the European Commission's FCH2RAIL project for the development of a hydrogen-powered railway prototype.

COMSA
COMSA Corporación collaborates in the RE-PLAN CITY LIFE project, focused on the use of Recycled Tyre Materials (RTM) within the framework of the Circular Economy.

Through the RE-PLAN CITY LIFE project, the viability of the projects Neoballast, aimed at the development of high-performance ballast by means of a covering made up of a binder plus rubber particles from end-of-life tyres, and Ecotrack, which aims to demonstrate the technical and commercial viability of the use of end-of-life tyres for recycled rubber sections and their production process, is being studied.

RTMs are not used to produce tyres, but to produce materials such as rubber, steel fibres and textile fibres. In this sense,

the aim of the RE-PLAN CITY LIFE project is to raise awareness of the use of end-of-life tyres in the public sector: roads,



railways, street furniture, building and construction, sports and leisure facilities, as well as public works in general.



STADLER
Stadler promotes green technology and advances the development of its vehicles and services in this direction

By offering innovative, long-lasting transport solutions, we contribute to the sustainable mobility of the future and generate value for

future generations. Stadler promotes green technology and advances the development of its vehicles and services in this direction. Environmental management also includes a life cycle perspective. The sparing and careful use of natural resources is an integral aspect of our company philosophy and our processes. For years the company has been taking

into account the principles of eco-design, whose aim is to design trains that have the minimum environmental impact in all phases of the life cycle, evaluating the following aspects:

- Upstream: Material and energy consumption (including transport)
- Vehicle manufacture: including energy consumptions, auxiliary materials and waste
- Downstream: Vehicle operation and maintenance and its subsequent disassembly and disposal

Stadler takes a circular-economy approach: Starting during vehicle construction, we aim to avoid specific material combinations in parts in order to simplify the disassembly, sorting and disposal processes for these materials at the end of the product's lifespan. This allows these materials to be reused in excellent condition.

THALES
Thales develops complex artificial intelligence (AI) systems that promote eco-responsible AI based on learning and knowledge and consume less energy.

Driver assistance systems (GreenSpeed™), traffic management systems (TMS) and systems to manage the automatic operation of metros (GreenCBTC) and autonomous trains (RailBot™) optimise energy consumption through carefully defined driving strategies and by calculating optimal acceleration and braking profiles in real time.

Anticipating incidents on the network is also an important factor in reducing unplanned train stops caused by obstacles on the tracks. Equipped with high-performance connected sensors, a train will be able to detect any obstacles on its own or parallel tracks, helping to save energy.

Station monitoring systems will analyse energy consumption in real time. Its sensors will determine the exact energy needs based on passenger flows.





CARLO BORGHINI | Europe's Rail Executive Director

“The amount of investment achieved in Spain to improve and enlarge its infrastructure can give an idea of the growth experienced in the last thirty years”

Mafex Magazine: Europe makes a firm commitment to sustainable, connected and digital mobility. In this shift of model, investments in R&D are also prioritised. The launch of Europe's Rail Joint Undertaking, successor to Shift2Rail, is a good example of this. Will this project mark new forms of participation and financing of railway research and innovation for the next seven years?

Carlo Borghini: The Shift2Rail Joint Undertaking was created to improve railway systems in Europe through cutting-edge research and innovation, co-funded by the sector. The launch of Europe's Rail is the proof of the engagement of the EU and the rail community to renew this partnership and continue to work actively on removing existing barriers to the creation of the Single European Railway Area. The activities of EU-Rail are set to support the railway sector in accelerating its contribution to the European Green Deal, the Sustainable and Smart Mobility Strategy and the Fit for 55 Package, in a context of recovery from the effects of the COVID-19 pandemic.

The objective of the new Joint Undertaking, EU-Rail, is to deliver a high-capacity integrated European railway network by eliminating blockers to interoperability and providing solutions for full integration, covering traffic management, vehicles, infrastructure and services, aiming at faster uptake and deployment of projects and innovations, approaching this challenge through 3 main pillars completing each other and covering the system approach, innovation and deployment.

With a significant increase comparing to Shift2Rail's budget, estimated at almost 50% excluding the funding absorbed by UK entities under the previous programme, EU-Rail started officially on 30 November, for a period of ten years, with a total amount of activities of EUR 1.2 billion to be delivered by its Members and other stakeholders under Open Calls, funded by EU-Rail with the resources provided by Horizon Europe up to EUR 600 million

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Mafex Magazine: What is your assessment of S2R since this initiative was launched? Does the pooling of participants manage to accelerate innovative technological developments? What fields does it cover and what do you think are the most significant advances that can be achieved?

Carlo Borghini: S2R has supported an unprecedented convergence of the rail sector. The recognised work achieved by Shift2Rail so far is shown through the different technological results from the Innovation Programmes (IPs).

For example, the IP1 has made progress in traction elements that reduced the consumption of energy. In IP2, the ATO GOA2, and adaptable train communications are only a few of the results that once deployed will have a major impact on the sector. On the freight side, the Digital Automatic Coupler (DAC) is a key result and a great example of how important Research and Innovation is for the railway sector. DAC is considered an enabler of a fully digital rail freight in the future. And, with regard to the passenger experience, the interoperability framework for IP4, for integrated ticketing inter alia.

Europe's Rail will focus on developing the new technological and operational solutions to deliver the railway system meeting the expectations of the Sustainable and Smart Mobility Strategy. The Strategy aims to double high-speed rail traffic by 2030 and, double rail freight traffic by 2050. For this to become a reality, rail needs to transform itself, re-invent itself, leverage its strengths – rail being a land guided system, iron on iron – and cost effectiveness. This transformation process shall be driven by the rail sector with an integrated system approach, involving technologies, operations but also the staff working in the rail system and its training to new functions and roles.

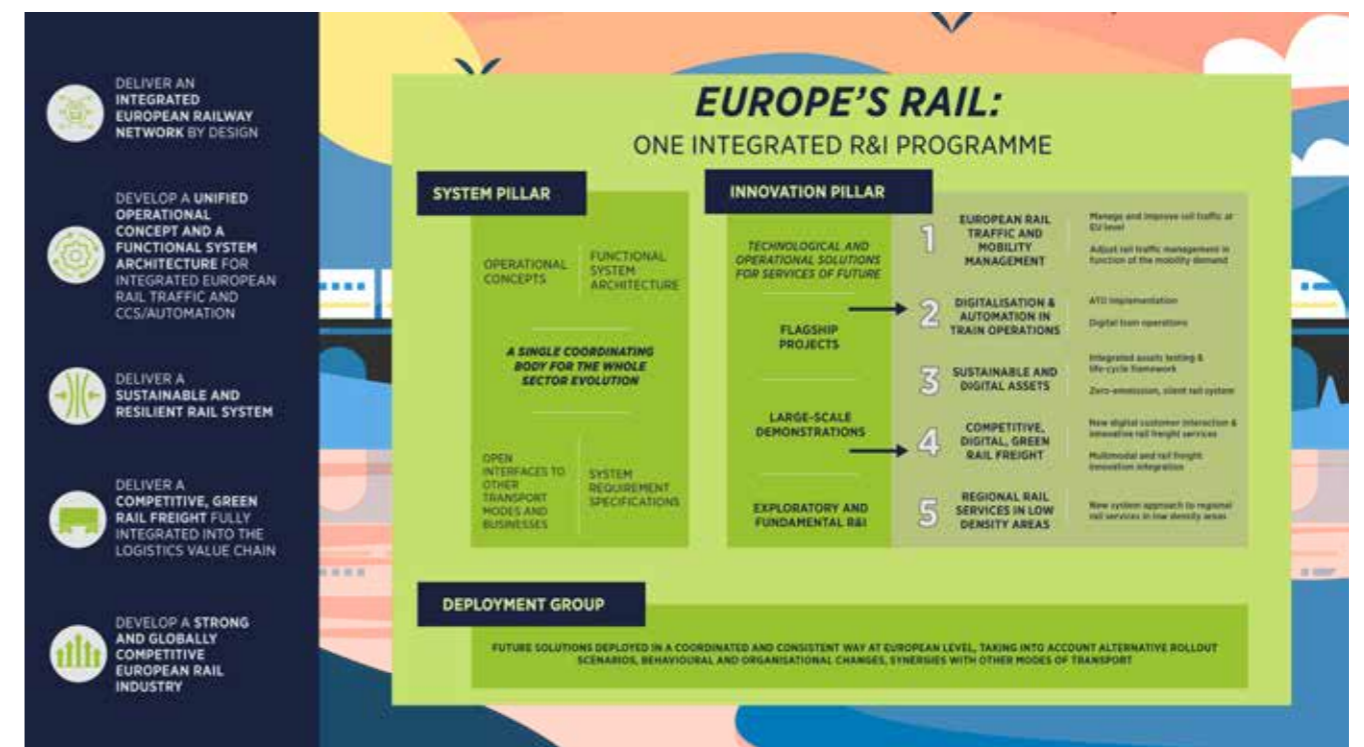
I am looking forward to receiving applications from a variety of entities eligible under Horizon Europe, ensuring that we have an open and inclusive programme, bringing together the research community, SMEs, operators, infrastructure managers and suppliers.

Digitalisation and automation are key enablers of such transformation and are at the heart of EU-Rail as they are expected to contribute to substantially increasing the performance of rail and creating opportunities for the deployment of future proof technologies. This transformation aims to deliver new rail services to its clients – passengers and business – while attracting new ones.

Mafex Magazine: How many projects are currently part of Europe's Rail? What can you emphasise about them?

Carlo Borghini: Europe's Rail has only started. We have just closed our first

Deployment Group



Call for Proposals and we anticipate a high level of participation. Another Call for Proposals covering exploratory research and other activities, will be launched in September, as already announced in the Work Programme, and applications accepted till year end 2022 indicatively. This is expected to be followed by other calls on a yearly basis.

To deliver on its objectives, Europe's Rail has identified five key areas covering European traffic management, improving the digitalisation and automation of train operations, financing research on improving sustainable assets, and crucial to the green transition, breaking down existing barriers that undermine the performance of rail freight. A fifth key area will contribute to connecting regions in Europe revitalising lines at risk of dismissal.

Mafex Magazine: Recently, the call for proposals for research and innovation activities Europe's Rail 2022-1 was published, in which projects worth 390 million euros are expected to be financed. What are the expectations for this call and what were the objectives of its launch?

Carlo Borghini: Our first Call builds upon the results of the Shift2Rail Programme, to reach high TRL levels, paving the way to the deployment of innovative operational and technological solutions in the areas of European rail network management,

automation and digitalisation of rail operations, sustainable and resilient systems, rail freight in the supply chain perspective and regional and capillary lines.

I am looking forward to receiving applications from a variety of entities eligible under Horizon Europe, ensuring that we have an open and inclusive programme, bringing together the research community, SMEs, operators, infrastructure managers and suppliers. The next five years will be critical to achieve large scale demonstrations of key solutions, in view of their deployment. Geographical coverage, gender balance, equity creation, synergies, openness are all elements underpinning the Call and its destinations.

Mafex Magazine: Among the founding members of Europe's Rail JU there is a large presence of Mafex members such as Alstom, Caf, Ceit, Indra, Talgo, Thales, Siemens and voestalpine Railway Systems, in addition to the Railway Infrastructure Manager, Adif. What can you tell us about their contribution in advancing this programme?

Carlo Borghini: MAFEX knows about the potential and capabilities of these enterprises and how the work developed within Research and Innovation has boosted their businesses. The EU Rail JU is the perfect ecosystem to share knowledge and work on common endeavours to make the

best out of the innovative solutions to be implemented in the railway sector. At the end, it will be up to the Members to promote and contribute to the market uptake of industrial and operational solutions developed together.

Mafex Magazine: How can Spanish industry contribute to the railway sector? What opportunities do you think exist for the Spanish industry?

Carlo Borghini: Spain, as many of other EU MSs has a large railway tradition. The amount of investment achieved in Spain, not only to improve the infrastructure and enlarge it to the point of making it the largest HS Network in Europe, can give an idea of the exponential growth experienced in the last thirty years in Spain.

That experience is with no doubt one of the main assets to contribute with. And not only this, we also need to think of the improvements to be done when trying to move goods by rail and the better use of regional lines. These topics will have a core importance in the EU Rail Programme and, to the benefit of all (society, industry, internal and external customers). The contribution on these matters coming from the railway stakeholders will be crucial for the success of the Programme.

Mafex Magazine: In mid-2022, and in a global context where the pandemic is still present two years later and the war in Ukraine, what do you think are the challenges currently facing the railway sector in Europe?

Carlo Borghini: More than ever rail can play a crucial role as the backbone of the European Economy. Last year, the European Year of Rail has boosted the attention to the rail sector, and it is now the moment to capitalise on this momentum to deliver and make rail the mobility lifestyle of passengers, the transport choice of logistic.

Within the framework established in the Single Basic Act, the Call is designed to attract applicants from the research and innovation value chain, while complying with the stringent legal requirements to materialise a leverage effect of the resources invested.



Find out more about all the activities and services we have prepared for 2022 to promote Internationalization, Competitiveness and Innovation.

mafex@mafex.es | 00 34 944 706 504

30 years of High-Speed in Spain

HIGH-SPEED IN SPAIN HAS TURNED 30 YEARS OLD IN 2022. IT WAS ON 21ST APRIL 1992 WHEN THE FIRST AVE TRAIN BEGAN ITS JOURNEY IN OUR COUNTRY. SPECIFICALLY, BETWEEN THE CITIES OF MADRID AND SEVILLE. THREE DECADES LATER, THIS HIGH-SPEED ROUTE HAS PLACED SPAIN AS A GLOBAL BENCHMARK WITHIN THE RAILWAY SECTOR.

Around 3,700 kilometres of network length place Spain at the head of high-speed in Europe and in the second position worldwide, only behind China. 30 years ago, when the first high-speed journey between Madrid and Seville was made, Spain had 18 trains and 470.5 kilometres of line connecting five cities – (sólo se enumeran cuatro): Madrid, Ciudad Real, Cordoba and Seville. The investment made for the largest railway engineering work

up to that time exceeded 3.2 billion euros.

With this high-speed launch, Spain became the fourth country in the world to bet on this transport system, after Japan (Tokyo-Osaka, 1964), France (Paris-Lyon, 1981) and Germany (Hannover-Würzburg, 1991).

Now, three decades later, the numbers have multiplied exceedingly

En 1992, España se convertía en el cuarto país del mundo en apostar por la alta velocidad

MAIN MILESTONES OF THE SPANISH HIGH-SPEED

- ▶ **APRIL 1992**
Madrid – Seville HSL
- ▶ **OCTOBER 2003**
Madrid - Zaragoza - Lleida (Madrid - Barcelona - French border HSL) Stretch
- ▶ **DECEMBER 2003**
Zaragoza – Huesca HSL
- ▶ **NOVEMBER 2005**
Madrid – Toledo HSL
- ▶ **DECEMBER 2006**
Córdoba - Antequera (Córdoba – Málaga HSL) Stretch
- ▶ **DECEMBER 2007**
Lleida - Camp de Tarragona (Madrid - Barcelona - French border HSL) Stretch
- ▶ **DECEMBER 2007**
Madrid - Segovia – Valladolid HSL
- ▶ **DECEMBER 2007**
Antequera - Málaga (Córdoba – Málaga HSL) Stretch
- ▶ **FEBRUARY 2008**
Camp de Tarragona - Barcelona (Madrid - Barcelona - French border HSL) Stretch
- ▶ **DECEMBER 2010**
Figueras - Tunnel of Pertus and Nudo Mollet - Girona (Madrid - Barcelona - French border HSL) Stretches
- ▶ **DECEMBER 2010**
Madrid - Cuenca - Albacete - Valencia (Madrid - Castilla la Mancha - Valencian Community - Murcia Region HSL) Stretch
- ▶ **DECEMBER 2011**
Ourense - Santiago - A Coruña (Madrid - Galicia HSL and Atlantic Axis HSL) Stretch
- ▶ **JANUARY 2013**
Barcelona – Figueras (Madrid – Barcelona – French border HSL) Stretch
- ▶ **JUNE 2013**
Albacete - Alicante (Madrid - Castilla la Mancha - Valencian Community – Murcia Region HSL) Stretch
- ▶ **SEPTEMBER 2015**
Valladolid-Palencia-León Stretch
- ▶ **DECEMBER 2015**
Olmedo-Zamora Stretch
- ▶ **JANUARY 2018**
Valencia-Castellón (Madrid - Castilla La Mancha - Valencian Community – Murcia Region HSL) Stretch
- ▶ **JUNE 2019**
Antequera Santa Ana-Granada Stretch
- ▶ **JANUARY 2020**
Vandellós – Tarragona Stretch (Mediterranean Corridor Connection with Madrid – Barcelona HSL)
- ▶ **OCTOBER 2020**
Zamora – Pedralba de la Pradería (Madrid – Galicia HSL) Stretch
- ▶ **FEBRUARY 2021**
Monforte del Cid - Elche / Orihuela (Madrid - Castilla la Mancha - Valencian Community – Murcia Region HSL) Stretch
- ▶ **DECEMBER 2021**
Pedralba de la Pradería - Ourense (Madrid – Galicia HSL) Stretch

Source: Adif

and there are already more than 200 trains circulating on the 13 high-speed lines that connect 67 cities. The total track stands at 3,726 kilometres, which allow around 68% of the Spanish population to benefit from this network. During all these years, more than 350 million travellers have used these services. Of these, around 267 correspond to the users of the AVE and Avant services and about 90 million to those of the variable gauge services, which allow to use, without transfers, the two types of track existing in Spain.

The first high-speed line placed Spain on the international scene and meant a transformation at a technological and industrial level. Nowadays the Spanish industry is a global benchmark in terms of infrastructure, innovation, and sustainability, having imported its know-how to countries around the world. In fact, the Spanish railway industry faces a world leadership in terms of competitiveness and prestige. A fact that is demonstrated in the contribution that Spanish companies are making in hundreds of projects inside and outside our borders.



Source: Adif

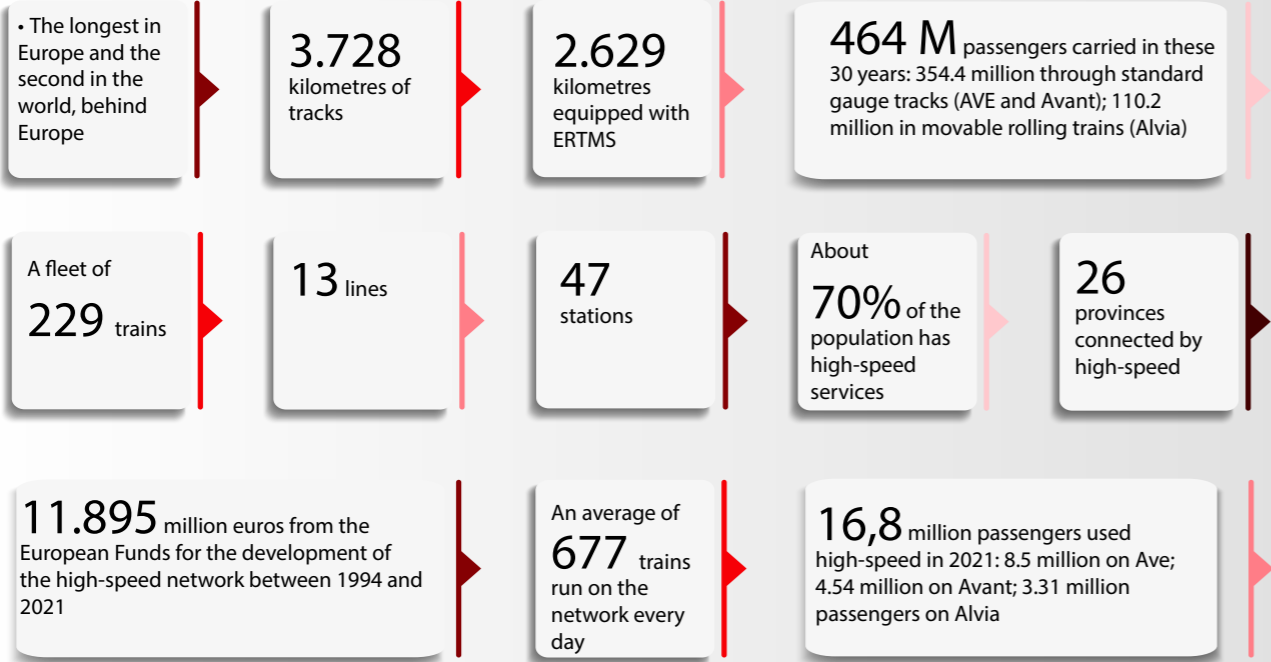
According to the OECD, Spain is among the top 10 countries and the high-speed network is a benchmark, an example to be followed by many countries. It is, in short, one of our best cover letters and

it places the Spanish industry us at the forefront of the sector at an international level. And, according to Pedro Fortea, General Director of Mafex, “in addition to revolutionising the Spanish transport market, the implementation of high-speed in Spain accelerated and consolidated the development of a powerful railway industrial fabric that today is solidly based on three main pillars: innovation, internationalisation, and the knowledge and skills acquired.

This specific knowledge resulted initially from the integration of different technologies, some of them from other European countries, but integrated thanks to Spanish engineering and construction companies. Little by little we were consolidating the existing industry at that time, and increasingly developing our own national business fabric, until placing ourselves in the pre-

La primera línea de alta velocidad colocó a España en el panorama internacional y supuso una transformación a nivel tecnológico e industrial

HIGH-SPEED IN FIGURES:



sent where we can boast of being one of the few countries in the world with a leading industry in the railway design, manufacture of rolling stock, signalling, construction, operation, and maintenance". This good work of the Spanish railway industry is evident in the fact that it is present in the most relevant high-speed projects in the world, in

countries such as the United States, the United Kingdom, Turkey or Saudi Arabia, among others.

The construction of the new high-speed infrastructures currently existing in Spain has involved the investment of more than 50 billion euros. The main milestone achieved? The connection of the terri-

tory, uniting numerous cities from centre to centre and promoting development and a more sustainable mobility. Not surprisingly, 26 provinces currently have high-speed services, which represents 57.9% of the total area of Spain. On average 677 trains run every day and more than 31 million people enjoy their benefits.



Railway Traction

IMAGINING THE MOTION



INGETRAC Traction converters are based on the smart integration of proven Power Modules (BPM) and a configuration adapted to the vehicle's needs.

At Ingeteam, we imagine vehicles in motion, and we are ready to successfully address any challenge related to rail vehicle traction.

INFRASTRUCTURE

High-Speed Line Madrid-Seville

The Madrid-Seville high-speed line, which with its 470.5 kilometres of track made it the longest high-speed line in Europe at the time, was the largest railway engineering work carried out in our country until then. It was put into service on 21st April 1992, the same day that Expo'92 opened its doors to the public. In addition to the arrival of high-speed in our country, the Madrid – Seville line meant the roll out of a transport system that has transformed mobility in a way that, 30 years ago, seemed inconceivable. It has undoubtedly meant the total transformation in the way users travel.



Stretch of the high-speed line between Madrid and Seville.

There were many challenges that had to be faced for its construction:

- The decision to implement the European track gauge, which made it necessary to modify and complete the original project to circumvent the Pass of Despeñaperros.
- The facilities were another giant leap due to the innovative approach with which they were designed:
- Electrification. The challenge was defined by the increase in speed, which marked the need to optimise energy capture, meaning that light catenaries were required. For the first time in Spain, a voltage of 25 kV was installed in alternating current, compared to that of 3,000 V in direct current of the Spanish railway. Finally, the Re-200 catenary, employed in Germany for high speed, was used.
- Signalling. For the first time, side signals were dispensed

La línea Madrid-Sevilla fue la mayor obra de ingeniería ferroviaria llevada a cabo en España hasta entonces

with on the track and the control and management of the entire line was carried out in an automated and centralised way from the Atocha Control Centre, in Madrid. The LZB system was also imported from Germany.

- Automated and centralised circulation management system. Through this system, the Control Centre has memorised the route and characteristics of the line and, as Adif states, "through a cable laid on the route and the electronic interlocks (a total of eight along the line), it receives information about the circulation, processes it and sends to the train's driving cab the necessary indications for its circulation, among others, the speed."

- Communications system. The line was equipped with an advanced communications system, whose focal point is the fibre optic cable laid along the tracks, integrated by a train-ground telephone system. The Madrid-Seville high-speed line was the origin of the current system.

This high-speed line brought with it the development of other technologies of its own. Among them, Da Vinci, an advanced integrated railway traffic management system. Developed by the Railway Infrastructure Manager, Adif, it allows remote and centralised control and management of all the systems and facilities of the railway lines. This technology has since been imported into many other markets, such as the London and Medellín underground networks, and the railway

networks of Morocco and Lithuania.

In 1992, and according to Renfe data, more than 1.17 million passengers used high-speed services from the day of the line's roll out until 31st December, with a monthly average of 164,000 passengers.

Refurbishment of the line

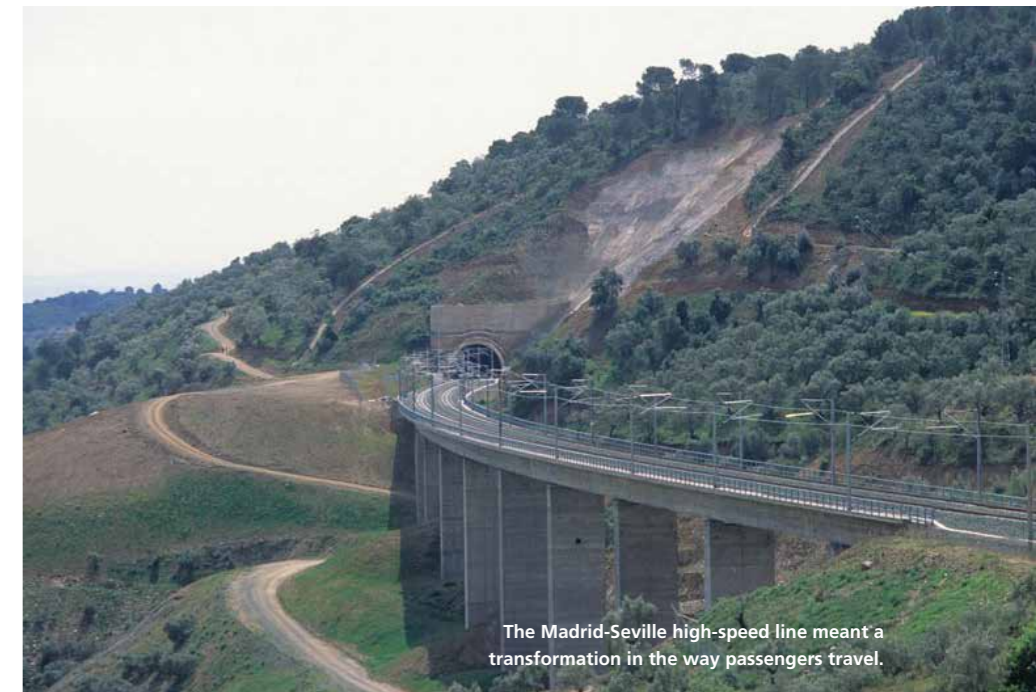
30 years later, the Madrid-Seville line continues providing a service and has been subjected to a rigorous maintenance plan during all these years. In fact, currently, the Railway Infrastructure Manager, Adif, is working on actions that guarantee the high safety standards that the line has offered since its commissioning. These actions are endowed with 650 million euros, financed at a rate of 55% by the EU's Recovery and Resilience Facility (RRF).

More specifically, the improvement works that are being carried out are:

- Implementation of the ERTMS (European Railway Traffic Management System), the most advanced train command and control system in the world that, although it is installed in the rest of the high-speed network managed by Adif AV, the Madrid-Seville line was not equipped with it since it did not exist when it was built. This system, which ensures European interoperability, was an EU initiative for railway signalling and communications to be compatible in all member countries.



Santa Justa Station, in Seville.



The Madrid-Seville high-speed line meant a transformation in the way passengers travel.

- Renovation of signalling and telecommunications facilities. In addition to the aforementioned implementation of the ERTMS, the ASFA digital system will also be installed. There will be renovation of other facilities

such as interlocks, train protection systems, object fall detectors or fixed telecommunications.

- Renovation of superstructure elements such as sleepers, ballast, or diversions.
- Comprehensive improvement of the infrastructure to condition its structures, tunnels, and grading and drainage systems.
- Replacement of elements of the overhead contact line (catenary) and video surveillance and security facilities.

Throughout these 30 years, the line has undergone a rigorous maintenance plan to ensure high safety standards

High-Speed Lines In The Spanish Territory

THE MADRID SEVILLA LINE WAS FOLLOWED BY MANY OTHER HIGH-SPEED LINES THAT HAVE BECOME A NETWORK AT THE FOREFRONT OF THE GLOBAL RAILWAY INDUSTRY.

Madrid–Zaragoza–Barcelona–French border line

It was launched on 10th October 2003 and with its 443 kilometres in length constituted the first section of the line between Madrid and Figueras, with 804 kilometres of total length. The first stretch, Madrid-Zaragoza-Lleida, involved an investment of 4.5 billion euros. Three years later, on 19th December 2006, the second section of the line, Madrid-Barcelona-French border, was put into service, another 108 kilometres corresponding to the Lleida-Camp de Tarragona route and the Lleida variant, which involved an investment of 1,613 million euros. It was not until February 2008 when the Tarragona – Barcelona section, of 98 kilometres and an investment of 2,653 million, was put into service. It was 103 series trains that covered the distance in 2 hours and 38 minutes.

Two years later, in December 2010, the Figueras-Perpignan international section was put into service, the end point of the corridor and a link with the European high-speed networks.



A train runs a service on the Madrid-Zaragoza-Barcelona-French border line.

Madrid–Segovia–Valladolid line

Launched on 22nd December 2007, it is the first section to become operational on the North and Northwest high-speed corridors. Railway services run through this infrastructure between Madrid and the Autonomous Communities of Castilla and León, Galicia, Asturias, Cantabria, and the Basque Country. It has just over 179 kilometres in length. When the new high-speed connections between Valladolid, Palencia and León – and in the future that of Burgos – became operational– it made it necessary to increase the capacity of the Madrid-Segovia-Valladolid line, for which the international standard gauge track was electrified and doubled in the 11.5-kilometre-long section between the Duero River channelling point and the Valladolid-Campo Grande station, where a third standard gauge parking track was also built.

Madrid–Toledo Line

On 15th November 2005, the Madrid-Toledo High-Speed Line was launched, the third in operation in Spain, which travels 75 kilometres in 33 minutes. It uses the Madrid - Seville line until Km 54 in the municipality of La Sagra, when another 20.5 kilometres of double track with international gauge start.

The design of tracks at the head of the line (P.A.E.T. de la Sagra Station), means that trains to Toledo can be diverted at the speed of 220 km/h, without having to reduce their speed. The line is equipped with the ERTMS, LZB and ASFA signalling systems, although it is currently run under the supervision of the LZB.

Córdoba–Málaga Line

The construction of this line meant connecting, for the first time with high-speed, the Mediterranean and the peninsular interior. Registered in the Andalusian corridor, it has a total length of 155 kilometres (from the link with the Seville-Madrid High-Speed line in the Córdoba municipality of Almodóvar del Río, to Málaga capital) and its construction was divided into a total of 22 sections, with a total budget of 2.1 billion euros.

The first 100 kilometres, between Córdoba and Antequera-Santa Ana came into operation on 16th December 2006. On 23rd December 2007, the line was completed up to the new Málaga María Zambrano station.

Madrid–Castilla La Mancha–Valencian Community–Region of Murcia Line

The Madrid-Cuenca-Albacete section was launched on 15th December 2010 and three days later the Madrid-Valencia connection, both belonging to the Madrid-Castilla La Mancha-Valencian Community-Murcia Region high-speed line, which once is completed in its entirety, will have a total length of 955 kilometres. Currently, 603 kilometres are in service. The overall invest-

ment planned for the implementation of the complete infrastructure is 12.41 billion euros, of which 6.6 billion correspond to the sections launched in 2010, Madrid-Albacete and Madrid-Valencia, and 1.92 to the Albacete-Alicante section. It was built with double international gauge track and is designed for maximum speeds of 350 km/h. It is

equipped with the latest technologies for communications (GSMR, in mobile telephony), security and signalling (ETCS).

The second large section of the line, between Albacete and Alicante, has been in service since June 2013.



Cuenca Station.

Madrid–Galicia Line

Newly built, with approximately 430 kilometres in length, there are sections in service and ongoing sections. The route begins at the bifurcation of the Madrid-Valladolid line, upon reaching the Valladolid municipality of Olmedo and it ends in Santiago de Compostela, where it connects with the Galician Atlantic Axis. Its construction has been divided into four sections: Olmedo-Zamora, with 99 kilometres, in service since 17th December 2015; Zamora-Lubián, with 139.1 kilometres; Lubián-Orense, with 101.7, which are ongoing; and Orense-Santiago, 87.1 kilometres long, in service since December 2011.



Recently launched Madrid-Galicia high-speed line.

Valladolid-Palencia-León Line

The commercial commissioning of this line represents the inclusion of the capitals of Palencia and León on the map of Spanish high-speed. The first service was carried out on 29th September 2015, with 162.7 kilometres in length, which is part of the North-Northwest high-speed corridor, and gives continuity to the Madrid-Segovia-Valladolid line in Castilla and León territory. Its approximate global investment is 1.6 billion euros.

As far as construction is concerned, the line was divided into two large sections: Valladolid-Venta de Baños, of 41.50 kilometres, and Palencia-León, of 121.20 kilometres in length, which connect with each other at the Venta de Baños Junction.

Latest high-speed lines put into service

Three decades after the commissioning of the first high-speed line in Spain, between Madrid and Seville, the network has multiplied almost eightfold, with accumulated investments exceeding 57.20 billion euros. In the last five years alone, Spain has added 527 new high-speed kilometres, distributed in 6 new connections that have meant putting an end to the Madrid-Galicia route and that, in addition, have allowed progress in the Mediterranean Corridor. 527 new kilometres that are added to the 3,240 existing in April 2017, date of the 25th anniversary of high-speed.

Monforte del Cid-Elche - Orihuela/Beniel Section: 54.1 kilometres

Also belonging to the Mediterranean Corridor, this section is part of the Madrid-Castilla La Mancha-Valencian Community-Murcia Region HSL. 1,493 million euros were allocated for its construction. To circumvent the different elements of orography that its layout presents, five tunnels and nineteen viaducts were built, therefore almost a quarter of the section runs underground or elevated. Two new stations, Elche High-Speed and Orihuela Miguel Hernández were incorporated, and it became operational in February 2021.



Track infrastructure of the Monforte del Cid-Elche-Orihuela/Beniel stretch.

Pedralba de la Pradería, Zamora, - Ourense Section (Madrid-Galicia Line): 119 kilometres

This section, with an investment of 3,965 million euros, was the culmination of the high-speed connection to Galicia, where, including the Atlantic Axis, more than 10 billion euros have been invested. As acknowledged by the Railway Infrastructure Manager, Adif, "the construction of the route was a technical and engineering challenge, due to the complex orography it goes through, and it represents one of the most complex sections of the line and of the entire high-speed network. In fact, it integrates up to 30 tunnels and thirty other viaducts, including the O Corno tunnel (8.6 km) and the Requejo viaduct (1.7 km). Likewise, it is a unique stretch in Spain due to its high concentration of ballastless track (track on concrete instead of on the traditional ballast): 72% of its length has been built with this technique, which allows it to adapt to the movements of the structures and to facilitate rigidity transitions between consecutive tunnels". It started operating in December 2021.

Valencia – Castellón Connection: 73.5 kilometres.

Through the installation of a third rail, and through the conversion to the mixed gauge of one of the tracks of the section between Valencia and Castellón, high-speed reached Castellón. The infrastructure also required the adaptation of the associated superstructure elements, as well as the stations. It was launched in January 2018.

Antequera - Granada: 122.8 kilometres

Launched on 25th June 2019, the Antequera - Granada high-speed line is part of the Mediterranean Corridor. With an investment of 1,675 million euros, it allows the direct connection between Granada, Málaga, Córdoba, Seville, Madrid, and other Spanish cities. The difficult geographical conditions through which the route passes made it necessary to build 21 viaducts and seven tunnels, with a total of 12 kilometres.

Vandellòs - Tarragona section: 48.9 kilometres

The investment allocated to this line, key in the development of the Mediterranean Corridor, and launched in January 2020, was around 700 million euros. In addition to the link between these two cities, the line also allows the connection with the Madrid-Barcelona HSL.

Zamora - Pedralba de la Pradería (Madrid-Galicia Line) Section: 109.2 kilometres

Along the almost 110 kilometres of this section, fourteen viaducts and nine tunnels were built. The section also has the new Sanabria AV station, located in the municipality of Palacios de Sanabria. It was launched last November 2021.

Upcoming lines

High-Speed continues its journey in Spain. Not surprisingly, the investments of the Railway Infrastructure Manager (Adif) for the period 2021-2025 amount to 12 billion, an investment challenge that will be driven by the Transformation, Recovery and Resilience Plan of the

Spanish Government, within the Next Generation EU financing mechanism. In addition, the railway network will reach 4,000 kilometres of length this year, thus consolidating, as Adif itself explains, "Spain's world leadership in the development of a sustainable mobility model, connected, and

supporting and revitalising territories".

Currently, the Railway Infrastructure Manager is carrying out the tests prior to the commissioning, throughout this year, of four other high-speed lines:

Connection of all High-Speed corridors and a new model of railway operation in Madrid: a station with two terminals. Standard gauge tunnel between Madrid-Chamartín-Clara Campoamor and Madrid-Puerta de Atocha and two new access tracks to Madrid between Atocha and Torrejón de Velasco.



Futuristic Madrid Nuevo Norte Interchange.

The tunnel between the stations of Madrid-Chamartín-Clara Campoamor and Madrid-Puerta de Atocha (7.3 km) crosses the subsoil of the centre of Madrid and has involved the investment of 337.8 million euros.

The main milestone of this new line is not only that it will link the two stations of Madrid by means of standard gauge, but also that it will connect all the high-speed corridors. In its first phase, the new tunnel will allow direct transverse routes to be carried out, without

the need to change trains in Madrid, from destinations in the North and Northwest of the country and to those in the South and the Levante, and vice versa.

In a later phase, when the connecting by-pass between the Madrid-Barcelona and Madrid-Levante high-speed lines is built, cross-cutting journeys to and from the East will also be possible.

Another of the main milestones of this infrastructure is what will become a station with two terminals. And

after the construction of the Atocha station, its underground extension will allow travellers to schedule stops both in Atocha and Chamartín for those routes that pass through Madrid, either of origin or destination.

The last phase of this construction is the duplication of tracks of the route between Atocha and Torrejón de Velasco, of 28 kilometres, which has involved an investment of 727 million euros. In this section, two new tracks will be put into service, which will be added to the two existing ones.

Section Beniel-Murcia El Carmen Station (vaso norte) of the Monforte del Cid-Murcia line.

This construction means the arrival of high-speed to Murcia. In its 15 kilometres in length, it includes the access tunnel to the Murcian capital (phase I, of 1.1 km). 1.5 billion euros have been invested, and this amount includes the development of provisional interventions in the station of Murcia El Carmen: a first phase of rehabilitation of the current historic building and the construction of another provisional one for high-speed traffic.

The implementation of these 4 key connections in the development of high-speed will depend, on the one hand, on the progress and development of the tests and, on the other, on the subsequent obtaining of the authorisation from the Railway Safety Agency.

In addition to these 4 new constructions, other works and projects stand out that are also underway.

- Exterior variant of Ourense.
- Variant of Pajares.
- Palencia-Santander High-Speed Line.
- Burgos-Vitoria High-Speed Line.
- Vitoria/Gasteiz-Bilbao-Donostia/San Sebastián High-Speed Line.
- Installation of the third rail in the Astigarraga-Irún section.
- Zaragoza-Pamplona-Y Vasca High-Speed Line.
- Madrid-Extremadura High-Speed Line (Second Phase).
- Mediterranean Coastal Corridor: new connections València-Castelló in standard gauge, Murcia-Almería HSL, implementation of the standard gauge between Castelló and Vandellòs.
- High-Speed connection with Madrid-Barajas-Adolfo Suárez airport.
- Stations adapted to new services and High-Speed mobility.
- Transversal connections: between the Madrid-Barcelona and Madrid-Levante HSL; between the Madrid-Galicia and Madrid-Valladolid HSL; and between the Madrid-Seville and Córdoba-Málaga HSL.

Phase 1 of the high-speed to Extremadura: Plasencia-Cáceres-Badajoz section.

There will be 150 kilometres that, with an investment of 1.7 billion euros, will mean the arrival of high-speed to Extremadura. It has been necessary to remodel and to adapt the stations of Badajoz, Cáceres, Mérida and Plasencia to the particularities of high-speed. Several tunnels and viaducts have been built on the route. For the line, Adif has included the ASFA digital signalling and security system.

Connection Venta de Baños (Palencia)-Burgos.

The Madrid-Segovia-Valladolid-Venta de Baños high-speed corridor to Burgos will be continued with a new section, which will connect Venta de Baños, in Palencia, with the capital of Burgos, 89 kilometres long. In addition, it marks the first step for its connection with the Basque Country and the French border. The investment has reached 730 million euros. Two tunnels and twelve viaducts have been required.

Operators

When the first AVE between Madrid and Seville was launched on 21st April 1992, at 300 kilometres per hour, Renfe had a fleet of 18 trains and 12 daily trips. Currently, that figure has multiplied to reach 229 vehicles and the 471 kilometres of track already reach 3,726 between them. Every day there are 331 services, 158 from Ave, 90 from Avant, 69 from Alvia, and 14 from Avlo.

It is not the only thing that has changed in these 30 years. New products have been added to the original offer of AVE and Renfe makes available to the traveller the Avant (Medium Distance at high speed), Alvia or Avlo (high speed at low cost). Together, they provide 331 services on a daily basis.

Avant

A first trip in October 1992 between Ciudad Real/Puertollano and Madrid, called 'lanzadera', was the prelude to Avant. This service was born in 2004 to meet mobility between nearby towns, but with the advantages of the AVE. It is therefore called medium-distance high-speed and serves with trains designed specifically for these connections. They reach a speed of up to 250 km/h and the services are carried out with 104, 114 and 121 series trains. Currently, Avant falls into the Category of Public Service and Renfe operates the service with high-speed trains designed specifically for short trips.

Alvia

Two types of track gauge coexist in the Spanish railway infrastructure, one of standard or international gauge (1,435 mm) and another of Iberian gauge (1,668 mm). This made it necessary for Renfe to have to work in such a way so that the trains could run, without interrup-



tion, through both. The result was the construction of movable rolling trains, which run through both infrastructures. We are talking about the Alvia trains, which were born in 2006, reach a maximum speed of 250 km/h and circulate to cities such as Pamplona, Cádiz, Asturias, Cantabria, Logroño or the Basque Country. These services are delivered with the series 120, 130, 730, 121 and with formations of Talgo 7.

Avlo

Almost a year ago, in June 2021, Renfe's latest addition was born, the Avlo trains, which run between Madrid and Barcelona. It is a new high-speed service that was added to the traditional lines, but with a particularity: they are marketed under the low-cost brand. With similar features to the AVE in terms of speed and comfort, the aim is



The new station of Murcia El Carmen will be an installation located near the current one.

to facilitate access to high speed for all types of travellers from other means of transport, especially the road. The first connection, Madrid-Zaragoza-Barcelona-Figueras, started with 40 trains and made four daily trips in each direction. For this connection, five trains of the 112 series have been refurbished, the cars unified in a single economy class.

In February of this year the Avlo service was increased with its arrival in Valencia through 6 daily trips, three in each direction. Four of them also stop in Cuenca and Requena-Utiel. In this first phase, it runs with trains of the 112 series.

NEW STAKEHOLDERS IN HIGH-SPEED

The liberalisation of the sector has also reached high-speed and has brought new operators who, under the low-cost brand, aim to make high-speed service available to everyone.

Ouigo

In May 2021, Ouigo, the low-cost high-speed brand of the French Railways, SNCF, was born, a fleet of 14 double-decker trains of Alstom's Euroduplex model, each one with



New operators have arrived on the scene to offer high-speed services in Spain

509 seats. With the advent of the liberalisation of passenger railway transport, Ouigo was the first low-cost service operated in the Spanish market. The trains connected Madrid and Barcelona, with stops in Zaragoza and Tarragona. The price, from 9 euros.

For a later stage, Ouigo plans to take its services first to the Valen-

cian Community and then to Andalusia: Córdoba, Seville and Málaga.

Iryo

It is a new trademark of the private railway operator ILSA, which, as announced in February 2022, will begin to circulate in Spain from the second half of 2022 connecting Madrid and Barcelona. Although it will not be its only service. The operator expects that by the end of the year it will be providing service in Seville, Málaga, Córdoba, Valencia, Alicante, and Zaragoza. The travel times, of course, will be the same as those currently offered by Renfe.

A little further in the future, by 2025, Iryo plans to make available to passengers 58 daily frequencies between the stations of Seville-Santa Justa, María Zambrano Málaga, Córdoba and Madrid in which it is estimated that they will exceed 2.5 million passengers. The forecasts point to a fleet of twenty ETR 1000 trains, of the 109 series, of the so-called Frecciarossa 1000, with capacity for 467 passengers.



High-speed train operated by Ouigo.

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High-speed puts the **Spanish railway industry** in the limelight of the global forefront

La Mecca-Medina high-speed, a project with Spanish presence.



Not only did the arrival of high-speed in our country mean a paradigm shift in terms of mobility and transport. It also brought with it an important international projection of the Spanish railway and its industry, placing it on the international scene. The Spanish industry is currently a global benchmark in terms of infrastructure, innovation, and sustainability, driven to a large extent by this high-speed whose 30th anniversary we are now celebrating. Not surprisingly, it is present and has imported its know-how to countries around the world. Today, the Spanish railway industry is present in the high-speed projects of countries such as the United States, Saudi Arabia, the United Kingdom, or Turkey.

"There is no doubt that Spain today has more and better infrastructures. Our high-speed network is a benchmark, an example to be followed by many countries. It is, in short, one of our best cover letters and it places us at the forefront of the sector at an international level", states Pedro Fortea, General Director of Mafex.

And he continues: "Let us remember that our high-speed network was a catalyst for the process of modernisation of our country, as well as a boost to the territorial and social cohesion of our regions. But in addition to revolutionising the Spanish transport market, the implementation of high-speed accelerated and consolidated the development of a powerful railway industrial fabric that today is solidly based on three

main pillars: innovation, internationalisation, and the knowledge and skills acquired".

This growth of the Spanish railway industry at an international level is currently evident in the fact that it is at the world's forefront of know-how, experience, and technology. Many years of work and projects have helped it to obtain that benchmarking and to have a reputation



Follo Line Railway Tunnels (Norway).

for excellence, rigour, and professionalism.

In the case of high-speed, as Pedro Fortea recalls, this specific knowledge initially resulted from the integration of different technologies, some of them from other European countries, but integrated thanks to Spanish engineering and construction companies.

"Little by little we were consolidating the existing industry at that time, and developing more and more of our own national business fabric, until placing ourselves in the present where we can boast of being one of the few countries in the world with a leading industry in the railway design, rolling stock manufacture, signaling, construction, operation and maintenance", he claims.

In fact, the developments of Spanish companies contribute to a greater digitalisation of the logistics chain and associated operations, the real-time traceability of shipments, as well as an optimisation of tracks and infrastructures and the renewal

"Nuestras empresas son un referente mundial en el diseño, construcción y mantenimiento de redes de ferrocarril"

of rolling stock, with an average life of 25 years, which needs to be adapted to the new demands of the market. In short, Spanish companies work to create quality environments that are safer, more comfortable, reliable and, in addition, respectful of the environment.

The Spanish railway industry has reached such dimensions that make it a key and driving sector for both our economy and our country's image. The figures speak for themselves: 30,000 direct jobs, a turnover of more than 15 billion euros (more than 8% of industrial GDP), average investments of 4% of its turnover in R + D + i and a booster to export for small and medium-sized enterprises through the driving industries, who-

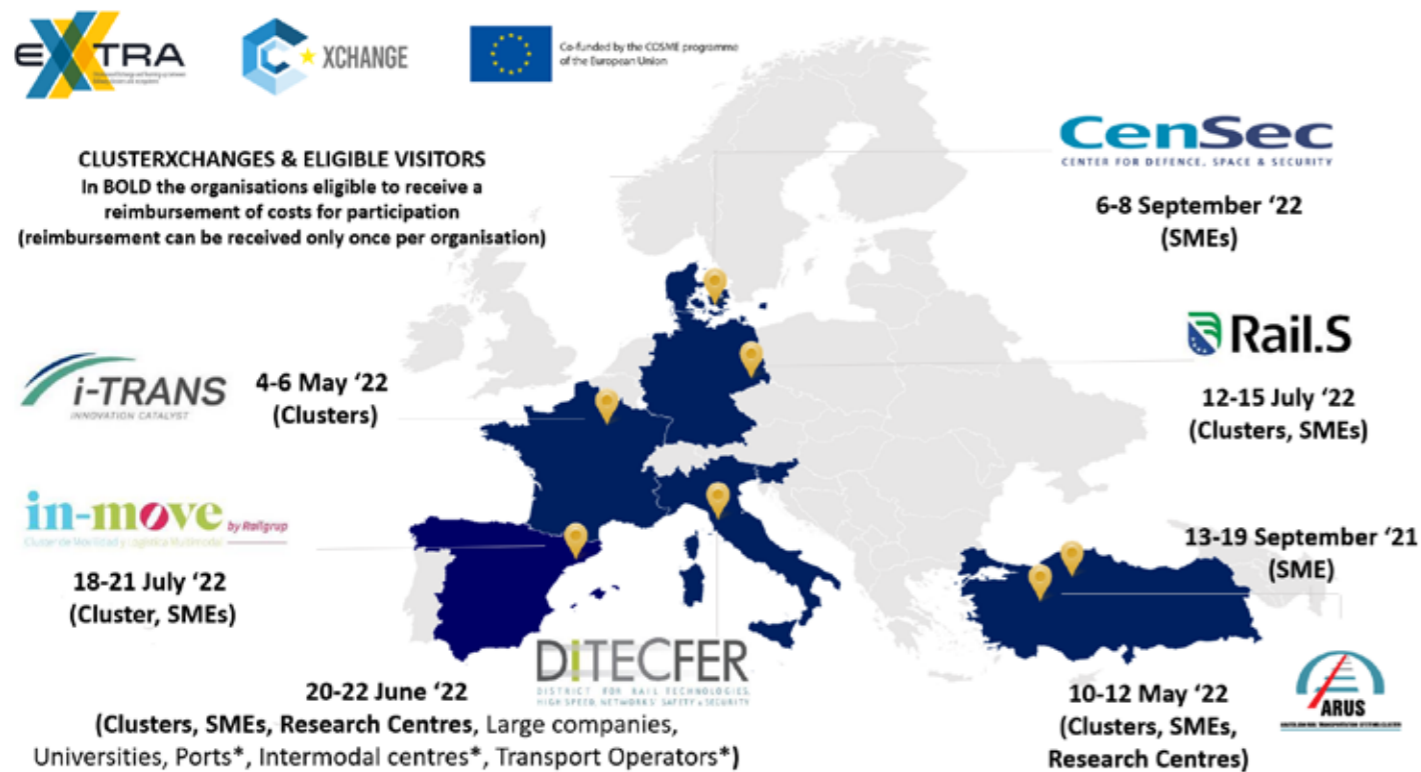
se export has in some cases reached 90%.

"Our companies have become a global benchmark in the design, construction and maintenance of railway networks equipped with the latest technologies, which allow us to talk about well-being and social cohesion, sustainability and safety. Without the railway, in all its variants, as the backbone of sustainable, connected, and safe mobility, we will not be able to respond to today's demographic, social and environmental challenges. These are challenges for which the industry is prepared, just as it was 30 years ago, when we launched one of the most admired high-speed networks in the world," concludes Fortea.

High-speed train for the HS2 project, in the United Kingdom.



The role of collaborative environments and competitiveness in the railway ecosystem



Networking and joint work are a key strategy for the economic development of companies, and clusters are a clear example of this.

The European Commission defines clusters as groups of companies, economic actors and institutions located close to each other of sufficient size to develop knowledge, ser-

VICES, resources, and competences. Today there are more than 1,500 clusters in 200 regions within the EU-27, representing almost 25%

of total EU employment. This is why the EU employs clusters as intermediary agents to implement its policies. Proof of this is the "Euro-

pean Cluster Partnership" initiative launched by the European Commission to with the aim of encouraging clusters in Europe to intensify collaboration between regions and sectors

With the ultimate goal of boosting economic growth and competitiveness in Europe, the European Commission provides various tools such as the "European Cluster Collaboration Platform" and the "ClusterXchange".

The European Cluster Collaboration Platform allows EU cluster associations to pool resources and knowledge to work together specifically on joint strategies. Meanwhile, the ClusterXchange tool, offers an exchange programme based on the ERASMUS+ philosophy for clusters, SMEs and organisations.

There are over 1,500 clusters in 200 regions in the EU-27 which work as EU intermediary agents to implement its policies

The EXXTRA Project – "EXcellence EXchange and Teaming-up between RAILway clusters and ecosystems"- in which Mafex's innovation area participates, was born to promote mutual work between railway clusters. This project aims to support-clusters in the professionalisation of their competences and services global consolidation.

However, the most interesting impact of the project is its commitment to SMEs. SMEs represent more than 90% of the railway industry which

is why clusters must professionalise their specialised and customised business support services to these business profiles.

Within the framework of the "EXXTRA ClusterXchange" SMEs are able to benefit from a period of mobility in another country (e.g., Turkey, France, Italy, or Germany) to develop a specific activity plan such as missions to other countries that include a visit to a trade fair, B2B meetings or a visit to a business or local technology centres.

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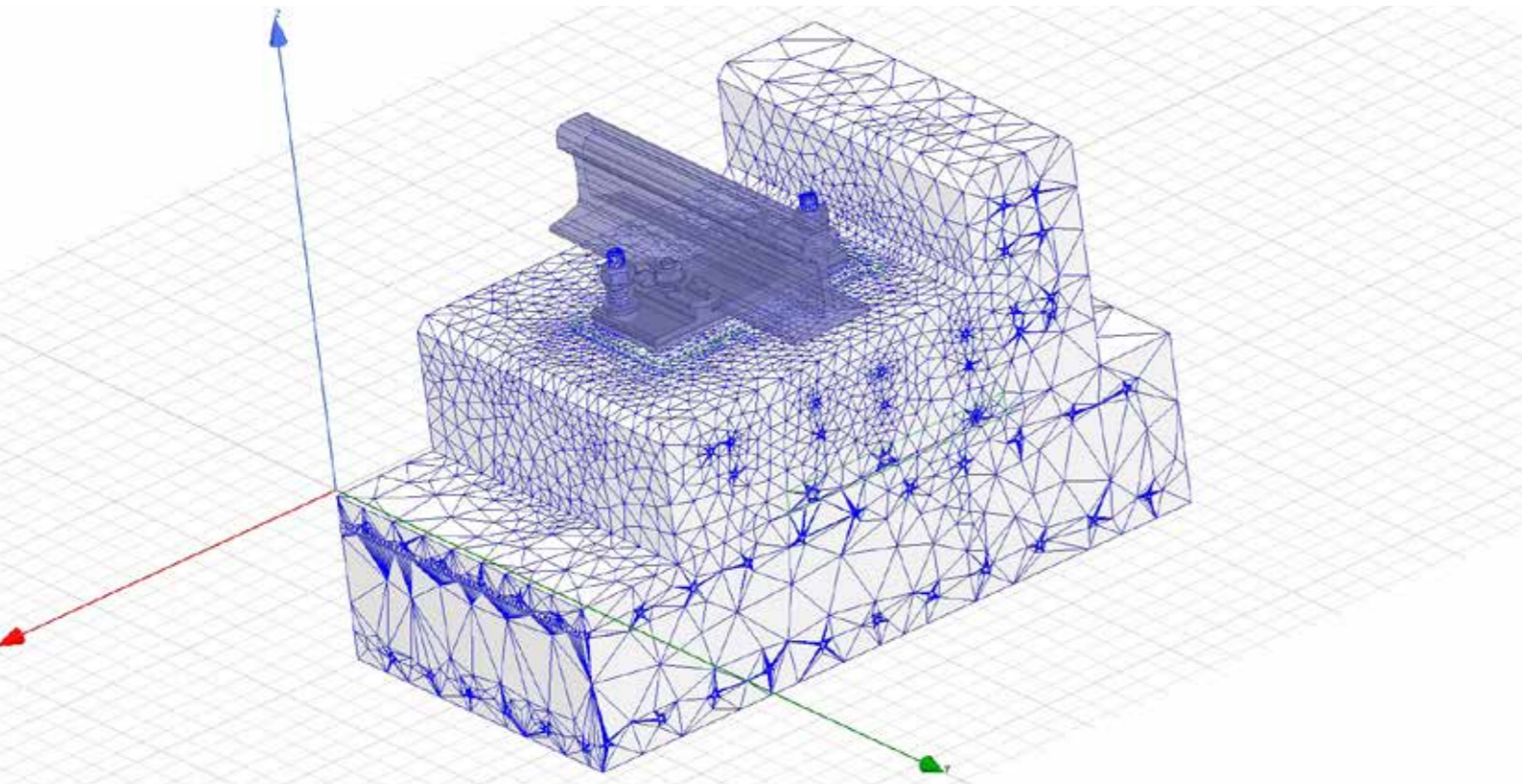
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Evaluating stray current leakage in direct current electrification systems

IDOM LAUNCHES A NEW STUDY WITH WHICH IT AIMS TO REDUCE STRAY CURRENTS, ONE OF THE MAIN PROBLEMS OF DIRECT CURRENT ELECTRIFICATION SYSTEMS. IN ITS DEVELOPMENT IT COMBINES THE USE OF THE TRACTION SYSTEMS SIMULATOR WITH FEM MODELLING.

IDOM has developed a study that aims to solve one of the main problems of direct current electrification systems: the evaluation and mitigation of stray currents.

This is an effect produced by the variability of the electrical resistance between the rail, fixations and the rest of the railway infrastructure, reducing the durability of the elements, as a consequence of the loss of mass of the reinforced steel due to corrosion.

This effect must be analyzed especially in tram and metro systems since, in addition to the reinforced steel itself, in urban environments

there is an increased possibility of affecting water and gas supply networks, etc. close to the rail system.

The methodology developed combines the use of a traction system simulator (IDOM-REPS DC, software developed by IDOM), with modeling using FEM (Finite Element Method) in 3-D © Maxwell for low and medium frequency electromagnetic systems.

Stray currents account for a fraction of the return currents that circulate through the metal structures that support the rails on which trains pass.

The methodology used for this analysis is as follows:

The combination of FEM and nodal analysis provides a detailed modelling of a complicated system like the one proposed.

This modelling undertaken can be verified by updating the value of the leaked current from the fixations throughout the real values of current leakage based on limited measurement by extension to another alternative, which the value of current leakage is based on classic massive measurement campaigns.

The application of this methodology to specific solutions, such as the use of stray current collector systems, allows the correct analysis and dimensioning of the return system, optimizing the durability of railway infrastructures.

Boosting digitalization and sustainability at Europe's Rail

As part of EU-Rail, Indra becomes key player in defining and implementing the strategic RDI agenda for the sector, in collaboration with the European Commission. Indra contributes its technological capabilities and experience, and collaborates with leading European companies, organizations, institutions and universities to develop and test on a large scale new digital and sustainable solutions that place the train at the center of green mobility.

Indra's purpose is to contribute its experience and continue to evolve its advanced technology for the railway sector, with the aim of leveraging all the benefits of CyberRail IoT, satellite ERTMS, di-

INDRA HAS REAFFIRMED THEIR COMMITMENT TO INNOVATION TO BOOST THE RAILWAY SECTOR BY BECOMING, WITH TALGO, ONE OF THE 25 FOUNDING MEMBERS OF EUROPE'S RAIL, THE LARGEST RAILWAY INNOVATION PROGRAM IN EUROPE AND, THEREFORE, JOIN ITS GOVERNING BOARD.

igital twins, big data, Artificial Intelligence and smart maintenance technologies to turn the train into the center of the new mobility ecosystem and put it at the service of the traveler.

For example, to address the integration of the entire mobility ecosystem, Indra will continue to work on its integrated, open, flexible and scalable solution for rail traffic management: Indra Rail

TMS, coupled with its specialized smart mobility platform: In-Mova Space. Focused on new digital technologies, In-Mova Space is oriented towards mobility as a service and generates a collaborative scenario in which data from all modes of transport is shared and information is enriched, applying intelligent analytics, learning and predictive models



Energy optimization of handlamps and reuse of 80,000 chargers through electronic processing

As an Advanced Manufacturing company, Luznor is characterized by its environmental commitment, promoting the servitization of its products, as well as the adaptation and incorporation of a new circular business model.

Since its foundation in 1998, Luznor has commercialized more than 80,000 units of handlamps and their chargers locally, nationally and internationally, in the railway sector. The incorporation of advanced technologies has allowed Luznor to implement services associated with products, with the ultimate goal to satisfying customer needs, above and beyond the characteristics of a product.

LUZNOR USES ECO-DESIGN WHEN LAUNCHING ITS NEW QR HANDLAMP WITH LI-ION BATTERY THAT IS ENERGY OPTIMIZED WITH 20% MORE AUTONOMY THAT INCREASES ITS LIFETIME BY 2.5 TIMES. THIS AVOIDS THE REPLACEMENT OF 200,000 KG OF BATTERIES.

Luznor uses eco-design when launching its new QR handlamp with Li-Ion battery that is energy optimized with 20% more autonomy that increases its lifetime by 2.5 times. This avoids the replacement of 200,000 kg of batteries.

In addition, Luznor is very committed to the reuse of chargers placed on the market. Through an electronic treatment that each charger receives from the new

handlamp, 16,000 kg of electronic waste and 20,000 kg of plastics are avoided.

With this project, Luznor meets the basic objective of the circular economy, which is that products, materials and resources are kept in the economy for as long as possible and waste generation is minimized, always ensuring sustainability and efficiency.



Reduction of consumption in high-speed trains, aerodynamic optimization

SIMULACIONES Y PROYECTOS, HAS BEEN WORKING FOR SEVERAL MONTHS ON THE DEVELOPMENT OF RIBLETS FOR HIGH-SPEED TRAINS THROUGH AERODYNAMIC AND AERO-ACOUSTIC CFD (COMPUTATIONAL FLUID DYNAMICS) SIMULATIONS.

Despite the enormous evolution of high-speed trains, is it still possible to improve their performance?

From Simulaciones y Proyectos, we have been working for several months on the development of Riblets for high-speed trains through aerodynamic and aero-acoustic CFD (Computational Fluid Dynamics) simulations.

Riblets are elements that adhere to the surface of the undercarriage and reduce drag.

How do riblets work?

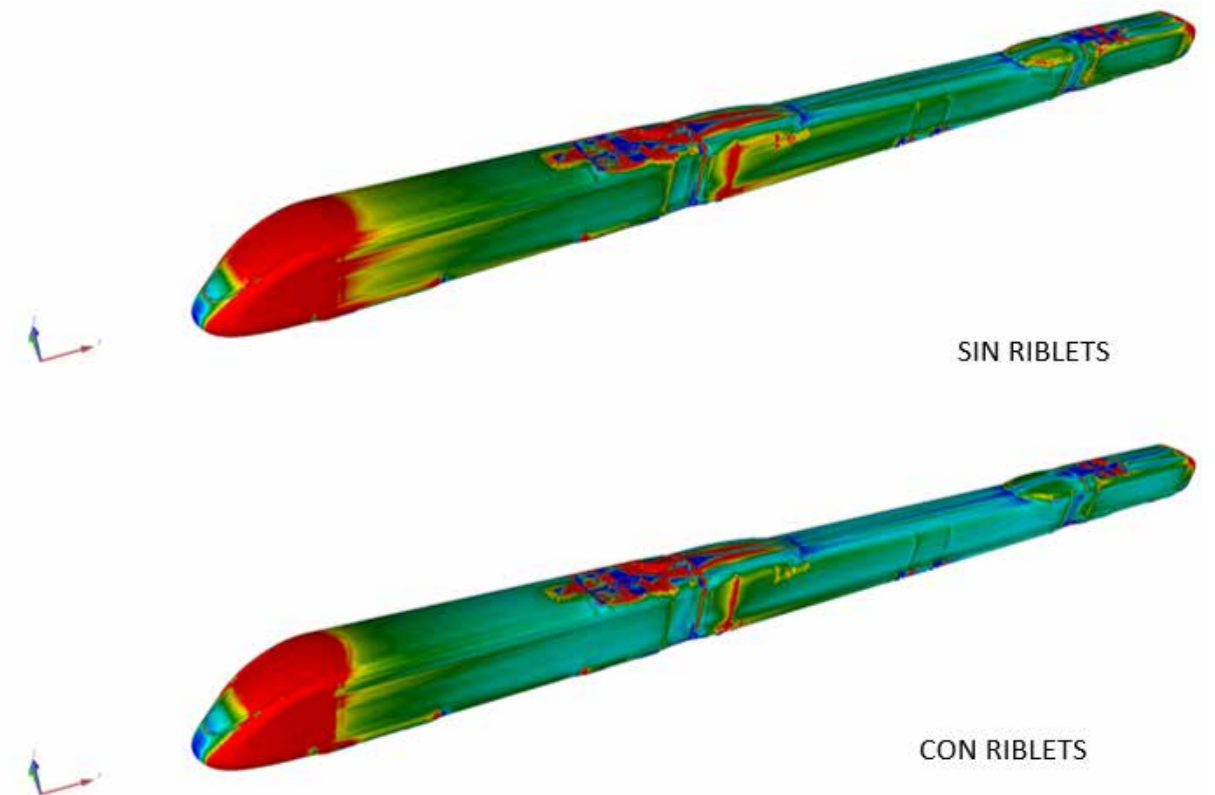
The Riblets, intend to emulate nature, specifically the skin of the shark.

The ideal case for drag is to have a laminar flow (without turbulence). In nature we find the solution. Sharks can swim at high numbers of Reynolds thanks to the ridges on their scales, on which the fluid behaves according to the viscous theory, reducing turbulence. This behavior is mimicked using Riblets.

The turbulent shear stress in the walls of the aerodynamic surfaces is one of the main causes of drag, therefore, if this parameter is reduced, the drag and the aeroacoustic noise generated will be reduced. In addition, the Riblets help delay the detachment of the boundary layer, causing the flow to gain momentum as it passes through them, this is again reflected in a decrease in drag.

Riblets on airfoils offer up to an order of magnitude reduction in viscous drag, increasing efficiency by reducing noise and fuel consumption.

This technology is already being used in airplanes and other vehicles. Will the high-speed train be the next to take advantage of it?



X2Rail-4 SWOC: Advanced signalling and automation systems. Smart Wayside Object Controller

Shift2Rail is the first European rail initiative to seek focused research and innovation (R&I) and market-driven solutions by accelerating the integration of new and advanced technologies into innovative rail product solutions.

This article is focusing in the Technical Demonstrator T2.10 Smart Radio- Connected all-in-all way side objects, also known as Smart Wayside Object Controller (SWOC), with the partnership of CAF SIGNALLING S.L, SIEMENS MOBILITY GMBH, HITACHI RAIL STS SPA, BOMBARDIER TRANSPORTATION SWEDEN AB (now part of ALSTOM group), INDRA SISTEMAS SA, AZD PRAHA SRO, RAILENIUM, TRAFIKVERKET, DEUTSCHE BAHN AG, MERMEC SPA and the leadership of THALES DEUTSCHLAND GMBH. This project has received funding from the Shift2Rail Joint Undertaking (JU) under grant agreement No 881806.

The JU receives support from the European Union's Horizon 2020 re-

THALES DEUTSCHLAND GMBH LEADS, TOGETHER WITH THE COOPERATION OF SEVERAL COMPANIES, THE TECHNICAL DEMONSTRATOR T2.10 SMART RADIO- CONNECTED ALL-IN-ALL WAY SIDE OBJECTS, ALSO KNOWN AS SMART WAYSIDE OBJECT CONTROLLER (SWOC).

search and innovation programme and the Shift2Rail JU members other than the Union.

The TD2.10 objective is to demonstrate a solution of object controllers with decentralized approach to rail automation. This approach will be scalable from high performance lines to regional and freight applications.

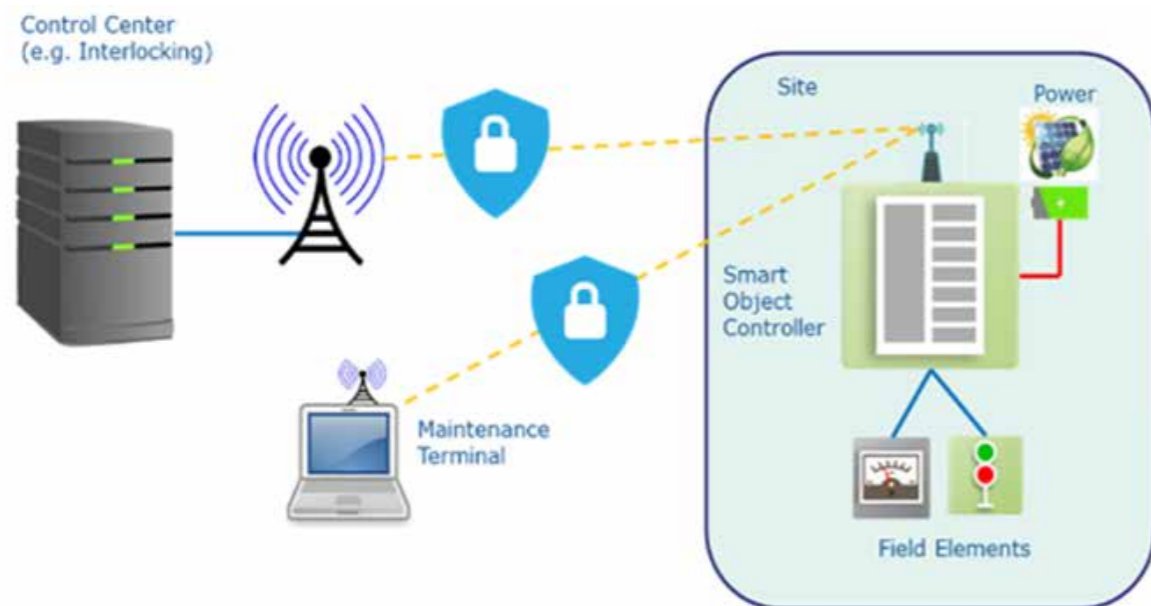
Although modern signalling systems will have considerably reduced trackside equipment, this solution is still relevant, as at least interfaces to points and level crossings will remain, and other necessary interfaces.

Today it is expensive to provide cabling for power and data to remote trackside objects. The cable is

vulnerable to cable theft, changes within track layouts are complex and costly and the cable restricts distances between trackside objects and signalling equipment. A reduction of the cables will reduce lifecycle costs significantly.

In the TD2.10 scope, system requirements and architecture for SWOC have been produced, to be developed and tested in the demonstrator.

A public report is generated with the conclusions from the analysis of the results of the tests, traced with requirements, of demonstrator at TRL 4 and the inputs for optimizing prototype. In a next step, the tests will be executed in operationally representative environment to reach TRL 6.



Application of virtual reality and augmented reality to industrial processes

Alstom's industrial center in Santa Perpètua de Mogoda was one of the first factories in the sector in Spain to incorporate the Industry 4.0 model into its workflows. The center's Special Processes team has recently launched several initiatives to implement new technologies in critical processes at the manufacture of trains and trams, such as the welding of boxes or the painting of rolling stock. Both processes require specific training that, due to their nature, involves the use of materials similar to those used in production and the generation of various types of waste.

In the case of welding, Alstom has developed AWATAR (Assistance Welding Alstom Transport Augmented Reality), a solution that

ALSTOM SPAIN USES AUGMENTED REALITY AND VIRTUAL REALITY FOR THE TRAINING OF WELDERS AND PAINTERS AT ITS SANTA PERPÈTUA FACTORY.

allows, through augmented reality, to simulate real work situations with scale models of the different parts of trains and trams. AWATAR is used in recruitment processes, personnel training, and programming workflows to be applied later in the production chain.

In the case of painting, the process is carried out using virtual reality. Once the glasses are on, the professional can visualize a digital

replica of the train and apply the paint, while the selection or training team can observe the entire process through an external monitor.

The implementation of this type of technology has made it possible to improve the quality of learning, considerably reduce training time, and offer a more sustainable alternative that does not involve the consumption of paint products.

Safe4Rail-3 project and the next generation of TCMS

This project has received funding from the European Union's Horizon 2020 research and innovation programme.

The project will improve the functionality of the next generation TCMS (NG-TCMS), which aims to provide newer and safer features to on-board subsystems as the backbone for reliable and high-availability train operation.

The main objective of Safe4Rail-3 is to contribute to the two railways demonstrators stemming from its complementary project, CONNECTA-3. Thus, the hardware and software developed and tested within the project will be installed directly in the two demonstrators for integration and validation.

The results of Safe4RAIL-3 will lead to a more competitive railway industry, as they will increase the flexibility and reliability of TCMS communications, reduce development and maintenance costs and achieve new functionalities for trains, paying special attention to the interoperability of manufacturers and the availability of multiple sources. The project will thus enhance the competitiveness of EU industry by placing European train operators at the technology forefront, supported by a combination of radical innovation and technical standards.

COMSA INDUSTRIAL TAKES PART, TOGETHER WITH OTHER PARTNERS, IN THE SAFE4RAIL-3 INNOVATION PROJECT, FOR THE DEVELOPMENT OF ADVANCED SAFETY TECHNOLOGIES AND COMPONENTS FOR THE NEXT GENERATION OF THE TRAIN CONTROL AND MONITORING SYSTEM (TCMS).



Fagus, the asset control system for efficient and ecological management

Data such as location, temperature, emissions, or acceleration are collected by devices placed on assets.

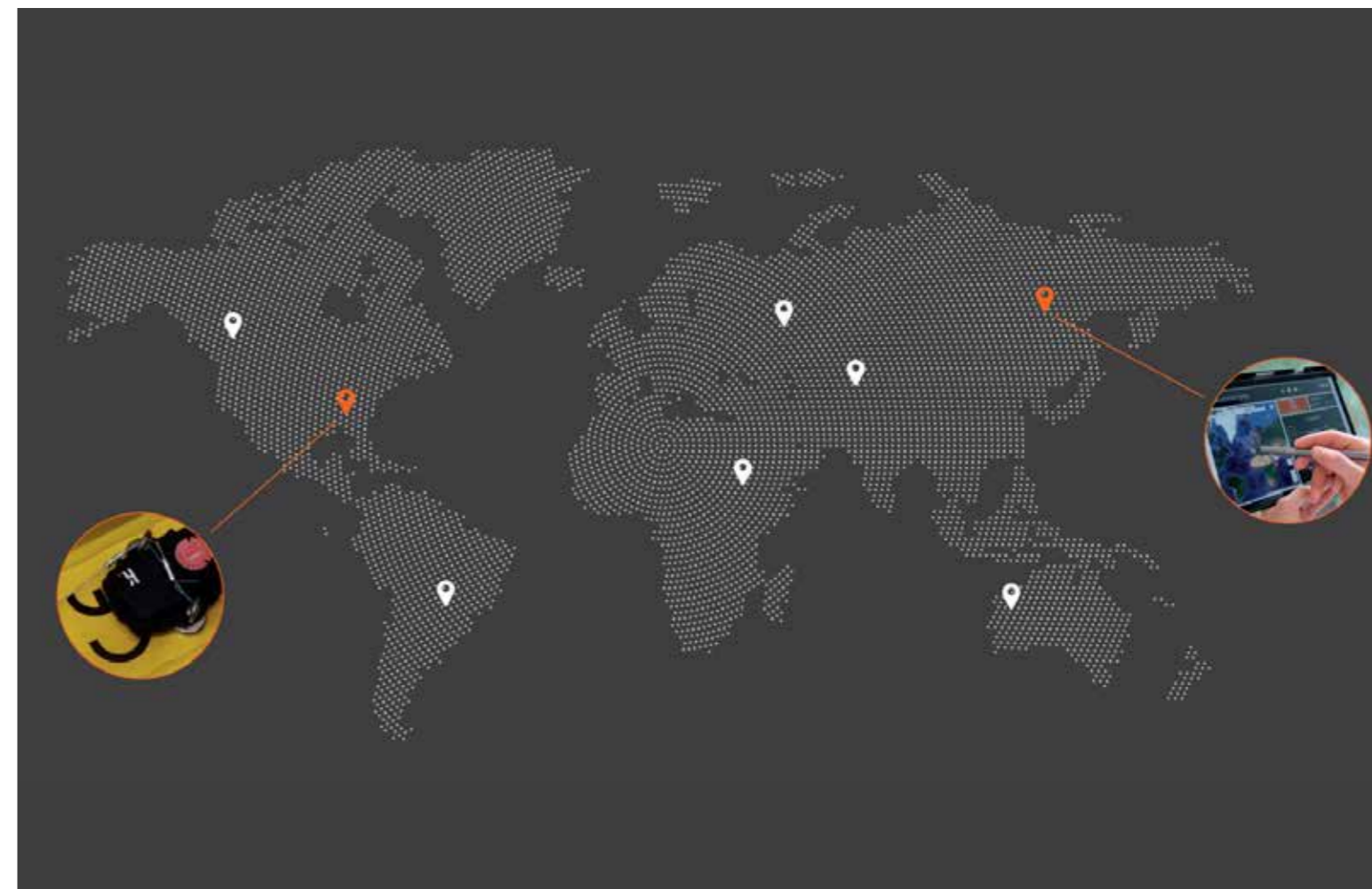
KIMUA GROUP HAS DEVELOPED A NEW SERVICE TO OPTIMIZE BUSINESS ASSET MANAGEMENT DECISIONS.

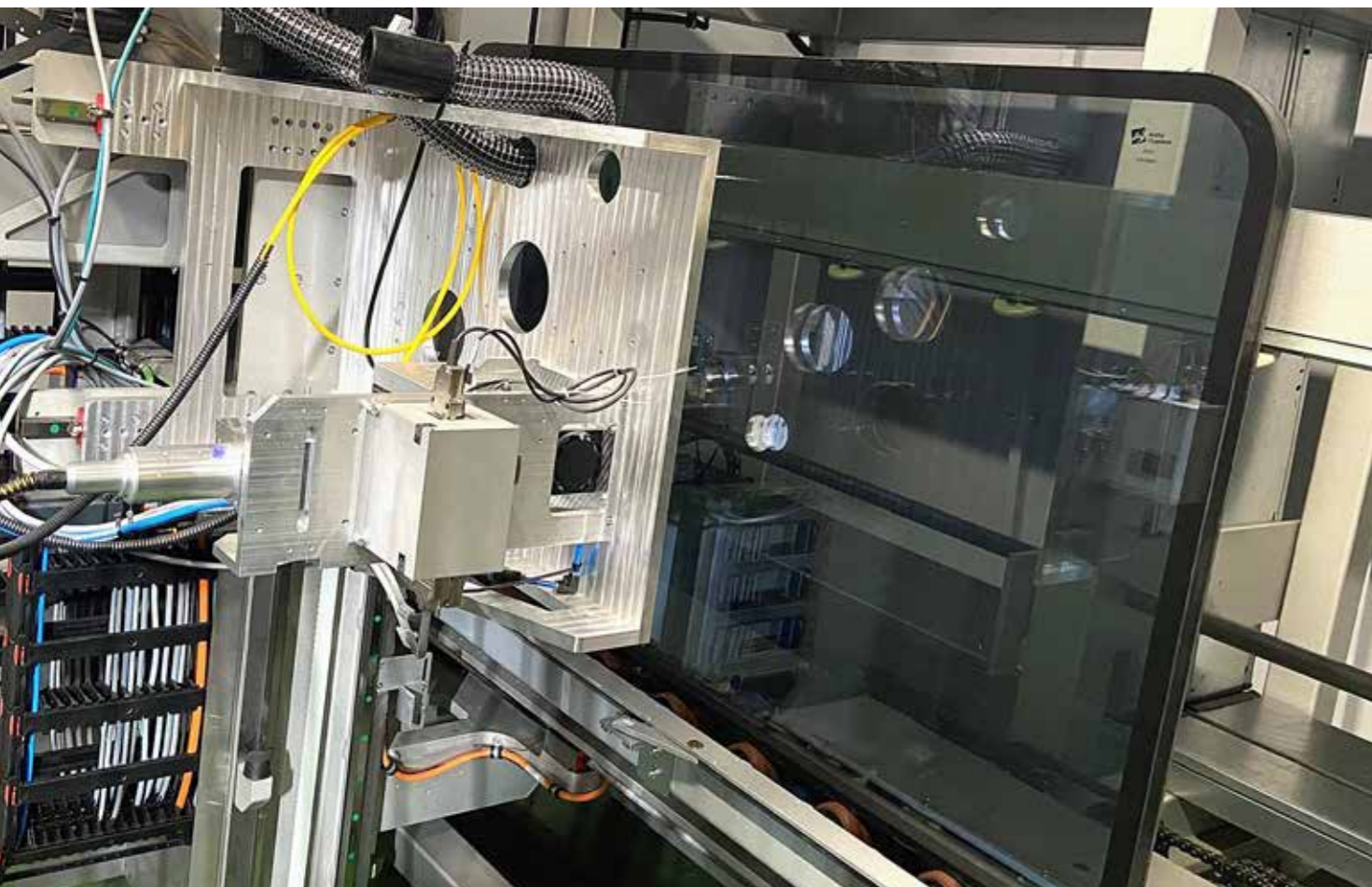
This data is transferred to the user platform in the form of information through 4G or satellite connectivity. Information such as the days of use or route tracking, distance traveled, and the carbon footprint emitted.

Through this information, the user has knowledge for the management and security of their assets, agility in decisions and control of any fleet.

No two problems are the same, and therefore no two solutions are the same. With Fagus we adapt to each case and each environment by proposing a personalized solution. The secret? It's always the same, base decisions on information.

Data is captured and, through analysis, converted into valuable information. A key knowledge to control assets and make quick and efficient decisions.





Innovative glazing to improve mobile coverage

In recent years, advancements in the technology of solar control and low-emissivity coatings used in the glazing of buildings and rail transport have greatly improved energy efficiency in the most cutting-edge projects.

In the railway sector, glazing plays an essential role, as it allows for visual communication between the exterior and the interior. Certain essential properties are required, such as mechanical and structural safety, energy and acoustic insulation. In addition to allowing natural lighting, high-performance glazing results in greater comfort and habitability, while minimizing energy consumption. ARIÑO DUGLASS has been one of the most active & innovative companies in improving the properties of glazing for both

ARIÑO DUGLASS APPLIES LASER TECHNOLOGY TO ENHANCE THE TRANSMISSION OF RADIO FREQUENCY SIGNALS THROUGH GLASS WITH METALLIC COATINGS FOR THERMAL CONTROL.

the architectural and railway sectors.

In the modern age of wireless hyperconnections, the use of multi-layer metallic coatings results in a problem known as a "Faraday cage". The metallic layers not only insulate from infrared light for improved thermal comfort, but they also attenuate signals increasingly used by mobile technologies. Among these signals, the most relevant are those used for mobile communication in the range of 900 to 2600MHz, up to the 5GHz band. The Faraday cage effect occurs in all-metal cabins, such as a standard train carriage fitted with windows containing multi-layer metallic

coatings (today, this is corrected by means of repeaters in the same vehicle, however this solution is very expensive and requires maintenance).

Frequency Selective Surfaces (FSS) solve this problem by partially removing the coating with the appropriate patterns. Ariño Duglass applies laser technology to enhance the transmission of mobile signals, reducing the amount of metal layer removed.

By removing only 1% of the coating, we can improve the signal inside the train carriages by 50 to 300 times, balancing aesthetics, energy efficiency and improvement of mobile signal.

ENGINEERING, CONSULTANCY AND CERTIFICATION

Projects and infrastructure technical assistances, superstructure, signalling, communications and ticketing

- ▶ ACYGS Sales Management, S.L.
- ▶ Aimen Centro Tecnológico
- ▶ Ardanuy Ingeniería, S.A.
- ▶ Asea Brown Boveri, S.A.
- ▶ Caf Signalling, S.L.
- ▶ Caf Turnkey & Engineering, S.L.
- ▶ Calmell, S.A.
- ▶ CEIT
- ▶ Citef (Fundación para el fomento de la innovación industrial)
- ▶ Dsaf-Dinámicas De Seguridad, S.L.
- ▶ Mieres Rail, S.A.
- ▶ Enclavamientos y Señalización Ferroviaria ENYSE, S.A.U.
- ▶ Ibérica Tecnología en Sistemas de Seguridad Ferroviarios, S.L. (ITSS)
- ▶ ICF - Ingeniería y Control Ferroviario
- ▶ Idom-Engineering, Consulting, Architecture
- ▶ Ikusi, S.L.U.
- ▶ Indra Sistemas, S.A.
- ▶ Ineco-Ingeniería y Economía del Transporte, S.A.
- ▶ Inse Rail, S.L.
- ▶ Luznor Desarrollos Electrónicos, S.L.
- ▶ Segula Technologies España, S.A.U.
- ▶ Sener Ingeniería y Sistemas, S.A.
- ▶ SGS Group Spain
- ▶ Simulaciones y Proyectos, S.L.
- ▶ Tecnival, S.A.
- ▶ Teldat, S.A.
- ▶ Teltronic
- ▶ Tekniker
- ▶ Thales España Grp, S.A.U.
- ▶ TPF Getinsa Euroestudios, S.L.
- ▶ Trigo Group
- ▶ Typsa - Técnica Y Proyectos, S.A.
- ▶ Vicomtech
- ▶ WSP Spain-Apia, S.A.

Consultoría en sistemas, medioambiental, gestión financiera e informática

- ▶ Aimen Centro Tecnológico
- ▶ Aquafriech, S.L.
- ▶ Ardanuy Ingeniería, S.A.
- ▶ Asea Brown Boveri, S.A.
- ▶ Citef (Fundación para el fomento de la innovación industrial)
- ▶ Fundación Gaiker
- ▶ Idom-Engineering, Consulting, Architecture
- ▶ Ineco-Ingeniería y Economía del Transporte, S.A.
- ▶ Intertek Ibérica Spain, S.L.U.
- ▶ Mainrail, S.L.
- ▶ Nertatec, S.L.
- ▶ Segula Technologies España, S.A.U.
- ▶ Sener Ingeniería y Sistemas, S.A.
- ▶ SGS Group Spain
- ▶ SQS (Software Quality Systems, S.A.)
- ▶ Simulaciones y Proyectos, S.L.
- ▶ TPF Getinsa Euroestudios, S.L.
- ▶ Vicomtech
- ▶ WSP Spain-Apia, S.A.

Technical Specifications Drafting and supervision of rolling stock manufacturing

- ▶ Aimen Centro Tecnológico
- ▶ Ardanuy Ingeniería, S.A.
- ▶ Asea Brown Boveri, S.A.
- ▶ Caf Turnkey & Engineering, S.L.
- ▶ Hispacold, S.A.
- ▶ Idom-Engineering, Consulting, Architecture
- ▶ Ineco-Ingeniería y Economía del Transporte, S.A.
- ▶ Segula Technologies España, S.A.U.
- ▶ Sener Ingeniería y Sistemas, S.A.
- ▶ SGS Group Spain
- ▶ Trigo Group
- ▶ WSP Spain-Apia, S.A.

Work supervision

- ▶ Aimen Centro Tecnológico
- ▶ Ardanuy Ingeniería, S.A.
- ▶ Asea Brown Boveri, S.A.
- ▶ Caf Turnkey & Engineering, S.L.
- ▶ Idom-Engineering, Consulting, Architecture
- ▶ Indra Sistemas, S.A.
- ▶ Ineco-Ingeniería y Economía del Transporte, S.A.
- ▶ Inse Rail, S.L.
- ▶ Intertek Ibérica Spain, S.L.U.
- ▶ Segula Technologies España, S.A.U.
- ▶ Sener Ingeniería y Sistemas, S.A.
- ▶ SGS Group Spain
- ▶ Sice Tecnología y Sistemas
- ▶ Tpf Getinsa Euroestudios, S.L.
- ▶ Typsa - Técnica y Proyectos, S.A.
- ▶ WSP Spain-Apia, S.A.

Product and process certifications

- ▶ ACYGS Sales Management, S.L.
- ▶ Aimen Centro Tecnológico
- ▶ Ardanuy Ingeniería, S.A.
- ▶ Certifer Belgorail, S.A. Sucursal en España
- ▶ Cetest, S.L.
- ▶ Citef (Fundación para el fomento de la innovación industrial)
- ▶ Dsaf-Dinámicas De Seguridad, S.L.
- ▶ Fundación Gaiker
- ▶ Idom-Engineering, Consulting, Architecture
- ▶ Ineco-Ingeniería y Economía del Transporte, S.A.
- ▶ Intertek Ibérica Spain, S.L.U.
- ▶ Ricardo Ceretification Iberia, S.L.
- ▶ Sener Ingeniería y Sistemas, S.A.
- ▶ SGS Group Spain
- ▶ SQS (Software Quality Systems, S.A.)
- ▶ Simulaciones y Proyectos, S.L.
- ▶ Trigo Group
- ▶ WSP Spain-Apia, S.A.

(O&M) plans and transport and demand studies

- ▶ ACYGS Sales Management, S.L.
- ▶ Aimen Centro Tecnológico
- ▶ Ardanuy Ingeniería, S.A.
- ▶ Caf Turnkey & Engineering, S.L.
- ▶ Citef (Fundación para el fomento de la innovación industrial)
- ▶ Mieres Rail, S.A.

- ▶ Gantrex Spain
- ▶ Idom-Engineering, Consulting, Architecture
- ▶ Ineco-Ingeniería y Economía del Transporte, S.A.
- ▶ Segula Technologies España, S.A.U.
- ▶ SGS Group Spain
- ▶ Tekniker
- ▶ Tpf Getinsa Euroestudios, S.L.
- ▶ Typsa - Técnica y Proyectos, S.A.

Training and simulations tools

- ▶ Aimen Centro Tecnológico
- ▶ Asea Brown Boveri, S.A.
- ▶ Lander
- ▶ Segula Technologies España, S.A.U.
- ▶ Simulaciones y Proyectos, S.L.
- ▶ Tekniker
- ▶ WSP Spain-Apia, S.A.

INFRASTRUCTURE AND SUPERSTRUCTURE

Civil works (platforms, stations, depots)

- ▶ Aimen Centro Tecnológico
- ▶ Azvi, S.A.
- ▶ Caf Turnkey & Engineering, S.L.
- ▶ Comsa Corporación
- ▶ Funor, S.A.
- ▶ ICF - Ingeniería y Control Ferroviario
- ▶ Inse Rail, S.L.
- ▶ Lantania
- ▶ Luznor Desarrollos Electrónicos, S.L.
- ▶ Sener Ingeniería y Sistemas, S.A.
- ▶ Uretrek Soluciones Innovadoras, S.L.U.

Electrification

- ▶ Alstom Transporte, S.A.
- ▶ Azvi, S.A.
- ▶ Asea Brown Boveri, S.A.
- ▶ Caf Turnkey & Engineering, S.L.
- ▶ Comsa Corporación
- ▶ Cunext
- ▶ ICF - Ingeniería y Control Ferroviario
- ▶ Ingeteam Power Technology, S.A.
- ▶ Inse Rail, S.L.
- ▶ La Farga Yourcoppersolutions, S.A.
- ▶ Lantania
- ▶ Telice, S.A.
- ▶ Uriarte Safybox
- ▶ Valdepinto, S.L.

Infrastructure and superstructure equipment and components

- ▶ Aimen Centro Tecnológico
- ▶ Alstom Transporte, S.A.
- ▶ Amurrio Ferrocarril y Equipos, S.A.
- ▶ Arcelormittal España, S.A.
- ▶ Artech (Electrotécnica Artech Smart Grid, S.L.)
- ▶ Asea Brown Boveri, S.A.
- ▶ Azvi, S.A.
- ▶ Cables de Comunicaciones Zaragoza, S.L.
- ▶ Caf Turnkey & Engineering, S.L.
- ▶ CEIT
- ▶ Comsa Corporación

- Cunext
- Dsaf-Dinámicas De Seguridad, S.L.
- ICF - Ingeniería y Control Ferroviario
- Mieres Rail, S.A.
- Flexix, S.A.
- Funor, S.A.
- Ikusi, S.L.U.
- Inse Rail, S.L.
- Ladicim
- Lantania
- Precon - Prefabricaciones y Contratas, S.A.U.
- Pretensados del Norte, S.L.
- Talleres Alegría, S.A.
- Talleres Zitrón
- Tecnival, S.A.
- Telice, S.A.

Track assembly

- Alstom Transporte, S.A.
- Amurrio Ferrocarril y Equipos, S.A.
- Azvi, S.A.
- Caf Turnkey & Engineering, S.L.
- Comsa Corporación
- Gantrex Spain, S.A.
- ICF - Ingeniería y Control Ferroviario
- Inse Rail, S.L.
- Lantania
- Pretensados del Norte, S.L.
- Talleres Alegría, S.A.
- voestalpine Railway Systems JEZ, S.L.

TRAFFIC CONTROL AND SIGNALLING SYSTEMS, COMMUNICATION, PASSENGER INFORMATION AND TICKETING

Traffic control and signalling (safety)

- Alstom Transporte, S.A.
- Cables de Comunicaciones Zaragoza, S.L.
- Caf Signalling, S.L.
- Caf Turnkey & Engineering, S.L.
- CEIT
- Enclavamientos y Señalización Ferroviaria ENYSE, S.A.U.
- Electrans, S.A.
- ICF - Ingeniería y Control Ferroviario
- Ikusi, S.L.U.
- Indra Sistemas, S.A.
- Inse Rail, S.L.
- Luznor Desarrollos Electrónicos, S.L.
- Revenga Ingenieros, S.A.
- Segula Technologies España, S.A.U.
- Sice Tecnología y Sistemas
- Siemens Rail Automation, S.A.U.
- Tecnival, S.A.
- Teltronic, S.A.
- Telice, S.A.
- Thales España Grp, S.A.U.
- Uriarte Safybox
- voestalpine Railway Systems JEZ SL

Protección (security) y supervisión de infraestructuras

- Alstom Transporte, S.A.

- Azvi S.A.
- Asea Brown Boveri, S.A.
- Caf Turnkey & Engineering, S.L.
- Comsa Corporación
- Dsaf-Dinámicas De Seguridad, S.L.
- ICF - Ingeniería y Control Ferroviario
- Indra Sistemas, S.A.
- Inse Rail, S.L.
- Mainrail, S.L.
- Segula Technologies España, S.A.U.
- Siemens Rail Automation, S.A.U.
- Telice, S.A.
- Thales España Grp, S.A.U.
- Vicomtech

Systems and equipment for collection, ticketing and access control

- Asea Brown Boveri, S.A.
- Caf Turnkey & Engineering, S.L.
- Calmell, S.A.
- Comsa Corporación
- Gmv Sistemas, S.A.U.
- Ikusi SLU
- Indra Sistemas, S.A.
- Inse Rail, S.L.
- Revenga Ingenieros S.A.
- Sener Ingeniería y Sistemas, S.A.
- Sice Tecnología y Sistemas
- Siemens Rail Automation, S.A.U.
- Telice, S.A.
- Vicomtech

Communications

- Azvi, S.A.
- Cables de Comunicaciones Zaragoza, S.L.
- Caf Turnkey & Engineering, S.L.
- CEIT
- Cellnex Telecom, S.A.
- Comsa Corporación
- Enclavamientos y Señalización Ferroviaria ENYSE, S.A.U.
- Gmv Sistemas, S.A.U.
- ICF - Ingeniería y Control Ferroviario
- Ikusi SLU
- Indra Sistemas, S.A.
- Inse Rail, S.L.
- Revenga Ingenieros S.A.
- Sener Ingeniería y Sistemas, S.A.
- Sice Tecnología y Sistemas
- Siemens Rail Automation, S.A.U.
- Teldat, S.A.
- Teltronic, S.A.U.
- Telice, S.A.
- Thales España Grp, S.A.U.
- Vicomtech

Passenger information and on-board entertainment systems

- Alstom Transporte, S.A.
- Caf Turnkey & Engineering, S.L.
- Gmv Sistemas, S.A.U.
- Icon Multimedia, S.L.
- Indra Sistemas, S.A.

- Inse Rail, S.L.
- Ikusi SLU
- Revenga Ingenieros, S.A.
- Sice Tecnología y Sistemas, S.A.
- Siemens Rail Automation, S.A.U.
- Tecnival, S.A.
- Teldat, S.A.
- Telice, S.A.
- Vicomtech

ROLLING STOCK MANUFACTURERS

High Speed trains (over than 250km/H) M.R para tráfico de pasajeros alta velocidad (más de 250km/H)

- Alstom Transporte, S.A.
- Caf-Construcciones y Auxiliar de Ferrocarriles, S.A.
- Patentes Talgo, S.L.
- Siemens Rail Automation, S.A.U.
- Zeleros

Long distance and regional passengers trains (up to 250km/H)

- Alstom Transporte, S.A.
- Caf-Construcciones y Auxiliar de Ferrocarriles, S.A.
- Patentes Talgo, S.L.
- Siemens Rail Automation, S.A.U.
- Stadler Rail Valencia, S.A.U.

Urban and suburban trains

- Alstom Transporte, S.A.
- Caf-Construcciones y Auxiliar de Ferrocarriles, S.A.
- Patentes Talgo, S.L.
- Siemens Rail Automation, S.A.U.
- Stadler Rail Valencia, S.A.U.

Freight wagons and Locomotives

- Alstom Transporte, S.A.
- Caf-Construcciones y Auxiliar de Ferrocarriles, S.A.
- Patentes Talgo, S.L.
- Siemens Rail Automation, S.A.U.
- Stadler Rail Valencia, S.A.U.
- Talleres Alegría, S.A.
- Zeleros

Vehicles for infrastructure maintenance

- Alstom Transporte, S.A.
- Caf-Construcciones y Auxiliar de Ferrocarriles, S.A.
- Patentes Talgo, S.L.
- Siemens Rail Automation, S.A.U.
- Talleres Alegría, S.A.

MANUFACTURERS OF VEHICLE COMPONENTS, AUXILIARY EQUIPMENT AND SYSTEMS

Traction and propulsion components

- Aimen Centro Tecnológico
- Alstom Transporte, S.A.
- Ariño Douglass, S.A.
- Artech (Electrotécnica Artech Smart Grid, S.L.)
- Asea Brown Boveri, S.A.
- Caf Equipos y Componentes
- Caf Power & Automation, S.L.U.
- Flexix, S.A.

- Forging Steel Products, S.L.
- Ingeniería Viesca, S.L.
- Ingeteam Power Technology, S.A.
- Mgn Transformaciones del Caucho, S.A.
- Siemens Rail Automation, S.A.U.
- Zeleros

Control, auxiliary and diagnostic systems

- Aimen Centro Tecnológico
- Alstom Transporte, S.A.
- Artech (Electrotécnica Artech Smart Grid, S.L.)
- Asea Brown Boveri, S.A.
- Caf Power & Automation, S.L.U.
- CEIT
- Enclavamientos y Señalización Ferroviaria ENYSE, S.A.U.
- Gmv Sistemas, S.A.U.
- Hispacold S.A.
- Ibérica Tecnología en Sistemas de Seguridad Ferroviarios, S.L. (ITSS)
- Indra Sistemas, S.A.
- Ingeniería Viesca, S.L.
- Ingeteam Power Technology, S.A.
- Kimua Group
- Nertatec, S.L.
- NGRT, S.L.
- NRF España, S.A.
- Stadler Rail Valencia, S.A.U.
- Teldat, S.A.
- Zeleros

Assembly equipment

- Agui, S.A.
- Aimen Centro Tecnológico
- Artech (Electrotécnica Artech Smart Grid, S.L.)
- Asea Brown Boveri, S.A.
- Danobat, S. COOP.
- Forging Steel Products, S.L.
- Fundiciones del Estanda, S.A.
- Funor, S.A.

Mechanical components

- Agui, S.A.
- Alstom Transporte, S.A.
- Caf Equipos y Componentes
- Caf-Construcciones y Auxiliar de Ferrocarriles, S.A.
- Flexix, S.A.
- Forging Steel Products, S.L.
- Funor, S.A.
- Fundiciones del Estanda, S.A.
- Hispacold, S.A.
- Metalocaucho, S.L.
- Mgn Transformaciones del Caucho, S.A.
- Nertatec, S.L.
- Stadler Rail Valencia, S.A.U.
- Talleres Alegría, S.A.
- Zeleros

Interiors

- Agui, S.A.
- Ariño Douglass, S.A.
- Colway Ferroviaria, S.L. (Nexus Management)
- Flexix, S.A.
- Fundación Gaiker
- Satys Interiors Railway Spain, S.A.

Safety

- Agui, S.A.
- Alstom Transporte, S.A.
- Artech (Electrotécnica Artech Smart Grid, S.L.)
- Dsaf - Dinámicas de Seguridad, S.L.
- Enclavamientos y Señalización Ferroviaria ENYSE, S.A.U.
- Fundación Gaiker
- Indra Sistemas, S.A.
- Luznor Desarrollos Electrónicos, S.L.

MAINTENANCE: EQUIPMENT, MAINTENANCE SERVICES AND REFURBISHMENT

Infrastructure and superstructure maintenance

- Aimen Centro Tecnológico
- Alstom Transporte, S.A.
- Amurrio Ferrocarril y Equipos, S.A.
- Azvi, S.A.
- Caf Turnkey & Engineering, S.L.
- CEIT
- Comsa Corporación
- ICF - Ingeniería y Control Ferroviario
- Mainrail, S.L.
- Mieres Rail, S.A.
- Gantrex Spain
- Inse Rail, S.L.
- Ladicim
- Smart Motors
- Uretek Soluciones Innovadoras, S.L.U.

Rolling Stock maintenance

- Aimen Centro Tecnológico
- Alstom Transporte, S.A.
- Artech (Electrotécnica Artech Smart Grid, S.L.)
- Azvi S.A.
- Caf Equipos y Componentes
- Caf - Construcciones y Auxiliar de Ferrocarriles, S.A.
- Caf Turnkey & Engineering, S.L.
- Comsa Corporación
- Grupo Trigo
- Hispacold, S.A.
- Patentes Talgo, S.L.
- Siemens Rail Automation, S.A.U.
- Stadler Rail Valencia, S.A.U.
- Talleres Alegría, S.A.
- Talleres Zitrón

Maintenance of traffic control and signalling, communications, passenger information and ticketing systems

- Aimen Centro Tecnológico
- Alstom Transporte, S.A.
- Artech (Electrotécnica Artech Smart Grid, S.L.)
- Azvi, S.A.
- Caf Signalling, S.L.
- Caf Turnkey & Engineering, S.L.
- Dsaf-Dinámicas de Seguridad, S.L.
- Electrans, S.A.

- Gmv Sistemas, S.A.U.
- ICF - Ingeniería y Control Ferroviario
- Ibérica Tecnología en Sistemas de Seguridad Ferroviarios, S.L. (ITSS)
- Ikusi, S.L.U.
- Indra Sistemas, S.A.
- Inse Rail, S.L.
- Luznor Desarrollos Electrónicos, S.L.
- Patentes Talgo, S.L.
- Sice Tecnología y Sistemas, S.A.
- Siemens Rail Automation, S.A.U.
- Smart Motors
- Telice, S.A.
- voestalpine Railway Systems JEZ, S.L.

Maintenance of traffic control and signalling, communications, passenger information and ticketing systems

- Aimen Centro Tecnológico
- Alstom Transporte, S.A.
- Artech (Electrotécnica Artech Smart Grid, S.L.)
- Caf Equipos y Componentes
- Caf-Construcciones y Auxiliar de Ferrocarriles, S.A.
- Caf Power & Automation, S.L.U.
- Caf Turnkey & Engineering, S.L.
- Enclavamientos y Señalización Ferroviaria ENYSE, S.A.U.
- Gmv Sistemas, S.A.U.
- Géminis Lathes
- Grupo Trigo
- Hispacold, S.A.
- ICF - Ingeniería y Control Ferroviario
- Indra Sistemas, S.A.
- Ingeteam Power Technology, S.A.
- Kimua Group
- Mgn Transformaciones del Caucho, S.A.
- NGRT, S.L.
- NRF España, S.A.
- Patentes Talgo, S.L.
- Satys Interiors Railway Spain, S.A.
- Sice Tecnología y Sistemas
- Smart Motors
- Stadler Rail Valencia, S.A.U.

Maintenance of systems, equipment and vehicles components

- Aimen Centro Tecnológico
- Alstom Transporte, S.A.
- Aquafisch, S.L.
- CAF Equipos y Componentes
- Danobat, S. COOP.
- Electrans, S.A.
- Kimua Group
- ICF - Ingeniería y Control Ferroviario
- Ingeniería Viesca, S.L.
- Nertatec, S.L.
- Newtek Solidos, S.L.
- Patentes Talgo, S.L.
- Tecnival, S.A.



ASEA BROWN BOVERI, S.A.

Rail is being rediscovered as a sustainable and energy-efficient form of transport. We understand the importance and implications of running these railway networks.

We provide complete solutions that protect your infrastructure, and meet the expectations of users and transport stakeholders for all key applications. These include infrastructure, passenger stations, control and signaling units, tunnels and rolling stock.

🚩 C/ SAN ROMUALDO, 13 - 28037 (MADRID)

☎ +34 915 81 93 93



✉ contact.center@es.abb.com

🌐 new.abb.com/railway/abb-solutions-for-transportation-rail-and-infrastructure



ACYGS SALES MANAGEMENT S.L.

ACYGS es una empresa consultora de servicios de ingeniería dedicada exclusivamente al sector ferroviario y especializada en todos los servicios de consultoría e ingeniería asociados a un taller de mantenimiento de material rodante. Ofrecemos un servicio de ingeniería ferroviaria personalizada para cada cliente, adaptándonos a las necesidades de cada taller y proyecto, desarrollando su actividad a nivel internacional realizando con éxito proyectos en los 5 continentes, brindando soluciones globales avaladas por la experiencia de más de 20 años en el sector de mantenimiento de material rodante de los profesionales que forman parte de Acygs.

🚩 C/ Loeches , 65 - Oficina 7 Madrid (MADRID)

☎ +34 914 85 52 88



✉ jazamora@acygs.com

🌐 www.acygs.com



AGUI S.A.

AGUI is a B2B subcontractor expert in the manufacturing of electro-mechanical assemblies for OEMs. We collaborate with the client in the design of the product, contributing with our knowledge in process engineering and welding, and once the product is defined, we industrialize and manufacture it according to the takt time. AGUI is certified in ISO-3834 and EN-15085, which positions us as a reference supplier for welded assemblies.

🚩 Pol. Ind. Lintzirin-Gaina. Parcela B-1. 20180 Oiartzun - (GUIPÚZCOA)

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☎ +34 943 552 066

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🌐 www.agui.com



AQUAFRISCH, S.L.

More than 25 years of experience in the railway sector endorse Aquafrisch as a manufacturer of train washing systems, bogies washing cabins, WC extraction systems (CET) and other products for the maintenance of rolling stock in railway workshops.

Our equipment is installed in more than 30 countries on 5 continents. Aquafrisch is also a leader in industrial water treatment and purification. Aquafrisch takes care of the design, manufacture, installation, commissioning, training and maintenance of the machines according to the customer's needs. Aquafrisch is certified ISO9001:2015, ISO14001:2015 and ISO 45001:2018.

🚩 Margarita Salas 7, 28521 Rivas-Vaciamadrid (MADRID)

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🌐 www.aquafrisch.com



ARCELORMITTAL

ArcelorMittal, as the steel industry leader in product and process innovation, is fully geared to meet the future requirements of the rail industry. With rail production facilities in Spain, Poland, Luxembourg and USA offers a wide portfolio of rails for subways, trains, trams, light rails, crane rails, crossings and rail accessories. We are specialist in rail for high-speed net, with over 1 million tons produced, and presence in infrastructure of over 30 countries, the high technologic quality allows participating in the more demanding tenders all over the world. ArcelorMittal has its own R&D Rail Excellence Centre for developing new products and processes.

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ARDANUY INGENIERÍA, S.A.

Ardanuy Ingeniería, S.A. is an engineering consulting firm specialized in studies, projects, works management, safety engineering (ISA), operation / maintenance studies; and technical guidance for railways (high-speed, conventional, freights, metros, trams, cable cars), electrical engineering (sub-stations and high-voltage lines), roads (highways, freeways, BRT's, streets, etc.), buildings (architecture and facilities) and telecommunications.

The company was established in 1992 and is comprised of a permanent team of more than 200 professionals.

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AIMEN CENTRO TECNOLÓGICO

We are an innovation & technology Centre specialized in materials and in advanced manufacturing technologies, especially joining technologies and laser technologies applied to materials processing and robotics. We develop R&D&I in collaboration with companies in the field of the technologies for industry 4.0, and we offer technological services to industry in the field of welding and corrosion engineering, manufacturing engineering, design and simulation and mechatronics; developing customized and integral technological solutions which respond to the needs of our clients and associated companies. Our accredited laboratories provide analysis and testing services, especially failure analysis and in-service behavior of industrial components.

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ALSTOM ESPAÑA

As a promoter of sustainable mobility, Alstom offers a complete range of solutions (from high-speed trains to metros, tramways and e-buses), passenger solutions, customized services (maintenance, modernization), infrastructure, signalling and digital mobility solutions. The company recorded sales of €8,2 billion in the 2017/18 fiscal year. Alstom is present in over 60 countries and employs 38,900 people. In Spain Alstom employs around 2,000 people on 18 sites, including a rolling stock manufacturing site and 4 innovation centres where it runs R&D programmes for rolling stock and railway signalling, safety, security, digital mobility and services.

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AMURRIO FERROCARRIL Y EQUIPOS, S.A.

Design, production, installation of turnouts, track devices, crossings. For all type of purpose. Metro, tram, regional, conventional, high speed, heavy haul, ports and industrial.

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ARIÑO DUGLASS, S.A.

50 years' experience behind us as a company specialised in glass for architecture and railway. An extensive presence in the Spanish, European and world markets has enabled us to obtain the knowledge and know-how in order to offer the most technologically advanced products of high quality.

It is in our DNA to continuously research and develop technology that allows us to adopt the very latest manufacturing methods, resulting in business excellence and ongoing innovations. In partnership with a number of organisations and institutions, we collaborate, cooperate and lead different research projects.

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ARTECHE

The Artech Group is focused on offering equipment and solutions for the electricity and railway business worldwide. The expertise of more than 70 years manufacturing instrument transformers and electromechanical relays gives the client the assurance of a technological leader. With projects over more than 40 countries, our dedicated range of railway relays are designed to meet the highest standard requirements of the sector and its reliability and durability allow them to be used not only as general purpose relays, but also in all kind of safety functions, both for on-board and signalling applications making them suitable to be used in circuits requiring up to SIL-4 safety integrity level.

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AZVI

Azvi is the company which undertakes construction within Grupo Azvi. For over 100 years, Azvi has carried out a significant number of large scale civil engineering and building projects. Azvi has extended its activity to all construction areas in Europe, America and the Middle East, without losing sight of its origins and railway background. By applying principles of responsibility to the whole business sphere, seeking the creation of value, maintaining a strong commitment to all its stakeholders in all countries where it is present and investing in R&D Azvi continues constructing a company capable of facing the new challenges of an increasingly globalised market.

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CERTIFER BELGORAIL SA SUCURSAL IN ESPAÑA

Certifer Belgorail SA is a certification, inspection and safety evaluation entity for the guided transport sector, both conventional railways and subways and trams. We are an accredited body for the certification of interoperability (NoBo), national regulations (DeBo), safety evaluations under CENELEC standards (ISA) and under CE Regulations (AsBo). We are part of the Certifer Group, with a presence, in addition to Spain, in Belgium, France, the Netherlands, Germany, Austria, Italy, Sweden, Turkey, Algeria, Brazil, Australia, Vietnam, the United Arab Emirates and China.

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CABLES DE COMUNICACIONES ZARAGOZA, S.L.

Cables de Comunicaciones is one of the main European companies dedicated to the design, manufacturing and commercialisation of telecommunication, signalling and optic fibre cables. Ever since its foundation in 1971, it has contributed to the development and extent of the telecommunications infrastructures. Railway companies from the main European countries entrust us with the manufacture of their cables. Among them, they stand out: Adif, SNCF, NetworkRail, Infrabel etc. Cablescom undertakes its activity in Zaragoza, in the Malpica industrial park, over a surface of 77,000 m², which includes a production plant, offices and warehouses.

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CAF - CONSTRUCCIONES Y AUXILIAR DE FERROCARRILES, S.A.

CAF is one of the world leaders in the design and implementation of comprehensive transit systems. CAF provides comprehensive project and engineering management throughout all stages of the project including feasibility analysis and investigations, system design, civil work, signalling, electrification and other electromechanical systems, rolling stock supply and system operation and maintenance. In terms of rolling stock, CAF supplies and maintains high speed trains, regional and commuter trains, locomotives, metro units, trams and buses.

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CAF TURNKEY & ENGINEERING

CAF Turnkey & Engineering was created in 2007 with its head office in the Technological and Scientific Park of Biscay (Zamudio). It began its business in Integrated Engineering of Transport Services and in 2015, after merging with the company CMFS (Mexico), it increased its portfolio of services with the inclusion of EPC projects for both civil works and subsystems. Following solid and constant growth, the company currently has a workforce of 200 with offices in Zamudio, Madrid and Mexico, providing service to both companies within the CAF Group and national and international private and public customers.

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CALMELL, S.A.

The Calmell Group is the leader in access control and identification, through its companies Calmell S.A., Affix S.L., Idoneum S.A., which are respectively engaged in producing the supports (tickets, cards...), developing specific software and hardware, personalization and security. In the public transport sector it works for integrators and operators supplying any kind of support for ticketing and reader/writer systems. With a strong international presence through its network of representatives and distributors, the Calmell Group is able to satisfy your needs on a global level.

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CEIT

We are a Basque Technology Center founded by the University of Navarra, whose main objective is to develop applied R+D+i projects with companies to improve their competitiveness. We are part of BRTA (Basque Research & Technology Alliance), which includes 16 agents that constitute the Basque Network of Science, Technology and Innovation (RVCTI). We also participate in Shift2Rail Joint Undertaking as associated members. We focus our R+D+i activity within the railway sector in the following topics: energy efficiency, maintenance, railway dynamics, component design and characterisation, embedded systems (SIL4), positioning, data intelligence.

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CAF EQUIPOS Y COMPONENTES

CAF Equipment and Components is a key player within CAF Rail Services, the CAF Group's services division, as a Centre of Excellence in Equipment and Components to address the challenges of the railway industry. Our extensive experience as a key player in the CAF Group, has enabled us to develop a portfolio of products and services focused on the operational improvement of our customers' maintenance activities:

- Maintenance and improvement of Equipment and Components
- Supply and management solutions of Spare Parts and Components
- Comprehensive solutions in Workshop Equipment
- Refurbishment and Accident Repair

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CAF POWER & AUTOMATION

CAF Power & Automation designs and develops electric traction systems, energy storage systems and control & communication, which guarantee adaptable reliable and committed solutions with transport. Our systems are modular and flexible and can be integrated both in new vehicles and in those in service or that need refurbishment. Traction systems; Energy Storage (GREENTECH) and Control & Communication (COSMOS). Railway systems modernisation and refurbishment: Equipment and components, system integration, installation, maintenance and guarantee. Railway system maintenance: Technical support, spare parts, training courses, test benches.

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CAF SIGNALLING, S.L.

CAF Signalling, the technological subsidiary of the CAF Group, designs and provides Integral Signalling Solutions, both in Spain and abroad. The company has its own advanced technology products, both for onboard and wayside applications that make up the core of its integral solutions. As a result of a significant and growing effort in R&D&I, particularly in the area of critical safety systems, CAF Signalling promotes continuous innovation and customer focus.

CAF Signalling, boasts the Company's own in house engineering and expertise to take on "turn-key" railway signalling projects.

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CELLNEX TELECOM, S.A.

Cellnex manages a portfolio of more than 130,000 sites – including forecast roll-outs up to 2030 – in Spain, Italy, the Netherlands, France, Switzerland, the United Kingdom, Ireland, Portugal, Austria, Denmark, Sweden and Poland. Cellnex's business is structured in four major areas: telecommunications infrastructure services; audiovisual broadcasting networks, security and emergency service networks and solutions for smart urban infrastructure and services management (Smart cities and the "Internet of Things" [IoT]).

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CETEST, S.L. Centro de Ensayos y Análisis

Fully accredited ISO17025, CETEST is an experienced laboratory in railway vehicles and components testing. Its offering covers a wide variety of component test benches at their facilities as well as portable ones. CETEST provides a global on-track measurement deployment capacity. From validation and verification test in the development phase to product homologation and failure detection / root cause analysis in the after-sales operation, CETEST can assist you during the full lifecycle of your product. Their customers include passenger, freight and special track maintenance vehicle manufacturers, component suppliers, as well as Notified Bodies, engineering firms and authorities.

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CITEF (FUNDACIÓN PARA EL FOMENTO DE LA INNOVACION INDUSTRIAL)

CITEF (Railway Technology Research Centre) was created in 1997 as part of F2I2 (the Foundation for the Development of Industrial Innovation) for research, innovation, experimentation, study and teaching purposes within the railway knowledge area. It is a non-profit organisation pursuing aims of general interest within any rail transport technology sector.

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**COLWAY FERROVIARIA, S.L.**

COLWAY FERROVIARIA S.L., a company belonging to the COLWAY Group, is specialised in the design, engineering, manufacture, installation and commissioning of turnkey railway interiors and toilet modules projects. Revamping of seats and floors for a significant improvement of the coaches, with a controlled investment, is included among its capabilities. Through the integrated management of modular supplies & systems, based on experience, research and innovation, satisfaction and expectations of railway constructors and Public Administrations are achieved. Its work is based on the application of strong values: commitment, professionalism, ethics and agility.

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**COMSA**

COMSA is the company of COMSA Corporación specialised in railway infrastructures. Founded in 1891, the company provides a comprehensive service in the field of construction, maintenance, electrification and control and communication systems for high-speed and conventional lines, metros and tramways. In this business activity, it is leader in Spain, where has been involved in the carrying out of all high-speed lines, and has permanent operations in Argentina, Brazil, Croatia, Denmark, Mexico, Poland, Portugal and Uruguay. It has also taken part in a large number of projects in other markets such as Italy, the Philippines, Taiwan, Malaysia, India, etc.

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**CUNEXT COPPER INDUSTRIES**

Cunext in the way to continuous development has created the entire cable product range for overhead line electrification adapting at any speed from local transport to high speed line. Our modern technology together with a wide experience at cable and alloy manufacturing makes us the best partner for railway companies offering best product quality and service. Cunext Group locate production plants at strategic places such as Cordoba for copper products, Vitoria and Brescia for aluminium products.

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**ELECTROSISTEMAS BACH, S.A.**

Electrans, established in Barcelona in 1977, has had a successful career path that turn it in an international relevant supplier in signalling, particularly in the field of level crossing protection solutions, railway and tramway signalling, detection systems and LED lighting, obtaining its products and solutions worldwide recognition.

Electrans' constant progress is motivated by the commitment to innovation, at the service of the adaptability of systems and products for the current needs of railway projects.

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**FLEXIX, S.A.**

FLEXIX, develops, manufactures worldwide since 1950 INJECTION and EXTRUSION RUBBER PARTS, rubber-metal, rubber-plastic, special elastomers and assemblies. We are part of the KÄCHELE-FLEXIX Group, with 2 plants in Germany, 1 in Spain and a warehouse in USA. For the RAILWAY SECTOR we produce mainly for infrastructures, absorption of vibrations under track, tie pads for sleepers, different range of stiffness (14-152 kN/mm). We provide development in geometries (FEM), materials, (conductivity, non-harmful gases...)
 TYPE OF PARTS: Pads, Ducts, bellows, tubes, silent-blocks, joints, bumpers, axles, links, valves, bearings.
 MIXTURES: NR, SBR, EPDM, CR, H/NBR, ECO, AEM, ACM, Silicone, FPM.

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**FORGING STEEL PRODUCTS, S.L.**

Manufacturing of machined and if needed painted forged components ready for assembly destined to the railway rolling stock manufacturers for chassis, brakes, clutches, hooks etc.

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**DANOBAT S.COOP.**

Specialised Machine Tools and production systems for railway industry offering technologically advanced solutions and services, including among others engineering, consultancy, which are fully adapted to clients' needs. DANOBAT focuses its activity in the supply of turnkey solutions for the manufacturing and maintenance of railways rolling stock, incorporating own leading technology products, together with those manufactured by specialised companies.

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**DINÁMICAS DE SEGURIDAD, S.L.**

DSAF is a entrepreneurial society focused on the safety of the movement of people at risk. Committed to the new technologies applied to the design of signaling systems, prevention and emergency in safety, DSAF promotes the development of products that guarantee the highest grade of security according to the standards of type approval current in generalized risk societies such as global ones. The activity of DSAF focuses on these two major sectors: road / rail tunnels and wind towers.

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**ENCLAVAMIENTOS Y SEÑALIZACIÓN FERROVIARIA ENYSE S.A.U.**

Enyse is a Signalling company belonging to the Industrial Services division of the ACS group. For Enyse, the success of their projects is based on a high level of adaptation to functional and operational needs of the various railways - flexibility is the key word. In an industry increasingly integrating technology standards, the required Reliability, Availability, Maintainability and Safety standards not only apply to system design level, but are the actual premises to properly implementing and commissioning turn-key Signalling projects.

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**FUNDICIONES DEL ESTANDA, S.A.**

Since 1957 Estanda has been providing various sectors with steel castings. The half of all its activity is focused on the high-speed train brake discs manufacturing, being one of the first worldwide manufacturers, the other half is focused on a wide range of sectors such as the cement and mining industry, defence, off-shore, automotive industry, and bogie components for the railway equipment. Mostly low alloy steels, wear resistant steels, refractory steels, stainless steels and white irons are casted. With its 14.000 tonnes per year production capacity, Estanda manufactures from 10 to 2000 kgr. parts in all kinds of batch sizes, with 2.400 mm as its maximum part dimension.

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**FUNORSA**

Funorsa is a Steel casting foundry with more than 20 years in the railway sector. We are specialized in pieces of high responsibility as couplers, Pivots, connection rods and different parts of the bogies. We are able to cast low alloy, alloy and inox castings up to 1.300 kg with a capacity of 2.000 Tons per year.

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**GAIKER CENTRO TECNOLÓGICOS**

GAIKER Technology Centre, located in the Technological Park of Bizkaia, is devoted to the development of new technologies to be transferred to the industry. Since 1985, the Centre has carried more than 2,000 R&D Projects in the areas of Plastics and Composites, Environment and Recycling and Biotechnology. Besides, GAIKER offers to its customers Advanced Technological Services, Analysis and Tests and Technological Dissemination Services. GAIKER counts on 87 employees and was awarded in 2008 by the European Foundation for Quality Management (EFQM) with the "Prize Winner" for the best European organisation in "Management for Process and Facts".

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**GANTREX SPAIN, S.A.**

Gantrex is the global market leader in production, distribution installation and maintenance of high quality crane rail solutions. Gantrex products are used in many different applications and end-markets including ports, shipyards, steel mills aluminium smelters railway depots and heavy industries.

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**GEMINIS LATHES, S.A.**

Leaders in the development of horizontal and multiprocess lathes, and specialized in railway sector, where we are proud to support the manufacturers of trains and maintenance lines, among other agents in the value chain. We offer customized solutions with highly reliable machines for the maintenance of rolling stock. Our lathes are specialized in the machining of axles, axle-wheel set and wheels.

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**GLOBAL QUALITY ENGINEERING SER. UNA COMPAÑÍA DE TRIGO GROUP**

TRIGO Spain is a supplier of quality services and support in the supply chain in industrial sectors. Founded in 2001, it offers quality assurance services in products, maintenance, industrial means management and metrology with more than 600 quality professionals in Spain. TRIGO GROUP is present in 25 countries with a team of more than 10,000 professionals. TRIGO Spain exports to the railway sector good practices of high added value developed in sectors such as aerospace and automotive.

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**INGENIERÍA Y CONTROL FERROVIARIO, SAU**

ICF offers technical and sustainable solutions for railway signalling. In this area, our vocation is betting heavily on the development and innovation, constantly releasing new products that can be used to improve and optimize existing technology solutions. All the level crossings since June 2001 have been protected by ICF with its level crossing protection system SPN-900. We are working worldwide with more than 1000 international references. For us it's very important to be sustainable so we have worked hard to design systems that reduce dramatically its power consumption which allows it to work taking its energy only from sun, getting a zero CO2 emissions and zero external power supply.

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**IDOM CONSULTING, ENGINEERING AND ARCHITECTURE S.A.U.**

IDOM is one of the leading companies in the field of professional services in Engineering, Architecture and Consultancy. An independent company established in 1957 and it has participated in over 30.000 projects in five continents. In 25 countries with 42 offices. More than 3.500 staff possesses the expertise and experience to cover all the phases of a railway project (high speed, conventional, freight, metro, light rail, tramway, depot and workshops). From conception to commissioning and beyond and facing the challenges of an innovative, efficient and resilient Transport System. IDOM accompany the client by providing the correct technical assistance required for the decision making process.

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**IKUSI, S.L.**

At Ikusi, we provide complex turnkey integration project design, engineering and development services both for rolling stock and for infrastructure, with the agility and flexibility required by the rail industry. We are oriented towards improving our clients' competitiveness and innovation capacities, thanks to our deep business knowledge developed during these years. Our business focus is the design and supply of innovative technological solutions to help vehicle builders, transport operators and authorities optimize and transform their business while guaranteeing quality of service and enhancing passenger experience in terms of security, information, comfort and accessibility.

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**GMV SISTEMAS S.A.U.**

GMV is a leading firm in the design, development, implementation and rollout of Intelligent Transportation Systems (ITS) guaranteeing compliance with the railway sector standards. Main products and services: On board units for location and communications, Fleet Management Systems, Fare Collection Systems, Passenger information systems, CCTV systems, PA & Intercom system, Systems for security reinforcement, Eco-driving systems, Software for planning and scheduling of services. Conceived for all railway modes (tram, metro, commuter train, long distance, high speed trains...)

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**HIERROS Y CARBONES, S.A.**

Since 1997 Hicasa is specialised in transformation, tailored cut, storage and distribution of railway tracks materials, all kinds of rails and railways accessories with a permanent stock of more than 3.500 MT. In 2006 we have incorporated to our Group of companies a factory specialised in manufacturing light rails from 7 kg/m to 48 kg/m, manufacture according European and American Standard, Australian or South African together with other types of Standard (AREMA). Our own experience allows us the optimal management of the supply chain, exporting to more than 30 countries all over the world.

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www.hicasa.com

**ICON MULTIMEDIA, S.L.**

With over 25 years of experience, we have an extensive experience in the Digital Signage sector. Our DENEVA Digital Signage platform is specially designed for high availability environments such as Smart Cities or as a powerful and comprehensive marketing tool for 'Smart Stations', guaranteeing a reliable and safe travelers and users experience.

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**INDRA**

Indra is one of the leading global technology and consulting companies and the technological partner for core business operations of its customers world-wide. It is a world-leader in providing proprietary solutions in specific segments in Transport and Defense markets, and a leading firm in Digital Transformation Consultancy and Information Technologies in Spain and Latin America through its affiliate Minsait. Its business model is based on a comprehensive range of proprietary products, with a high-value focus and with a high innovation component. In the 2018 financial year, Indra achieved revenue of €3.104 billion, with 43,000 employees, a local presence in 46 countries and business operations in over 140 countries.

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**INECO**

Global leader in transport engineering and consultancy, it has contributed to the development of transport infrastructures for over 50 years in more than 50 countries. Its high level technical specialisation allows its activity to diversify into new markets and reinforce its presence in those where it is already established. Its participation in the whole railway system in Spain has led the company to develop important international projects like the Makkah-Madinah high speed in Saudi Arabia, the HS2 project in the United Kingdom or the deployment of ERTMS in Europe.

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**INGENIERÍA VIESCA S.L.**

We are specialists in design and manufacture of power electronic equipment. Our equipment works satisfactorily in all the continents with high reliability and availability, making efficient use of the available energy. We adapt our products to customer needs and requirements according with the applicable standards and the best quality. The expected functionality is guaranteed by means of specific test protocols. Our innovation is present in all our products: auxiliary power converters, battery chargers, flat battery starters, ...

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Ingeteam

INGETEAM POWER TECHNOLOGY, S.A.

Ingeteam is an international group specializing in power and control electronics (inverters, frequency converters, controllers and protections) and electrical engineering and automation projects. The company operates in 22 countries, with 3,900 employees. R&D is at the backbone of its business activities. In railways, the traction converters INGETRAC are based on an smart integration of proved Proved Modules, comprising all necessary elements to be fully operational, on each required application.

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INSE RAIL S.L.

Inse Rail is an engineering firm that is highly specialized in the railway industry and specifically its installations and systems. Founded in 1994, it is dedicated to engineering, consulting and project management in the railway, industrial, energy and building construction industries, carrying out its activities in the different stages of planning, design, construction and operation of investments. Inse Rail participates in the international development of the High Speed Rail and metropolitan transportation, with a strong specialization in electrification, signaling, security and communication systems, and other railway transport installations.

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INTERNACIONAL HISPACOLD, S. A.

Hispacold, a World leader Company for climate systems with more than 40 years' experience is specialized in passengers comfort. Hispacold designs and manufactures HVAC solutions for all rail vehicles: trams, metros, EMUs, DMUs, LRVs... with proven and reliable technology solutions. Hispacold is certified in the most recognized International quality management, environment and safety standards: ISO 9001, ISO 14001, OSHAS 18001, EN 15805-2 and the prestigious IRIS ISO/TS 22163.

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LA FARGA YOUR-COPPERSOLUTIONS, S.A.

La Farga is able to produce all the range of railway products in an integrated process. Our railway range includes all alloys used, the different measures of grooved contact wire and all supporting and electricity supply elements, feeders, hangers and cables. Furthermore, we offer technical visits and assessment to our clients and we constantly develop new railway products with the aim of introducing the best copper solutions into the market. La Farga is a family-run metallurgical company, with more than 210 years of history. We produce semi-finished copper products and their alloys for several technological sectors.

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LADICIM - UNIVERSIDAD DE CANTABRIA

LADICIM participates in R&D projects focused on the innovation of the railway superstructure, carrying out studies on the development of its elements, acc to national (Adif), European (EN) and American (AREMA) reference standards. The results are reflected in more than 500 reports, 25 research papers with a high impact index and 7 Doctoral Theses. The projects include collaborations in countries such as the USA, Canada, Saudi Arabia, Turkey, Germany, Senegal, Tanzania, Morocco or Ethiopia. LADICIM has implemented a quality system according to the UNE-EN ISO/IEC 17025 standard, being accredited by ENAC (Spanish Accreditation Board) for the testing of fastenings, sleepers and rail welds.

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LANDER SIMULATION & TRAINING SOLUTIONS

Lander Simulation & Training Solutions, S.A. specialises in designing, developing and implementing cutting-edge commercial simulation devices for training purposes. On the basic premise of preventing accidents and loss of human life, Lander works with each customer to build training simulators which meet the specific needs of each operation. Lander was incorporated in 2002, and now operates in more than 20 countries across all 5 continents. Its solutions cover the entire range of railway operations - suburban trains, long-distance units, high-speed trains, freight, monorail systems, metros or light rail..

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INTERTEK IBÉRICA SPAIN SLU

Intertek has agreements with governments, customs and standard organizations to ensure that imported products meet the quality and safety regulations of the country of destination, thus protecting consumers from sub-products. Conformity Verification Programs provides smooth customs clearance for exporters. Intertek also supports the energy, engineering and construction sectors, supporting the design, commissioning, maintenance and decommissioning phases of infrastructures, plants and equipment to assure their integrity. Services include technical inspection and audit, non-destructive testing and technical staffing, and others.

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IBÉRICA TECNOLOGIA EN SISTEMAS DE SEGURIDAD FERROVIARIOS SL (ITSS)

IBERICA TECNOLOGIA EN SISTEMAS DE SEGURIDAD FERROVIARIOS SL (ITSS), founded in 2005, is a leading manufacturer and supplier of railway hazard monitoring equipment, focusing mainly on hot axle box / hot wheel and Wheel impact load / Weighing in motion detectors. The ITSS systems use state-of-the-art infrared and fibre-optic technology. The PEGASUS HADB/HWD multi beam system monitors the axle box and brake temperatures of coaches. The AGUILA WIM/WILD system uses fibre-optic sensors to detect off-centre wheels and flat spots. It can also report train weight and overloading. ITSS products are the model representation of a perfect combination of experience and innovation.

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KIMUA ENGINEERING, S.L.

Kimua designs and produces different types of auxiliary tools for lifting, transporting, assembling and doing maintenance of rolling stock and its components during any stage of the Railway value chain. Additionally, Kimua has added 2 new business units to its portfolio; one for providing renting services of standard solutions and a second one for providing its clients with specific training courses in areas like handling and lashing of big and large loads.

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LANTANIA

Lantania specializes in the construction of heavy civil works (roads, highways, dams, water treatment plants, maritime works, railways and airports), building construction and energy projects. The company began its activity in 2018 with the acquisition of the construction, energy and services business units of the Isolux Corsán Group and the subsequent purchase of the Velasco Group in 2019. One of the differential characteristics of Lantania is its ability to execute any kind of rail project in an integral way. The company has built more than 150 km of infrastructure, tunnels and railway viaducts, as well as more than 50 traction power substations and more than 1,500 km of overhead line.

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LUZNOR DESARROLLOS ELECTRONICOS, S.L.

LUZNOR is a company specialized in the design and manufacture of professional torches, emergency lighting and other electronic security devices. LUZNOR puts at your disposal highly qualified technicians, a high quality standard, efficient development, manufacturing and control systems and, above all, a philosophy of commitment to clients that allows LUZNOR to offer innovative products with advanced technology and recognised prestige.

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MAINRAIL S.L.

MainRail is a high-tech startup devoted to providing IT-based solutions to help you digitizing and optimizing the railway infrastructure maintenance operations. We combine our expertise in a wide range of technologies (e.g. big data analysis and visualization, digital twins, IoT, machine learning, etc.) with a solid knowledge in railway maintenance and operations. Our solutions are based in a customizable IT platform (MainRailMT) for the management of all maintenance-related operations and a family of IoT devices (MainRailID) for a continuous and cost-effective inspection of your infrastructure.

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**METALOCAUCHO, S.L. (MTC)**

MTC, being part of Wabtec Corporation, designs and manufacture rubber-metal components for suspension and vibration control systems used on railway, automotive and industrial applications. With headquarters in Spain, MTC has 4 production facilities in 1) Spain, 2) China, 3) India and 4) USA, which offers to customers the possibility to localize production in any of these countries. Thanks to a wide commercial presence in any country of the world, MTC gives local support to develop projects for both OE and Aftermarket business.

Our main products are related to Primary Suspensions, Secondary Air Springs, Bushings, Buffers, Layer Springs, Subassemblies, Elastic Wheels, etc.

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**MGN TRANSFORMACIONES DEL CAUCHO, S.A.**

MGN was established in 1957 and since then it has been developing its activity both designing and manufacturing rubber-metal components, mainly for the railway industry. MGN invests in research and innovation as a basis for the development of elements to be adapted in the new understanding of passenger and freight trains, taking the latest technological advances of the rubber world, vibration control and damping systems. - Primary and secondary suspensions. - Conical springs - Bushes and spherical bearings - Rods, Bogie subsystems - Pivot Bushes - Elastic Supports - Compression buffer and Draw Gear springs - Bellows, Gangway protections - Profiles, o-rings and seals.

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**MIERES RAIL S.A.**

Design, manufacturing and supply of turnout systems, and their components, for Metro, classic or conventional lines, industrial and heavy haul or High Speed up to 350 km/h.

Design, manufacturing and supply of casted manganese steel crossings. Trimetallic flash butt welding.

Insulated glued joints, transition rails, fastening systems, locking systems, wear measuring devices.

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**NRF**

Since 1927 NRF is a leading manufacturer and supplier of cooling products for the automotive market, industrial, railway and marine sector. NRF is known for the production of high quality radiators, but also produces and supplies a large range of other engine cooling and air conditioning products. NRF has global engineering, testing and development facilities. Railway and ship manufacturers, large retailers of vehicle parts, radiator shops and specialists in more than 80 countries worldwide daily rely on NRF's high quality products.

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**PARRÓS OBRAS, S.L.**

Family business with over 25 years experience in civil construction and iron and steel industry for the railway sector. Parros Group which is specialized in pile driving and catenary foundations, has implemented the 80% of the foundations of the entire Spanish High Speed Network. Whether conventional railway network or Highspeed Railway (AVE), PARROS GROUP is distinguished by the versatility of our machines adapted "Ad hoc" for auxiliary civil works from the railway, with automatic switching to the three Spanish gauges. Also innovative is our implementing system of noise barriers from the railway track and its foundations. Generic activities of building and general construction.

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**PATENTES TALGO, S.L.U.**

Talgo is a Spanish company with more than 70 years of experience, specialized in designing and manufacturing trains, maintenance equipment as well as providing maintenance services to railway operators worldwide. Today, Talgo is the leading global reference for Spanish High Speed Technology and the number one player in Spain's railway market. Due to Talgo's successful expansion strategy and its globally acclaimed products, the company has become truly international. Its key success factors are innovation, unique technology, sustainability, safety, competitiveness and tailor-made projects with clear focus on customer. Talgo trains are internationally recognized as the best in their category.

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**NERTATEC S.L.**

NERTATEC is an engineering company specialized in design, instrumentation and automation applied in the railway field.

Based on the development or analysis of test procedures, NERTATEC designs and builds (or adapts) automatic, semi-automatic or manual test benches, addressing the stages of 3D and constructive design, electronic electrical design, control and automation software, manufacturing, training, calibration and maintenance.

NERTATEC is also working on projects for the development of analytical models of energy consumption and technical assistance for the engineering of transformation of railway vehicles powered by LNG and Hydrogen with fuel cell.

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**NEXT GENERATION RAIL TECHNOLOGIES, S.L. (NGRT)**

NGRT S.L. is a company focusing on railway safety, working with railway regulators and helping infrastructure managers and train operators secure their infrastructure and operations. NGRT's products are designed to detect any anomalies that occur in the railway infrastructure.

The NGRT applications will detect rolling stock, independent of speed, direction and track conditions at any location, in all weather conditions, as well as anomalies impacting on the railway infrastructure.

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**NEWTEK SOLIDOS, S.L.**

NEWTEK is mainly active in the manufacture of systems for filling sand in trams, trains and locomotives. NEWTEK supplies installations composed of storage silos, fixed sand feeders, sand feeding mobile units, aspiration systems and dust collection devices. The company also designs, manufactures and maintains custom installations according to the needs of each client.

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**PREFABRICACIONES Y CONTRATAS, S.A.U. (PRECON)**

PRECON is the Spanish leader in design and supply of precast concrete products for railway tracks, either ballast and ballastless tracks.

It has supplied monoblock, twinblock, block slabs and sleeper for switches and crossings, Either for high speed, conventional lines, haul, subways and tramways.

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**PRETENSADOS DEL NORTE, S.L.**

PRETENSADOS DEL NORTE, is one of the most important producers of pre-stresses steel in the world. Our products are recognised for having the best quality on the market. Our high standards of quality mean that we are talking about the best pre-stresses steel you can find. Our company has more than 30years' experience in manufacturing and investment that have led to what we are today: PRETENORTE. Technologically, we have equipped our company in Vitoria-Gasteiz with the best state-of-the-art machinery. We continue to incorporate the latest novelties for your complete satisfaction. Pretenorte is highly specialised in pre-stressed steel and its many applications.

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**REVENGA SMART SOLUTIONS**

Revenge Smart Solutions offers comprehensive solutions for the transport sector: railways and metros, roads, ports & airports. In railways & metros we focus on passenger experience solutions, ranging from intercomms, public address and information panels, to systems related with revenue/cost issues, like ticketing, tolling and access control, and also with operator oriented solutions like railway telephony, signalling (level crossings, point heaters and inspection systems) and station control. More than 45 years of experience. Projects deployed in 24 countries.

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RICARDO CERTIFICATION IBERIA S.L.

Ricardo Certification Iberia is part of Ricardo Group. We provide independent assurance, certification, testing and consultancy services for railway and other sectors. We are accredited as NoBo, DeBo, AsBo and ISA in line with national and international standards. With capabilities in all disciplines - rolling stock, signalling and telecommunications, energy efficiency, safety management, operational planning and so on, we help our customers to overcome the technical, regulatory, operational and commercial demands of the industry. By maintaining constructive dialogue throughout the process, we help to eliminate inefficiencies, thereby to reduce risks, delays and costs overruns.

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SATYS INTERIORS RAILWAY SPAIN

Satys is a Spanish company specializing in the design and manufacture of galley systems for railway rolling stock. A galley system is broken down into 3 main families of equipment:
 - Refrigerated cabinets
 - Functional systems. Cooling, electricity, water, lighting, etc.
 - Interiors. Countertops, lining, etc.
 Satys offers a wide range of products specifically for each one. Thanks to the unique and highly efficient Satys technology, our products are internationally recognized as the best in their class in terms of quality, safety, availability, reliability, accessibility and environmental friendliness.

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SICE TECNOLOGÍA Y SISTEMAS, S.A. (SICE TYS)

SICE Tecnología y Sistemas, (SICE TYS) is a group of companies that provides solutions and systems for Transport and Traffic, Environment and Energy efficiency, Smartcities and Telecommunications. SICE TYS, as systems integrator, offers technological solutions adapted to the railways sector, conceiving a centralized management with functionalities oriented to the operation of public and private transport, integrating:
 - Security Systems
 - Telecommunications Systems - Signaling (Interlockings, Level Crossings, CTC) (ENYSE) - Automatic Fare Collection - Traffic Prioritization of Public Transport - Engineering (OFITECO): railway lines; Tunnel monitoring; Load test (railways bridges).

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SIEMENS MOBILITY, SLU

Siemens Mobility is a separately managed company of Siemens AG. As a leader in transport solutions for more than 160 years, Siemens Mobility is constantly innovating its portfolio in its core areas of rolling stock, rail automation and electrification, turnkey systems, intelligent traffic systems as well as related services. With digitalization, Siemens Mobility is enabling mobility operators worldwide to make infrastructure intelligent, increase value sustainably over the entire lifecycle, enhance passenger experience and guarantee availability.

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SIMULACIONES Y PROYECTOS S.L.

Simulaciones y Proyectos (SyP) is a company dedicated to solving complex fluid dynamics problems using CFD (Computational Fluid Dynamics) tools. SyP solves any fluid dynamics problem thanks to its engineering team and state-of-the-art software tools (FLOW-3D, HELYX, ANSYS DISCOVERY, SpaceClaim, FluidFlow...). Among others, we can solve:
 Comfort and HVAC studies in trains, stations and infrastructures.
 Optimization of ventilation shafts, tunnels.
 Studies of aerodynamics and aero acoustics in trains.
 Train-tunnel pressure studies.

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SEGULA TECHNOLOGIES

SEGULA Technologies is an engineering group with a global presence, helping boost competitiveness within all of the major industrial sectors: automotive, aerospace, energy, rail, naval and defense, pharmaceutical and oil & gas. Present in 30 countries and with 140 offices worldwide, the Group fosters a close relationship with its customers thanks to the expertise of its 12,000 employees. A leading engineering specialist placing innovation at the heart of its strategy, Segula Technologies conducts large-scale projects, ranging from studies to industrialisation and production.

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SENER INGENIERÍA Y SISTEMAS, S.A.

SENER is one of the leading engineering and technology groups in Europe with over one billion euros of annual turnover, more than 2,000 professionals and a continuously growing international presence with offices in over 15 countries. In the field of railway engineering, Sener counts on an extensive experience in metros, light rail trains systems and tramways, conventional railway line, freight transport and High Speed Lines. SENER's activities range from preliminary, conceptual and feasibility studies, basic and detailed engineering to project management services, supervision of works, value engineering and ICE services.

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SGS GROUP SPAIN

SGS is the world's leading inspection, verification, testing and certification company. We are recognized as the global benchmark for quality and integrity. With more than 97,000 employees, we operate a network of more than 2,600 offices and laboratories around the world. Our core services can be divided into four categories: Certification, Inspection, Testing and Verification. We are constantly looking beyond customers' and society's expectations in order to deliver market leading services wherever they are needed. Our independent services add significant value to our customers' operations and ensure business sustainability.

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SMART MOTORS

Smart Motors applies new technologies to generate added value from the monitoring of critical railway assets that believe that Digitalization and the uses of advanced analytics are the way to service excellence. The priority is to generate new knowledge about the operation of railway assets that satisfies the requirements of the most demanding environments and with a real day to day contribution. Smart motors has its own Digitalization Platform to help maintenance and operation that brings together signaling monitoring systems, infrastructure and rolling stock, as well as IoT sensors adapted to the railway sector.

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SOFTWARE QUALITY SYSTEMS, S.A.

SQS is a company specialised in software validation and verification with extensive experience in safety critical systems and, specifically, in the railway sector. We accompany our clients throughout their development process, optimizing it and guaranteeing compliance with specific regulations and standards for their sector in terms of safety, functionality, quality, etc. Likewise, we design and implement automated test environments and complement our offer with training activities in the field of software testing and quality.

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STADLER RAIL VALENCIA, S.A.U.

International rail vehicle construction company, Stadler, is headquartered in Bussnang in Eastern Switzerland. Founded in 1942, it has a workforce of over 8,500 based in various production and over 40 service locations. Stadler provides a comprehensive range of products in the heavy and urban transport segments: High-speed trains, intercity trains, regional and commuter heavy rail trains, underground trains, tram trains and trams. Stadler also manufactures main-line locomotives, shunting locomotives and passenger carriages, including the most powerful diesel-electric locomotive in Europe. It is the world's leading manufacturer in the rack-and-pinion rail vehicle industry.

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Talleres Alegría, s.a.

TALLERES ALEGRÍA, S.A.

Talleres Alegría, s.a. is a family owned company devoted since 1900 to design, manufacturing and after sales assistance of all kind of fixed track material, its accessories and spare parts. Developing of Designing and Commissioning Integral projects of turnouts to be installed at Depots and Industrial Ports and Factories. Design, manufacturing, repair and maintenance of self propelled vehicles to carry out works at the infrastructure. Design, manufacturing, retrofitting, repair and maintenance of freight wagons.

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**TECNIVIAL****TECNIVIAL, S.A.**

In TECNIVIAL we specialize in all types of fixed signalling for track (Marker Boards), conventional lines and High Speed lines. We are one of the companies approved by the Spanish Railway Infrastructure Administrator (Adif) and the others. The last product boosted to the market have been the NANOTEC SIGNS (R+D). The incorporation of cutting-edge materials (carbon nanoparticles) to the signs manufacturing , allows the improvement of its behavior and mechanical features: light, corrosion-free, low residual value and maintenance, eco-friendly, resistant to loads (snow/ wind). Besides, we develop Corporative Image projects according to the needs of the customer; design & installation.

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ZELEROS

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