



ERTMS DEPLOYMENT IN SPAIN

With over **2,900 km of lines in service and more than 400 trains equipped**, Spain is a global leader in ERTMS deployment. ERTMS has played a key role in the success of iconic routes like Madrid-Barcelona, where rail is gradually replacing air travel as the preferred mode (market share increased from 48% after 12 months of service to 82% by the end of 2023). Spain's experience also highlights the effective interoperability of ERTMS—involving no fewer than six companies. The system has been instrumental in achieving key milestones, such as reducing pollution from other transport modes and introducing new operators to Spain's high-speed network.

What is the status of ERTMS deployment in Spain?

Under the strong leadership of infrastructure manager ADIF, the deployment of ERTMS in Spain has been one of the most advanced in Europe. Since the year 2000, Spain has committed to this system to improve interoperability, safety, and efficiency in rail traffic. There are currently 2,000 km in service with ERTMS Level 1 (N1) and 1,300 km with ERTMS Level 2 (N2) installed mainly in the high-speed network corridors:



Atlantic Corridor (belonging to European TEN-T corridor): Originating with the LAV Madrid-Valladolid in 2007, it now includes connections to Galicia, León, and Asturias. Work is ongoing on the connection to France via the Basque Country, and a connection to Santander is under construction.



Northeast Corridor: Following the launch of the Madrid-Barcelona section in 2008, the LAV Madrid-Zaragoza-Barcelona-French border was completed in 2013, enabling the Barcelona-Paris connection.



East Corridor: Connects Madrid with the Community of Valencia and Murcia. Major milestones include the openings of Madrid-Albacete and Madrid-Valencia in 2010, Madrid-Alicante in 2013, and Madrid-Murcia in 2022. Ongoing projects include the Valencia-Alicante and Murcia-Almería sections.



Mediterranean Corridor (belonging to European TEN-T corridor): A vital infrastructure for passengers and freight, it connects Catalonia, the Community of Valencia, Murcia, and Andalusia. ERTMS has already been installed on sections such as Vandellós-Tarragona.



Cantabrian-Mediterranean Corridor: A project aimed at connecting the north and east of the country, though its development is still partial. Ongoing works include the Zaragoza-Castejón/Pamplona/Logroño and Miranda del Ebro-Logroño sections.



South Corridor: Began with the LAV Madrid-Sevilla in 1992 under other signalling system and is currently being upgraded to ERTMS. It has expanded with lines to Málaga, Cádiz, and Granada.



Southwest Corridor: The LAV Madrid-Toledo (2005) is the first section of the future Madrid-Extremadura-Lisbon connection, which is still under development.



Other Key Nodes: The Atocha-Chamartín tunnel (2022) facilitates transit between corridors. A high-speed line between Barajas Airport and Chamartín is planned, with completion expected in 2025. ERTMS is also installed on the suburban networks of Madrid and Barcelona.

How is ERTMS implemented in Spain?

Spain is a proven success story in demonstrating adaptability of ERTMS to operational needs, infrastructure constraints, and performance requirements.

For each railway line included in the [ERTMS National Implementation Plan \(NIP\)](#), the network will feature a mix of ERTMS levels:



Lines with low to medium traffic density, such as conventional lines, are equipped with ERTMS Level 1, ensuring efficient and cost-effective operation.



High density corridors, i.e. many High-speed lines incorporate either ERTMS Level 1 and Level 2, optimizing safety and capacity.

Regarding rolling stock, RENFE currently has 380 vehicles equipped with ERTMS in service and in the coming years will equip an additional 1,205 vehicles. Ouigo has 16 trains in service with ERTMS, and Iryo, for its part, has 20.

Which ERTMS suppliers are involved?

Six UNISIG suppliers of ERTMS have contributed to the development of the Spanish railway network, achieving full interoperability between their products, both on-board and trackside.

In other words, trains equipped with on-board units from any of the five suppliers in Spain can operate seamlessly on trackside infrastructure provided by any of the others, a significant technological milestone.

What are the benefits brought by ERTMS in Spain?

After several years of ERTMS implementation in Spain, it has delivered significant benefits:



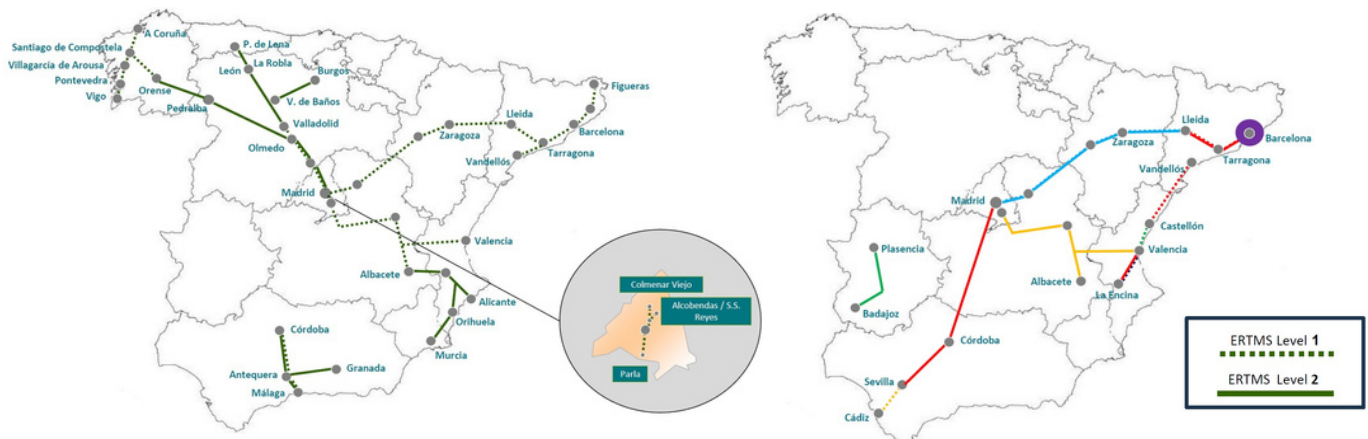
From an infrastructure manager's perspective, **adopting ERTMS expands tendering opportunities**, as any ERTMS-certified supplier can bid for contracts. Additionally, increased capacity allows for more trains to operate, leading to higher revenue from rail tariffs.



ERTMS also fosters competition among operators. As a result, **passengers have benefited from an average 40% reduction in ticket prices**, along with greater service differentiation—offering both low-cost and first-class options on the same routes. Passengers in High Speed Spanish network have evolved from 8 million in 2006 to 44 millionsmillion in 2023.



Furthermore, **ERTMS brings substantial environmental benefits**. More passengers are consciously choosing trains over planes for travel between these cities, reducing carbon emissions to just one-sixth of those produced by air or road transport.



Source: ADIF presentation at ERTMS 2024 Conference in Valenciennes

From plane to train: the example of the Madrid - Barcelona line and much more

The Madrid-Zaragoza-Tarragona-Lleida-Barcelona line went into commercial service in February 2008, and is acknowledged to be one of the most successful examples of instant modal shift from plane to train.

Thanks to the use of ERTMS, travelling between the Madrid an Barcelona only takes 2h30 minutes (compared to 6 hours in the past), with an average speed of 250 km/h. As a result, in the first 6 months the average number of passengers had already increased by 84%.

After the first year of service, the AVE Madrid Barcelona enjoyed a share of 40% of all trips between the two cities. By end of 2023, the share increased to 82%, with 8,7M trips between both cities.

Similarly, the increase in passengers on routes with rail competition has raised the railway's modal share compared to air travel to 85%. Some striking examples of rail market share between Spanish cities include: Valencia-Madrid (93%), Seville-Madrid (87%), Madrid-Alicante (87%), Valencia-Barcelona (96%), Málaga-Madrid (78%), and Murcia-Madrid (99%).

Additionally, new international routes between Spain and France using ERTMS-equipped lines have been introduced. The Barcelona-Paris route, as well as services to Toulouse and Marseille, exemplify the potential of ERTMS to boost cross-border rail traffic.

Spanish High Speed Liberalization

On November 27, 2019, a historic milestone for high-speed rail in Spain was reached. Following an open tender for capacity allocation, ADIF authorized the companies OUIGO and IRYO to compete with the incumbent operator, RENFE, on three key corridors: Madrid-Barcelona, Madrid-Valencia, and the Southern Corridor.

The average number of daily trains per direction increased from 76 in 2019 to 118 in December 2023 (average of three corridors). This growth has only been possible due to the presence of ERTMS on the lines, (albeit partially on the Southern Corridor).



Thanks to the increased capacity, the number of passengers has nearly doubled on the Madrid-Barcelona and Madrid-Valencia routes and risen by more than 15% on the Southern Corridor.

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