EUROPE ON RAIL

Reviving Portuguese–Spanish passenger rail lines

Eco-union & ZERO
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EUROPE ON RAIL

Europe on Rail is a European initiative led by civil society organisations to reduce carbon emissions derived from international mobility. Through research work and by bringing together actors of the railway sector, the aim is to foster ambitious policies for a train revival in Europe.

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eco-union is a non-profit organisation based in Barcelona that aims to promote the climate transition towards sustainability in Europe and the Mediterranean region. We work with governments, companies and international institutions to develop and implement policies that accelerate the energy transition, sustainable mobility, and green and blue economy, among other sustainable development issues.

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1. Context

This report aims to bring together updated information regarding the Portuguese-Spanish passenger train connections on **medium to long distance cross-border night and day lines.** It intends to understand the current state of play of Portuguese-Spanish passenger rail connections; what is the potential for the main mobility corridors between the two countries; what are the key infrastructure, operational or commercial challenges and opportunities; and what solutions are available in the short, medium and long term.

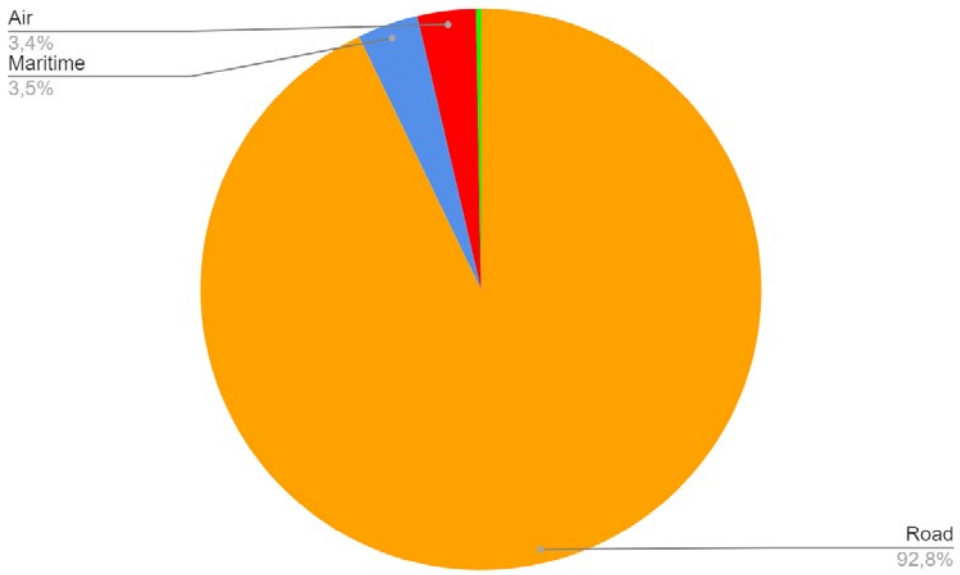
1.1. Transport, a major source of carbon emissions

In **Spain**, the transport sector is responsible for the emission of **28% of total national greenhouse gas emissions,** being the sector with the highest emissions.[1] In 2018, **road transport** contributed the most to greenhouse gas emissions with **92,8% of the total**, followed by maritime, air and rail transport representing respectively 3.5%, 3.4% and 0.3% of the total emissions of the transport sector.[2]

[1] Las emisiones de CO_2 en 2020 descienden por primera vez por debajo del nivel de 1990 – La Moncloa (2021)

[2] Emisiones contaminantes del transporte – OTLE (2019)

Figure 1. Share of emissions from the transport sector in Spain by mode of transportation (2018)



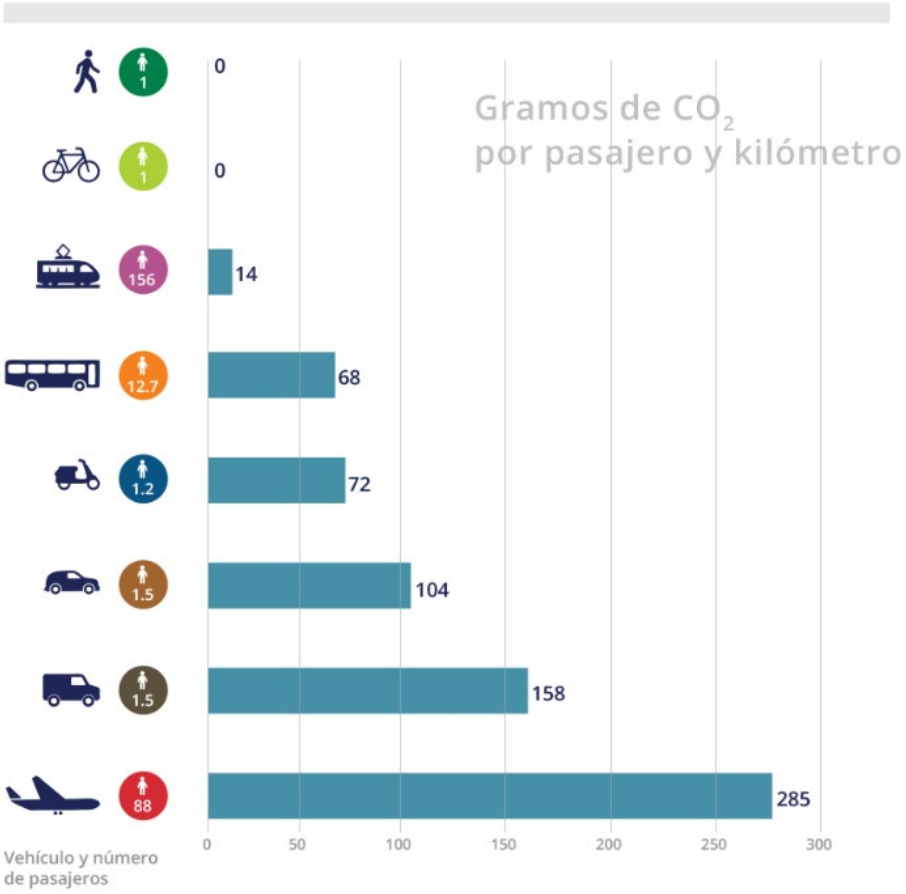
Source: Own elaboration based on data from the Observatory of Transport and Logistics in Spain

In **Portugal**, the transport sector also accounted for 28% of total CO_2 equivalent emissions in 2019.[3] The European Climate Pact states that in order to achieve **climate neutrality by 2050**, emissions from transport must be reduced by 90%. It is therefore essential to decarbonize today's mobility.

Rail outperforms air and road transport modes in terms of environmental impact. Only **1.5 to 2% of transport emissions are accounted for by rail.** In contrast, 71% of emissions are associated with road transport, 14% with shipping and around 13% with aviation.[4] Even in **relative terms**, emissions per person per kilometre travelled by rail are much lower than air and road transport.[5]

[3] Energia e clima: Emissões de gases com efeito de estufa – REA (2022). REA is an annual report by the Portuguese Environment Agency, about the state of the environment in Portugal.
[4] Greenhouse gas emissions from transport in europe – EEA (2021)
[5] Climate change: should you fly, drive or take the train – BBC (2019)

Figure 2. Grams of CO_2 emitted per passenger per kilometre in Europe in 2013[6]



Source: EEA

However, **the modal share of rail remains stagnant** and people are increasingly using air travel rather than rail. In 2019, the modal share of rail (air and maritime travel excluded) for Spain, Portugal and the EU was 10,3%, 4,6% and 8%, respectively. On the other hand, the car was the most used mode of transportation with 84,6% for Spain, 89,3% for Portugal, and 82,5% for the EU[7]. **Rail isn't used to its full potential**, especially not for cross-border travel. Increasing day and night train rail connections between Spain and Portugal requires going over multiple hurdles.

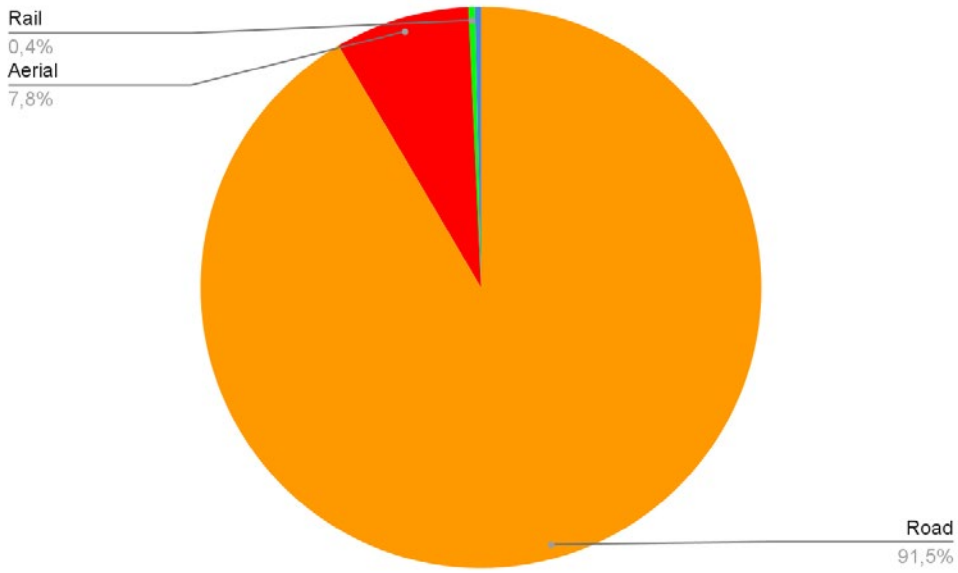
[6] **Note:** non-CO_2 emissions are not included in this graph, it only accounts for CO_2 emissions from planes.

[7] Modal split of passenger transport – Eurostat (2019)

1.2. A transport modal share dominated by road

Passenger **rail traffic between Spain and Portugal** was about 230,000 passengers in 2018. That same year, 4,88 million passengers flew from Spain to Portugal or from Portugal to Spain, 57,47 million passengers travelled by road and 22,000 passengers used inland waterways.[8] This shows that rail transport is a secondary means of transport. This flow is strongly dominated by **road and air transport.** Moreover, the trend in recent years shows an increase in road and air transport to the detriment of rail transport (see figure 3).

Figure 3. Structure of passenger transport between Spain and Portugal by mode of transport in 2018



Transport mode	2017	2018	Increase (%)
Road	53 650 000	57 470 000	7,1
Aerial	4 300 000	4 880 000	13,5
Rail	250 000	230 000	-8,4
Inland waterway	270 000	220 000	-17,4
Total	58 470 000	62 800 000	7,4

Source: Own elaboration based on data from the Observatorio Transfronterizo España–Portugal

[8] Observatorio Transfronterizo España/Portugal. Informe nº 9 / Observatório Transfronteiriço Espanha/Portugal. 9º informe – MITMA (2020)

1.3. Overcoming obstacles for cross-border mobility

Technical and infrastructure obstacles are some of the main challenges facing rail connections between Spain and Portugal.[9] Several technical characteristics in terms of infrastructure need to be worked on:

- Different existing gauges: there are two distinct track gauges along the corridor: the European gauge (1,435 mm) and the Iberian gauge (1,668 mm).
- Different voltages in electrified sections. Some sections are electrified at 25kV and others at 3kVCC, including within the same country and there is a need for harmonisation.
- Different signalling systems. These systems are not easily interoperable and it brings additional cost and technical and operational complexity for cross-border trains.
- The completion of the "missing link" between Évora and Elvas in Portugal. The connection between Spain and Portugal cannot currently be done directly because of this missing high-speed rail link.

Another challenge is the **COVID-19 pandemic**. With the closing of borders in neighbouring EU countries in March 2020, rail connections have also been stopped for an indefinite period. Many services on these cross-border lines have not reopened, others have lost money as they were hit hard by the pandemic: it indeed led to a drastic reduction of passenger numbers which resulted in service levels being reduced or withdrawn.

Competitiveness with airlines and road transport also slows down the renaissance of Spanish-Portuguese passenger rail lines. For instance, 2017 was a critical year for Spanish-Portuguese passenger rail traffic: about 120,830 passengers travelled from Portugal to Spain. It's almost twice as much as in 2008. However, 2.092.535 passengers travelled from Porto, Lisbon or Faro to Madrid or Barcelona by air the same year. Thus, **rail passengers only represent about 5,45% of the total number of passengers** travelling from Portugal to Spain by both train and air.[10] For the Madrid-Lisbon journey, there were over 1,5 million passengers between the two cities' airports in 2019, steadily increasing from the 1,1 million of passengers in 2012.[11]

9 Annual report 2020 – Atlantic Corridor (2021)
10 Observatorio Transfronterizo España/Portugal. Informe nº 9 / Observatório Transfronteiriço Espanha/Portugal. 9º informe – MITMA (2020)
11 Air passenger routes between the main airports of Spain and their main partner airports - European Commission (2019)

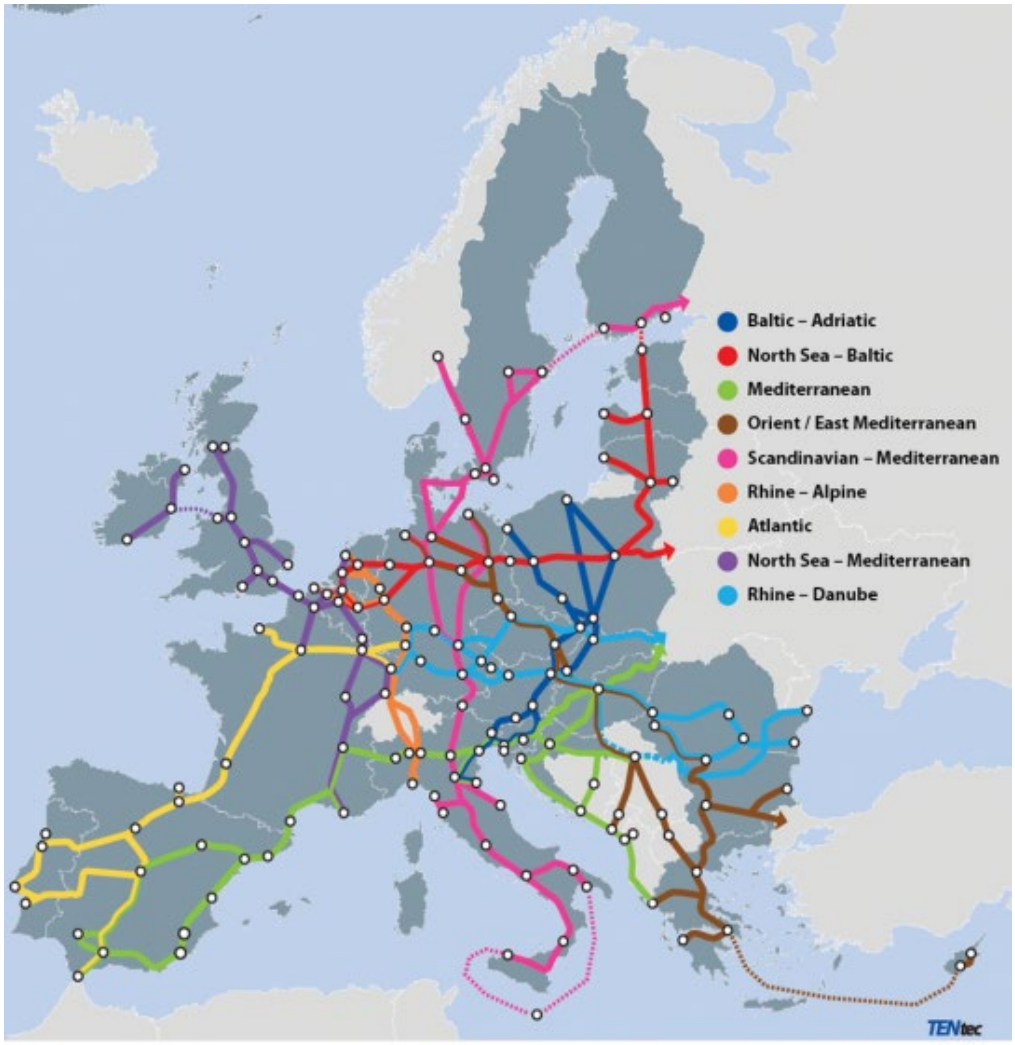
2. Policies, plans and infrastructures

Over the past few years, the railway networks of both Spain and Portugal have been evolving, as new infrastructure projects were developed. European rail connections between countries can be difficult and the lack of adapted infrastructure and political will can be an issue. There are, however, existing cross-border points between Portugal and Spain that could be exploited.

2.1. An ambitious Trans-European Transport Network (TEN-T)

Most of the cross-border Spanish-Portuguese rail lines are part of the **Atlantic corridor within the** Trans-European Transport Network (TEN-T). TEN-T is the European interoperable transport network, financed by the Connecting Europe Facility (CEF), connecting freight and passenger transport infrastructures. The network covers **road, rail and waterways as well as seaports and airports**. The objective of the TEN-T is to enhance economic relations between EU countries by coordinating the different member states' national roads through common regulations and technology. The nine Core **Networks** include the most important connections and nodes, and are to be completed by 2030.

Figure 4. TEN-T Core Network Corridors



Note: the nine TEN-T core network corridors are based on the CEF and TEN-T Regulations (1316/2013 & 1315/2013); they have been created as a coordination instrument to facilitate the completion of major parts of the core network of strategic importance.
Source: European Commission, Directorate-General for Mobility and Transport, TENtec Information System

Source: TEN-T Core Network Corridors (Freight and Passenger)

2.2. Atlantic corridor in the making

The **Atlantic Corridor,** one of the nine **core networks to be completed by 2030,** runs through **Spain, Portugal, France and Germany**. This corridor has a strong multimodal dimension, connecting rail, road, inland waterway and maritime routes. It covers more than 6200 km, connecting 15 ports and 44 terminals. It also acts as a connection node with 3 other rail freight corridors. Its infrastructures are used for both passenger and freight transport, and services are managed by different operators.

Several national operators are in charge of **passenger transport.** Rail routes connecting Spain and Portugal are managed by two different public companies, Renfe Viajeros (Spain) and CP (Portugal). For freight, the Atlantic Rail Freight Corridor (RFC) is the organisation in charge of managing international transport.[12] There is no similar singular organisation in charge of passenger transport on the corridor, which can explain the lack of current services.

The latest **Atlantic Corridor's report**[13], published by the European Commission, presents priority actions and initiatives to achieve a technically compliant and operationally efficient multi-modal transport and passenger corridor **by 2030**. The main priorities defined are:

- The enhancement of the **railway interoperability** in the corridor by overcoming the technical obstacles caused by difference in track gauges' size, different signalling systems and different voltages.
- Construction of a rail line connecting **Évora-Elvas-Caia** (Portugal) to create a high-speed freight train connection between Portugal and the Spanish hinterland.
- The enhancement of **multimodality** along the different stretches, with the goal of rebalancing the corridor's modal split.
- The improvement of the **logistic chain** to/from the EU in the global framework. This could potentially benefit the EU by exploiting its geographical location and interconnected maritime routes.

12 The RFC is born out of the association between the different infrastructure managers of the countries that are part of the Atlantic Corridor: Adif (Spain), IP (Portugal), SNCF Réseau (France) and DB (Germany).

13 CEF support to Atlantic Corridor – European Commission (2020)

Annual Report 2020 – Atlantic Corridor (2021)

Figure 5. Map of the Atlantic Corridor and main cities connected

Source: Annual Report 2020 – Atlantic corridor

2.3. Three cross-border sections between Portugal and Spain

The current three **cross-border sections** between Portugal and Spain are the following:

- The Valença do Minho (Linha do Minho) – Tui**,** cross-border section is part of the Porto–Vigo line.
- The Vilar Formoso (Linha da Beira Alta) – Fuentes de Oñoro cross-border section was used by the (a) Lisbon – Madrid, and the (b) Lisbon – Irun/Hendaye (France) night trains, both closed in 2020, on the *Aveiro – Strasbourg*[14], core atlantic corridor route.

[14] The main route is *Aveiro – Valladolid – Vitoria – Gasteiz – Bergara – Bilbao/Bordeaux – Toulouse/Tours – Paris – Metz – Strasbourg*. More info at: 2021/1153 (EU) Regulation

- The Elvas (Linha do Leste) – Badajoz cross-border section is connecting (c) Lisbon – Madrid through the Badajoz line on the *Sines/Lisbon – Valladolid – Madrid route*.

Figure 6. Existing infrastructure between Spain and Portugal

Source: Observatorio Transfronterizo España/Portugal

Valença do Minho (Portugal) – Tui (Spain)

There are current working passenger services assured by Renfe and CP with the "Tren Celta" on the **Porto-Vigo** rail infrastructure. Its cross-border section is located between **Valença do Minho (Portugal) and Tui (Spain)**. It is available from 5,25€ and connects Porto (Portugal) to Vigo (Spain) in 2h25. However Renfe offers only **two trains per day** in each direction. It (poorly) links Portugal to the region of Galicia, with which the country has very close economic and cultural connections.

Vilar Formoso (Portugal) – Fuentes de Oñoro (Spain)

While the infrastructure exists between **Vilar Formoso (Portugal) and Fuentes de Oñoro (Spain)**, no passenger services are currently offered. However, there used to be lines crossing this border section.

The **Lisbon–Madrid line and Lisbon–Irun/Hendaye** were two cross-border lines located within the *Aveiro–Strasbourg* main rail route[15]. This main route which connects Portugal to Spain is divided in two existing rail lines. Indeed, the first rail section, from Lisbon to Medina del Campo, is unique for both rail lines, yet from Medina del Campo, one way goes to Madrid and another one goes towards Irun and Hendaye (Figure 7).

Until 2020, there was a night train, the Lusitania, connecting Madrid to Lisbon through Fuentes de Oñoro and Vilar Formoso. It was interrupted due to the pandemic and never reactivated. This connection is particularly important for Portugal, as without it, it is isolated from France, a country counting with an important portuguese immigration.

The **Pampilhosa–Guarda–Vilar Formoso** portion of the international line will be closed due to the construction works to improve freight transport by replacing the track, allowing the crossing of trains 750m long and optimising operating conditions.[16] The construction operations are expected to finish in January 2023.

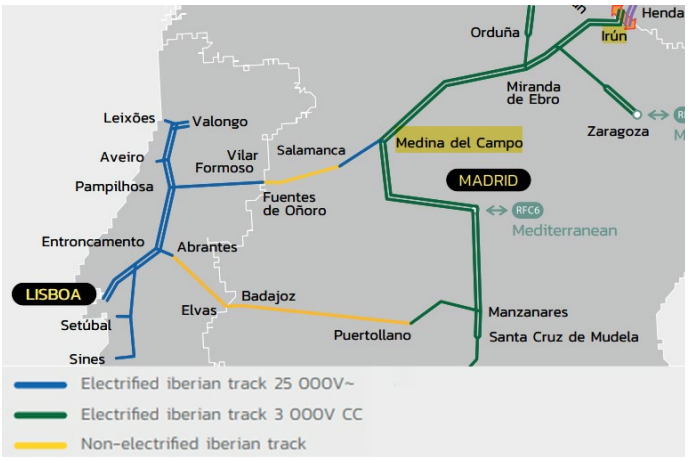


Figure 7. Cross-border rail lines between Portugal and Spain: Medina del Campo fork

Source: Annual Report 2020 – Atlantic corridor

[15] This route connects the port city of Aveiro with the German city of Mannheim, heading towards the northern region of Spain and onwards to the northwest of France (passing through Paris) and then eastwards to Germany.

[16] Los portugueses también llevan retraso en la nueva línea ferroviaria que enlaza con Badajoz – elDiario.es (2022)

Elvas (Portugal) – Badajoz (Spain)

Lisbon and Madrid are connected through the cross-border section **Elvas (Portugal) and Badajoz (Spain**).

There are **current passenger services offered by CP** from **Lisbon to Badajoz** (with a change in Entroncamento) and by Renfe from **Badajoz to Madrid.** A more direct HSR **Evora-Elvas** line is under construction and passenger services will be offered once it is achieved.

This rail line is part of the ***Sines/Lisboa–Madrid*** route, making it part of the Atlantic corridor route. The Madrid-Extremadura-Portuguese border rail line is currently under construction, and is expected to open by 2030. The 70 kilometres between Talayuela and Plasencia are under construction at the moment. The informative study of the portion between Madrid and Oropesa (200 km) is currently being developed by the Spanish government. The high speed line section between **Plasencia and Badajoz**, on the Spanish side, was inaugurated in July 2022 and reduced the amount of changes needed for passengers between Madrid and Lisbon to two, which remains a major obstacle for the use of the line.[17]

2.4. Ongoing and future works

Both Spain and Portugal have been greenlighting projects of improvement and renewal of their rail network. The projects focus on the development of a more connected and efficient rail network, especially in Portugal, where there are currently no functioning high-speed lines.

Situation in Portugal

The current Spanish and Portuguese railway planning is based on 3 different programs. Ferrovia 2020 is a railway investment plan presented by the Portuguese government in 2016 to increase the competitiveness of Rail transport, improve international links and create conditions for rail operability. This is

[17] El primer tramo de la Alta Velocidad a Extremadura se estrena en plena ola de indignación por los incendios – Cinco Días (2022)

financed by the **Connecting Europe Facility (CEF)** and the **Portugal 2020** programme, with a total investment of close to two billion euros. Some main issues it addresses are the electrification of lines (addition of 480km), signage (addition of 400km of lines with electronic signage), an increase of the length of freight trains and the installation of crossbars (multipurpose) that allow changing the gauge in international corridors.

The **Portuguese "National investments programme 2030"** PNI gives continuity to the investments foreseen in the previous Ferrovia 2020 investment plan. This strategic plan sets out the actions and investment priorities for the next decade. By including a total of 16 railway projects valued at 10.510 million euros, the PNI 2030 focuses on mobility and transport as key factors to increase the external competitiveness of the country. However, this plan does not plan for high-speed rail Lisbon-Madrid (South corridor) or Aveiro-Salamanca (North corridor) to be completed and fully operational by 2030. These connections are particularly important as they connect Spain and Portugal but were not given priority.

The Plano Ferroviário Nacional was launched in April 2021 and aims to improve rail in Portugal. It answers needs of accessibility, mobility, cohesion and development. It is still in the draft version, but will target key challenges, such as the adequate coverage of the territory, Iberian cross-border connections and integration in the European rail network.[18]

Situation in Spain

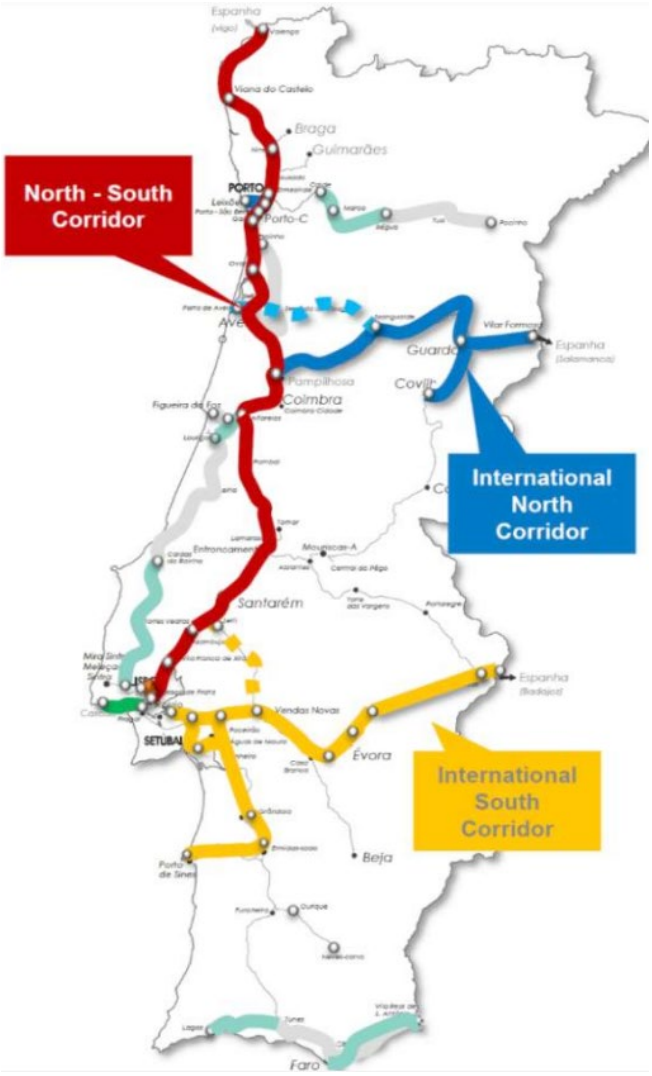
On the other hand, the Spanish Infrastructure and Housing Plan PITVI (2012–2024), focuses on adapting the rail network to the characteristics of the **European rail network,** the electrification of tracks and the deployment of high-speed lines. The total sum of investment for infrastructures will be between €141 975 million in the least favourable scenario and €150 605 million in the most optimistic one. The plan aims to optimise the existing infrastructures and services, limit the effects of transport on the quality of the climate and the environment, boost employment, economic activity, and competitiveness, improve accessibility on the territory and favour intermodality.

[18] Plano ferroviário nacional – República Portugesa (2021)

Priorities for Spain and Portugal inter-connections

Through the accomplishment of international and bilateral commitments, the PNI 2030, PITVI as well as Ferrovia 2020 plan are leading the modernization and development of the rail corridors connecting Portugal to Spain. Portugal is building its first high-speed rail line between Evora and Elvas, a crucial portion to connect Spain to Portugal without having to pass through Entroncamento. The portugues priority is the connection between **Porto and Lisbon**, to facilitate exchanges within the country, but also with Spain, as Porto is connected to Vigo. The Portugues corridors are organised in three strategic axes: the North–South corridor, the International North Corridor and the International South corridor.

Figure 8. Railway planning in Portugal



Source: Infraestructuras de Portugal. Ferrovia 2020

Portugal wants to prioritise the connections in the North, through the North-South corridor as it would facilitate a connection with France as well. For this reason, there is a particular emphasis on the **Porto–Vigo** line and its improvement from the Portuguese side, without matched enthusiasm from the Spanish side,[19] which has been more focused on the **Madrid–Lisbon** connection through Fuentes de Oñoro and the electrification to 25kV of the tracks between the border and Madrid. Nonetheless, **ADIF** has added 35 million euros to the Portuguese 5.500 million euros investment in the continuation of the Atlantic corridor towards Portugal.[20]

2.5. Large potential for rail development

The connections between Spain and Portugal by train are worse now than they were in 2019. While train alternatives to air travel exist for Spain-Portugal routes, there is no connection under 6h between Madrid and Lisbon or Madrid and Porto and no night train since it was halted in 2020 due to the Covid-19 pandemic. The situation could be improved with night train services and an improvement of the day connections (for example, offering services that do not require as many changes).[21]

In order to illustrate the current imbalance between rail and air passenger transport, it is interesting to take a look at the **Lisbon–Madrid** route. To complete the journey from Madrid to Lisbon by rail (600 km), it is necessary to do **2 transfers** instead of 3 previously as there are now direct trains between Badajoz and Madrid with the opening of the Badajoz–Plasencia portion in July 2022.[22] At present, neither Renfe nor Comboios de Portugal (respectively Spanish and Portuguese rail operators) offer a direct train route.

Direct flights between Madrid and Lisbon last approximately **1.20 hours** and there about 40 daily flights available everyday in both directions, as cheap as **11€ one-way**, with an average price of 77€ for a round-trip[23] while the price of

19 La línea de alta velocidad Elvas-Évora será la primera de Portugal y permite alcanzar 300km/h – elDiario.es (2021)
20 España busca reactivar la línea de alta velocidad Madrid-Lisboa – Cinco Días (2022)
21 Get on track: train alternatives to short-haul flights in Europe – Greenpeace (2021)
22 El primer tramo de la Alta Velocidad a Extremadura se estrena en plena ola de indignación por los incendios – Cinco Días (2022)
23 Cheap flights from Madrid to Lisbon–Kayak (2022)

the Madrid-Lisbon rail route varies heavily depending on how and when the transfers are done, starting at 42€ one-way through Badajoz[24]. Additionally, neither of the two infrastructure managers provide information on how to do the route by train.

Trains at the platform of Madrid Atocha
© Alessandro Pires De Souza | Dreamstime.com

[24] Trains from Badajoz to Madrid – Trainline (2022) and Comboios de Portugal (2022). Prices and timetables checked on the 6th of september 2022.

3. Porto–Vigo, a needed connection between Northern Portugal and Galicia

The Porto-Vigo line is not currently part of the core Atlantic Corridor, despite being connected to Portuguese sections of the corridor. A major future plan is to establish a direct link between Lisbon and Vigo and offer high-speed rail services across the route. The **Galicia–North Portugal Euroregion**, with increasing economic exchanges between themselves and the rest of Europe, would benefit from efficient infrastructure connecting two important points in those city-based economies. The regions also intend to facilitate movement for cross-border workers, which would be easier with efficient services.[25]

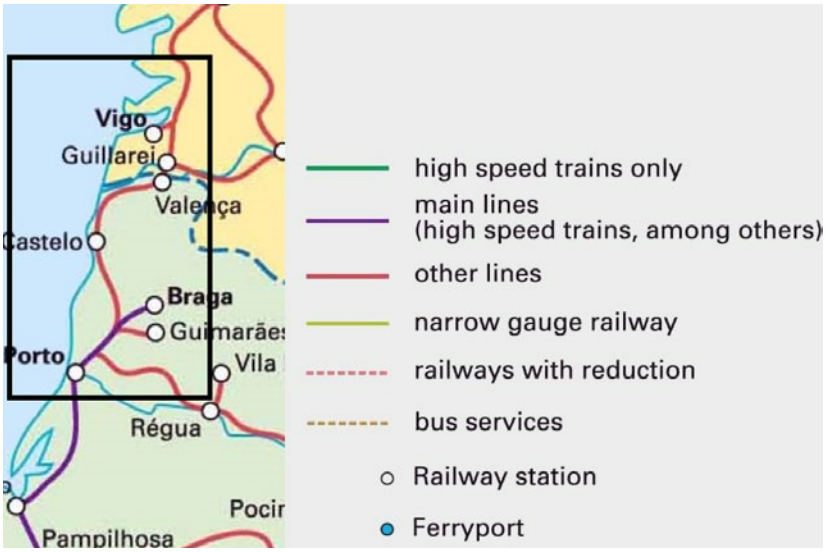
3.1. State of the line and infrastructure

The Porto – Vigo line pertains to the **North-South corridor** strategic axis as organised by the Plan Ferrovia 2030**,** also known as the "backbone" of the Portuguese rail network. The North-South corridor connects Lisbon to the Spanish border. It is thus composed of the **North line,** connecting Lisbon to Porto,

25 Galicia and Northern Portugal start simplifying the movement of cross-border workers – The Portugal News (2021)

and the **Minho Line**, inaugurated in 1882 and connecting Porto to the border city of Valença do Minho. Then, follows the **Valença-Tui-Guillarei-Vigo line.**

Figure 9. Focus on the Porto-Vigo line



Source: Own creation based on map from ontheworldmap.com

The railway infrastructure of the Porto-Vigo service consists of a conventional Iberian gauge network (1668 mm). It should be noted that the A Coruña-Vigo section, belonging to the Atlantic axis, has double track, electrified at 25kV and following the European Technical Specifications for Interoperability (TSI) specifications (ETI).[26] In addition, in 2021, electrification works were completed on the section between Braga, Viana do Castelo and Valença do Minho, on the Atlantic Axis that will connect Porto with Vigo. But there are still differences of tension on the line that warrant the use of hybrid rolling material, which is costly. The portion from Vigo to Tui is electrified at 3kVCC, while the Valença-Lisbon section is electrified at 25kV.[27]

3.2. (Deficient) services

The current conventional service, commonly known as **"Tren Celta",** is the railway service provided by the Comboios de Portugal operator (CP) and Renfe which connects **Porto** to **Vigo**. It takes **2 hours and 20 minutes to complete**

[26] Estrategia Indicativa del desarrollo , mantenimiento y renovación de la infraestructura ferroviaria – MITMA (2021). Observatorio Transfronterizo España/Portugal. Informe nº 9 / Observatório Transfronteiriço Espanha/Portugal. 9º informe – MITMA (2020)

[27] Ligação Porto/Vigo sem comboio elétrico por diferença de tensão, denuncia o Eixo Atlântico – O Minho (2022)

the 121 km. The service offers **two daily departures** from Monday to Saturday from each of the two cities.[28]

The service had a very **low demand,** leading to a situation of financial deficit. This could be easily explained by the fact that it takes longer to do this journey by train than by car (1h40). In 2018, 81 400 passengers travelled with the "Tren Celta" and the pandemic had a very severe effect on demand for the service the following years. Due to the covid pandemic and border closure, there were two cessations of service: from 15 March to 16 August 2020; and from 31 January to 1 May 2021. The Portuguese railway company has stated several times its willingness to close the line permanently, but political and citizen opposition has forced the company to keep the service.[29]

In order to promote the service, **Renfe and Comboios de Portugal** launched two offers to reduce the cost of the ticket in 2021 and 2022, with a price of €5.25 between Vigo and Porto.

	Porto – Vigo
Travel time	2h20
Distance	121 km
Services	**Two trains a day** in each direction, between Spain and Portugal by "Tren Internacional Porto–Vigo", commercially known as "Tren Celta", of the 0600/0650 series of railcars. According to Renfe, this offer will be gradually expanded as demand rates recover.
Starting price	The starting price is €5.25.
Current situation	On July 2, 2013, as a result of the agreement between Spain and Portugal, **direct trains between Vigo and Porto** started for the first time without intermediate stops. Subsequently, in July 2014, these trains also made commercial stops in Valença, Viana do Castelo and Nine, and that is still currently the case.

[28] Galicia recupera todos los trenes que circulaban a Portugal antes de la pandemia – La voz de Galicia (2021)
[29] El tren Celta Vigo-Oporto no despega tras 10 años de servicio – Atlántico (2022)

3.3. Ongoing and future projects

Ferrovia 2020 plans to increase the safety and reliability of the operation, the infrastructure capacity, and the efficiency of rail transport on several sections: the International North Corridor, the International South Corridor, the North-South Corridor, the West line, the Duero line, the Algarve line and the Cascaes line. It also aims to reduce travel time by using traction trains. The total cost is estimated at 399 million euros.

PNI 2030 aims to build a **new high-speed line between Lisbon and Porto**, with the objective of ensuring a travel time between the 2 cities of 1h 15 minutes. The high-speed railway will cost €4.5bn, almost half of the €10bn railway investments provided by the Portuguese Government under PNI 2030. It will be spent on electrification, enhancement works, as well as to renew passenger rolling stock.

The **environmental impact assessment** should be completed by 2023, opening the path to a public tender in early 2023, allowing work to begin in 2024. The first phase will focus on the Porto-Aveiro and Aveiro-Soure section, and then the connection to Carregado will be built, with work starting in 2026 to be completed by 2030. For the second phase, the Portuguese ministry for infrastructure and housing explained that the priority was the Vigo-Porto line, as Galicia is the Spanish region with which the country has the closest relation.[30] €900m were allocated for this project, which will ultimately reduce travel time between Porto and Vigo to one hour.[31]

The regional government of Galicia defends the creation of a **modern high-speed line between Vigo and Porto** to reduce journey times and connecting the port of Bouzas, as a way to increase competitiveness and intermodality. It also defends before the EU the incorporation of this high-speed line in the north-west Atlantic corridor.[32] The Portuguese government has also defended the interest of improving the Vigo-Porto line, to have easier access to Galician ports, with plans to have high-speed rail infrastructure connecting Porto to the border by 2030. On the Spanish side, there are plans for the prolongation of the high-speed rail line from Vigo to the Portuguese border, as part of the Spanish

30 High-speed Lisbon to Porto train will be "transformative" – The Portugal News (2022)
31 €10.5bn for rail in Portuguese 10-year investment plan – The Rail Journal (2020)
32 La Xunta pide a Bruselas que incorpore el AVE Vigo-Oporto al Corredor Atlántico Noroeste – treintayseis (2021)

Infrastructure and Housing Plan, PITVI (2012–2024), but it is not considered a priority.[33] The section between Madrid and Ourense was adapted for high-speed rail in 2021, which has reduced time travel between Madrid and Galician cities such as A Coruña, Santiago, and Vigo.[34] The section between A Coruña and Vigo, going through Santiago de Compostela, is high-speed rail as well.

Raiway bridges, Porto.
© Jorgefelix | Dreamstime.com

[33] La línea de alta velocidad Elvas-Évora será la primera de Portugal y permite alcanzar 300km/h – elDiario.es (2021)
[34] Renfe launches Madrid-Galicia high-speed service – International Railway Journal (2021)

4. Lisbon–Madrid, a connection ready to be reinstated

The Lisbon-Madrid line through **Vilar Formoso and Fuentes de Oñoro** is part of the Atlantic corridor's Aveiro-Strasbourg route. Although infrastructure exists on this line, **services are no longer running** since the beginning of the COVID-19 pandemic.

4.1. State of the line and infrastructure

The Lisbon–Madrid rail line infrastructure is composed of 2 Portuguese sections: the **Lisbon–Pampilhosa** line followed by the **Beira–Alta line**. The former links Lisbon to Pampilhosa through Entroncamento, Pombal and Coimbra. The latter connects Pampilhosa to the border with Spain, **Vilar Formoso**, through Mangualde and Guarda.

Figure 10. The Beira Alta line

Source: Annual Report 2020 – Atlantic corridor

From **Vilar Formoso (Portugal),** the line continues towards Fuentes de Oñoro (Spain), Ciudad Rodrigo and Salamanca before reaching **Medina del Campo,** a Spanish city that belongs to the Valladolid province. Two options remain from Medina del Campo, one line goes towards Madrid and the other one goes all the way to Irun and Hendaye, France. **The Lisbon Santa Apolonia – Madrid Chamartin line** passes by Medina del Campo, then continues to Avila and then Madrid. The route was inaugurated in 1995 but ceased operation in 2020.

From Lisbon to Madrid, the gauges used are **iberian gauges**. First, the Lisbon-Vilar Formoso section is composed of an electrified iberian track 25kV. Then follows a non electrified section, from Fuentes de Oñoro to Salamanca. The project to electrify this portion has been delayed a number of times, prompting local authorities to ask the central government to act in favour of its completion.[35] From Salamanca to Medina del Campo, we have an electrified iberian track 25kV. Finally, the Medina del Campo – Madrid last section is an electrified iberian track 3kV CC. Adif assured that the electrification of this portion to 25kV was close to be achieved.[36]

Neither Renfe nor CP currently offer cross-border passenger services between the **Vilar Formoso (Portugal) and Fuentes de Oñoro stations (Spain)**. It is possible to reach one station from the other by foot (18 minutes) or by car (4 minutes) but the connection is not done by rail or other types of public transportation. That is to say, it is not currently possible to travel from Madrid to Lisbon passing through this point of the border.

Figure 11. The Lisbon-Madrid line through Vilar Formoso

Source: Annual Report 2020 – Atlantic corridor

35 En busca de la electrificación del tren entre Salamanca y Portugal – SER (2022)
36 España busca reactivar la línea de alta velocidad Madrid-Lisboa – Cinco Días (2022)

4.2. Services (suspended)

The **night train services** on the Lisbon-Madrid line were interrupted in 2020.

	Night train Lisbon – Madrid through Fuentes de Oñoro (suspended)
Travel time	10h45 **Lisbon-Madrid:** Departure at 9:25pm from Lisbon, arriving at Madrid Chamartin Station at 8:40am. **Madrid-Lisbon:** Departure at 9:43pm from Madrid, arriving at Lisbon at 7:30am.
Distance	545 km
Services	Lusitania Railway Hotel from RENFE. Night train.
Starting price (2020)	25€
Current situation	The Lisbon – Madrid night train journey was once operated by the Trenhotel Lusitania international rail service, managed by RENFE. Inaugurated in 1995, it was suspended in March 2020 due to the COVID-19 pandemic. It has now been **permanently discontinued, officially for economic losses.** Thus, the only link between Madrid and Lisbon is a 3-train combo with 2 bookings and 3 tickets, through Badajoz. (see part 6)

4.3. Ongoing and future projects

The existing infrastructure would already allow the passage of trains and would be sufficient to offer services on that line, especially night train train services, for which travel time can be longer. There are currently no plans to relaunch the former night train line. In the meantime, it is possible to travel from one capital city to another through Entroncamento and Badajoz (see part 6) and the Spanish ministry of transport predicted that a direct line between Madrid and Lisbon could exist by the end of 2023.[37]

[37] La línea Madrid-Lisboa con dos tramos nuevos funcionará el año que viene según la ministra – elDiario.es (2022)

5. Lisbon – Irun/Hendaye, the connecting thread between three European countries

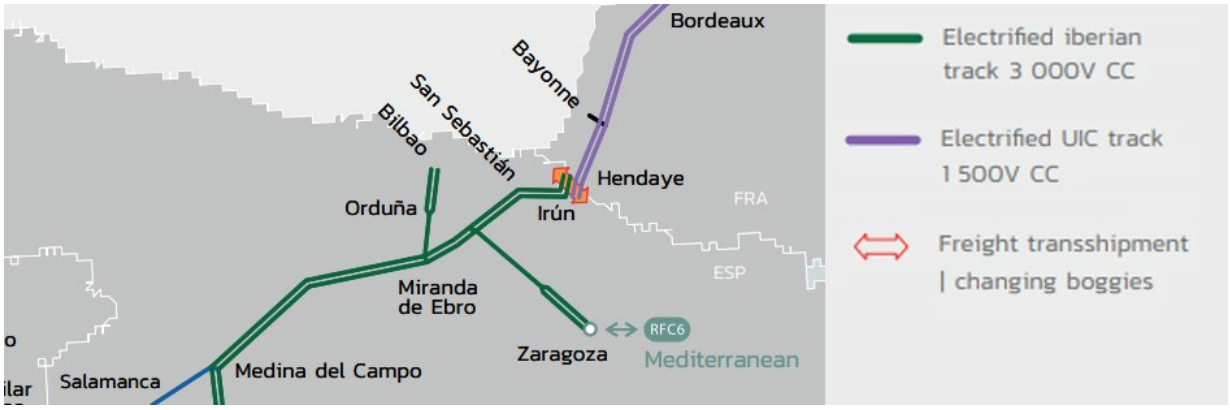
The Lisbon – Hendaye route serves a critical corridor opening Portugal and the northern region of Spain to France and the rest of Europe. While infrastructures exist on the Lisboa-Hendaye international line, previous night train **services have been suspended** in March 2020 due to COVID-19 and have now been permanently discontinued.

5.1. State of the line and infrastructure

The Lisbon – Hendaye line passes by Medina del Campo and then continues towards Valladolid, Burgos, Miranda de Ebro, Vitoria-Gasteiz, San Sebastian and Irun in order to finally reach Hendaya. At the moment the only services between Irun and Hendaya are run by **Euskotren**, the regional train operator.

The Medina del Campo – Irun section is an electrified iberian track of 3kV CC. The single track from Irun to Hendaye was electrified in 1929.

Figure 12. Focus on the Medina del Campo – Hendaye branch



Source: Annual Report 2020 – Atlantic corridor

5.2. Services (suspended)

	Night train Lisbon – Hendaye/Irun (suspended)
Travel time	13h55
Distance	806 km
Services (2020)	RENFE night train TrenHotel 310, also known as "Sud Express 310"
Starting price	29€
Current situation	This line has been suspended in march 2020 in the context of the COVID-19 pandemic. Sud-Express train hotel services are likely to **never open again**.

Even if the direct Lisbon–Hendaye night train has been suspended, it is still possible to travel from one city to the other using conventional trains and making several changes. The first step is to travel from Lisbon to Porto and then from Porto to Vigo. From there, many options remain: one of them is to travel from Vigo towards Vitoria-Gasteiz with Alvia trains. An intercity train provides a guaranteed connection to San Sebastian for instance. However, it requires buying several train tickets and losing a lot of time during the connections.

5.3. Ongoing and future projects

One main problem remains in order to consider a reopening of the **night train line.** Prior to its COVID-19 suspension, there was a pool of 4 Talgo IV carriages for the Lisbon-Hendaye Sud Express, operated by incumbent operators RENFE and CP. However, after the service suspension, RENFE has been selling its night train stock, even those that used to run the Elipsos trains France-Spain. Thus, it is likely that these Talgo trains will not return to action again in the country.[38] One option to rebuild a night train fleet could be to procure **2nd hand sleeper and restaurant coaches** from elsewhere in Europe, to be operated, through an open call, by incumbents or new entrants willing to offer competitive and convenient services.

38 The future of night trains in Iberia – Trains for Europe (2021)

6. Lisbon – Madrid, a future high-speed line connecting capitals

The future Lisbon – Madrid line aims to connect Portugal to Spain through the city of **Elvas**, on the Portuguese border, and **Badajoz**, on the Spanish one. However the rail infrastructure between **Evora and Elvas (84 km) is still being constructed.** At the moment, it is already possible to go from Lisbon to Madrid, going through Entroncamento instead of Evora as CP offers services from Lisbon to Badajoz and Renfe from Badajoz to Madrid.

6.1. State of the line and infrastructure

The future Lisbon – Madrid line would be composed of 2 main sections:

- **The first one** starts from Lisbon, and then goes towards Barreiro, Vendas Novas, Montemor-o-Novo and Evora Norte. It is part of a larger line starting from the South Porto de Sines, and then going towards Grândola and Setubal before reaching Lisbon.
- **The second is the cross-border section connecting** Elvas (Portugal) to Badajoz (Spain). It then continues towards Madrid, connecting Badajoz to Madrid through Mérida, Caceres and Plasencia.

Figure 13. Map of the future rail line connecting Lisbon to Madrid

Source: Own creation based on map from ontheworldmap.com

Therefore, the **missing rail link between Evora and Elvas (84 km)** makes it impossible for now to go directly from Lisbon to Madrid that way. The project to link the 2 iberian capital cities as part of the Trans-European high-speed rail network had formerly been cancelled on the Portuguese side in 2012.[39] However, in 2020, the Portuguese government saw in this project the opportunity to invest in the Portuguese railways and brought it back in the Plan Ferroviario Nacional. The Evora-Elvas link will be the **first high-speed rail line** of the country and is the largest railway expansion in Portugal in over more than a century.[40] Trains will be able to travel at 250km/h on this line, which would significantly reduce travel time, bringing it between 5 and 6 hours.[41] It was originally planned for 2023 but it is facing delays and is now announced for the beginning of 2024. However, it might not be operative until a year later.[42] Between Lisbon and Évora, the projects for the Lisbon-Barreiro and Barreiro- Montemor-o-Novo-Évora sections are currently paused and still need to be updated.[43]

The **Lisbon-Madrid** line is composed of different states of infrastructure. First, the 108 km rail section from **Lisbon to Evora** is electrified, with iberian track 25kV. The Evora-Elvas section will have electrified single track (25kV – 50Hz). 52 over and underpasses, 29 railway bridges and viaducts and 3 technical stations will be built along the section.[44] Finally, the line section connecting

39 Alta velocidade que o Governo diz não ser TGV – Nascer Do Sol (2018)
40 Atlantic Corridor – Portugal: International South Corridor (refertelecom.pt)
41 Lisbon–Madrid rail link to take less than nine hours – The Portugal News (2022)
42 Los portugueses también llevan retraso en la nueva línea ferroviaria que enlaza con Badajoz – elDiario.es (2022)
43 Programa nacional de investimentos 2030 – República Portugesa; Terceira Travessia do Tejo–Rave
44 Plano ferroviário nacional – República Portugesa

Badajoz to Madrid runs along conventional non-electrified railway lines of Iberian gauge, belonging to Adif, but the electrification is planned for the coming years.

6.2. (Disconnected) services

Direct services do not currently exist on the Lisbon-Madrid line through Bareiro, Evora and Elvas. However, ongoing services from Lisbon to Madrid do exist, in a discontinued way, and pass through the northern city of Entroncamento. Thus, the first step is to travel from Lisbon to **Entroncamento** by Intercity train. From there, a regional train links Entroncamento to Badajoz. There is only one train a day between Entroncamento and Badajoz, which means there is only one possibility per day to do the Lisbon-Madrid journey. The last step is to travel from Badajoz to Madrid.

Figure 14. Map of the current rail line connecting Lisbon to Madrid

Source: Own creation based on map from ontheworldmap.com

	Step 1: Lisbon – Entroncamento[44]	**Step 2:** Entroncamento – Badajoz	**Step 3:** Badajoz – Madrid[45]
Travel time	1h	2h50	4h20
Starting price	13€	12€	17€
Fastest Service	Intercity Train – CP	Regional train – CP	Intercity Train – Renfe

45 Comboios de Portugal (2022). Prices and timetables checked on the 6th of Septem. 2022
46 Trains from Badajoz to Madrid – Trainline (2022)

6.3. Ongoing and future projects

Apart from the construction of the missing link between Evora and Elvas, projects of rail line improvements are currently taking place. In March 2020, the European Commission approved €265 million funding through the "Multiregional Operational Programme for Spain" and over 1 billion euros funding from the EU's European Regional Development Fund for the improvement of the **Madrid – Extremadura – Portuguese** border high-speed rail line.[47] It involved the 178.6 km **Badajoz – Mérida – Plasencia** section to be used for passenger and freight traffic. Electrification, safety, signalling, telecommunications and auxiliary installations are being set up. While there is still work, the line was inaugurated earlier this year and already shows an increase of demand of 19%, compared to 2019.[48]

Electrification has already begun on the **Badajoz – Mérida** stretch. The electrification of the Plasencia-Badajoz portion should be achieved in the first trimester of 2023.[49] Once finished by 2030, the Badajoz – Madrid line is expected to link both cities in 2 hours 31 minutes. Moreover, PNI 2030 plans to construct a new electrified single-track rail link between **Sines and Grândola** between 2026 and 2030, so that Madrid could be linked to Porto de Sines. The aim is to promote rail interoperability with the Spanish and European network. It represents a budget of 150 million euros.

Finally, Ferrovia 2020's objectives on the International South corridor are to increase capacity to 2,5 times the current, in order to reach 36 trains per day from 400 m to 51 trains of 750 m. The investment plan also seeks to reduce the time of travel between **Sines and Elvas** to about 1 hour and 30 minutes, and allow the use of electricity. The total cost is about 629,6 million euros.

Despite the financial aid, current investments do not seem to be sufficient to deploy on time competitive and efficient rail services such as the Madrid-Lisbon rail link. The case of this link is an example of the slow development of **cross-border connections between Spain and Portugal.** It has been more than 10 years since there has been a train between Madrid and Lisbon through

47 Work continues on Spanish section of Madrid–Lisbon high-speed railway – European Commission (2020)
48 La línea Madrid–Lisboa con dos tramos nuevos funcionará el año que viene según la ministra – elDiario.es (2022)
49 Raquel Sánchez anuncia la electrificación de la línea convencional entre Humanes y Plasencia y el estudio de su nueva estación – La Moncloa (2022)

Extremadura. The Spanish government estimates that, by developing the **railway sections between Plasencia and Toledo and between Badajoz and Elvas** (Spanish and Portuguese territory), the connection between the two capitals will be ready by the end of 2023, while some Portuguese media indicate that such connection will only be possible in 2024. There is some discontent among groups of parliamentarians from Extremadura, who, among other things, criticise the **neglect of conventional train networks** and the multiple railway incidents both in the development of the sections and in the railway services that are carried out.

Figure 15. Predicted travel time between Madrid and Lisbon through Badajoz between 2022 and 2050

Year	2022	2024-25	2030	2040	2050
Travel time	10h	6h10	4h30	3h55	3h35
PT Projects		new HSL Évora-Elvas	Upgrade of existing conventional line Poceirão - Bombel	New HSL Lisboa – Poceirão incl. Tagus Bridge Elvas – Caia border last stretch	New HSL Poceirão - Évora
ES Projects	new HSL Badajoz-Plasencia	new HSL Plasencia-Talavera de la Reina	new HSL Talavera de la Reina - Madrid	Elvas – Caia border last stretch	

Source: Carlos Secchi, European Commission

The future and ongoing projects should reduce travel time between Madrid and Lisbon, eventually reducing it to **3h35 in 2050**. However, this announced progress should be put in perspective. The 625 kilometres between Madrid and Lisbon are more or less **equivalent to the distance between Madrid and Barcelona**. That journey can be done by train in 2h20, which reinforces the incomprehension that in 2022, an equivalent journey in terms of distance should take around 10 hours. The planned works will not allow the Madrid-Lisbon line to compete with air travel and be under 3h45 by 2030, as the Lisbon-Evora high-speed rail link is not planned to be finalised until 2050.[50]

[50] Enhancing low-carbon mobility between Spain and Portugal - Mobility eco Forum: Carlos Secchi (2022)

7. Policy recommendations

Cross-border rail between Portugal and Spain is majorly important as a way to connect two neighbouring countries in the most sustainable (and convenient) way possible. Currently, there is no direct connection between the two capitals and it takes a significant amount of time travelling between the two countries. A number of investments and works are being planned on both sides, but there is a lack of international coordination and public commitment that could hinder the development of functional connections. Based on our previous assessment, we propose therefore the following **policy recommendations** to relaunch, in a **short to medium term**, night and day passenger lines between the two countries.

1 Relaunch a direct Madrid–Lisbon connection

Currently, three border-crossing points allow a connection between Spain and Portugal. Reestablishing this link between two major European cities is particularly important as without it, Portugal is isolated from the rest of Europe. Ensuring the deployment of competitive cross-border lines like the Madrid–Lisbon by 2030 might require further funding. The future **Lisbon–Porto** and **Porto–Vigo** high-speed lines will not be completed until 2030 and **going through Vigo** is therefore not an option in the short term. **Through**

Badajoz, the construction of the missing high-speed rail link between Evora and Elvas planned to be done in 2024, as well as the works on the Spanish side, will reduce travel time between Lisbon and Badajoz and ultimately travel time between Lisbon and Madrid.

The relaunch of this line could be an option for a direct day train, taking between around 6 hours once it is completed and 7 hours before with a direct day train using current infrastructure while waiting for the completion of the link. For the **Vilar Formoso–Fuentes de Oñoro** border connection, the cross-border infrastructure exists but political willingness is missing. The previous **night trains**, from **Lisbon to Madrid** (10h45) and Hendaya (13h55) could be reinstated. The challenge concerns the profitability of the line, which ultimately led to the decision of cancelling it after it was interrupted during the pandemic. An attractive offer could have a positive impact on demand.

2 Promote new (day and night) services from incumbent or new rail operators

Public authorities in charge of the network infrastructures should open lines to new operators, from the public or private sector. Through the recent EU action plan for rail and the associated calls for tender, the EC can also participate in the development of cross-border services. Opening lines to competition allows to increase the offer and could be beneficial for the development of international rail. CP and Renfe are currently not offering the necessary services to connect Portugal to Spain, in spite of having (however limited) possibilities. The entry of new actors could stimulate the sector, as is happening for night trains in other European countries (Austria, the Netherlands, Germany, etc.) or in the high-speed market (Spain, Italy or France).

3 Reinforce cooperation and coordination between public authorities and stakeholders

The Spanish and Portuguese government do not necessarily have the same priorities and objectives regarding the development of their rail network, but the advancements in this sector will only be effective if the efforts are coordinated.

Reinforced cooperation between the operators exploiting the lines, CP and Renfe, could help facilitate journeys for passengers and ultimately improve. **Euroregions** can provide expertise, capacity building and territorial involvement, and travellers associations, CSOs and tourism agencies (national, regional and local) can bring an understanding of the needs and wants of travellers.

4 Foster collaboration in the building of the Core European Network

The **European Union** is investing an important amount of money in the integration of new sections and lines in the Core European Network, which should facilitate connections between EU member states. This means that these projects should be planned and carried out thinking beyond a national perspective, with a collaboration between the states concerned. As an example, the Madrid–Lisbon lines, which were both approved by the European Commission as core networks, needing to be achieved by 2030, are experiencing a slow deployment due to, among other things, a lack of member states collaboration.

5 Improve information to travellers and facilitate ticket purchases

Presently, finding information on the possible ways to do the Madrid-Lisbon journey by train is difficult, as book tickets for the whole journey cannot be bought on CP, Renfe, or even train comparators website, and tickets have to be purchased for each section separately. It is not possible to do the journey without knowing beforehand the stations where the train changes have to be done. The information on services, prices and times are not readily accessible. The Transfermuga platform, which informs passengers of possible journeys by train and public transportation, is an interesting example of what could be done for spanish-portuguese cross-borders connections.

Conclusions

There are currently three cross-border points between Portugal and Spain: i) Valença do Minho (Linha do Minho)–Tui ; ii) Vilar Formoso (Linha da Beira Alta) –Fuentes de Oñoro; iii) Elvas–Badajoz. However there are no services between Vilar Formoso and Fuentes de Oñoro, limited services between Elvas and Badajoz with one passenger train a day in each direction offered by CP. Only two passenger trains run daily in each direction between Valença do Minho and Tui, with the "Tren Celta".

Covid-19 has dealt a major blow to the already depleted state of cross-border connections between Spain and Portugal. While temporary consequences such as the reduction in passenger numbers are weakening the system, other long-term consequences are affecting it in a stronger way. Indeed, the pandemic led to the disruption of two night train services in March 2020 connecting Spain to Portugal: "TrenHotel Lusitania" connecting Lisbon to Madrid and "Sud Express 310", connecting Lisbon to Hendaye. Both have actually been permanently discontinued, as Spanish operator RENFE has been refusing all kinds of plans for night trains.

In the present, **passenger transport between Spain and Portugal is largely dominated by road and air transport.** The scarcity of services and lines, the lack of attractiveness in terms of prices and travel times compared to air and road leave rail unable to compete with other modes of transport.

To increase the modal share of rail, it is necessary to continue developing **investments and support policies** in both national networks (Portuguese and Spanish) but also in cross-border sections and services. National and regional tourism agencies should participate in promoting cross-border rail tourism. It is vital not to lose the momentum generated by the climate emergency and the European institutional support for the railway.

To this end, it is necessary to continue deploying the **high-speed network** in both countries to improve journey times and competitiveness with other means of transport but without forgetting the maintenance and increase of the **conventional train network**. It is also necessary to rethink the alliances between Spain and Portugal in terms of **railway infrastructure planification** to improve interoperability. In addition, it is important to **recover lines and services** that have been closed and to improve and provide night and day services in key corridors such as the Madrid-Lisbon route.

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