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► **To cite this version:**

Philippe Menerault, Cyprien Richer. High-Speed Rail and Intermediary Metropolitan Areas: How an International Perspective Can Shed Light on the Particularities of the French Model. Major French Cities facing Metropolization, Springer Nature Switzerland, pp.71-92, 2024, 978-3-031-59313-0. 10.1007/978-3-031-59314-7_5. halshs-04613996

HAL Id: halshs-04613996

<https://shs.hal.science/halshs-04613996v1>

Submitted on 17 Jun 2024

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High speed rail and intermediary metropolitan areas: how an international perspective can shed light on the particularities of the French model

A crosscut of trajectories: Antwerp, Lille and Zaragoza

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Introduction

Through its role as a discriminating factor in city accessibility, high speed rail forms a part of metropolization strategies, as shown by the anamorphoses produced by Strasbourg's Image, City, Environment Laboratory (GIP-Reclus, 2000). As faster speed imposes selectivity (Ollivro, 2000), high speed rail networks are designed primarily on a national or even international scale, to directly connect major hubs in an urban structure. Therefore, they are a key positioning strategy for intermediate cities trying to capture the network, in a logic that resembles *ransom economics*, identified by B. Lepetit (1986) in his analysis of 18th century roads. In the analysis of networks (Curien and Dupuy, 1997), this notion of capturing is characterized by three complementary yet distinct dimensions related to:

- Morphology, in other words, routing new lines;
- Topology, meaning station locations;
- Service, or the level of service offered to users.

Coalitions of local and/or regional authorities seek to weigh in on these different components through interactions with the railway operator and the State. Their aim is to influence where high speed rail travels and the stops it makes. We can also refer to this as territorial appropriation¹, which intersects urban project development, a marker of the metropolitan ambition of these intermediate cities. These territories look to develop their spaces in a more or less synergistic relationship, through a process of congruity, with the arrival of high speed rail.

The term 'intermediate' used to describe the Lille, Zaragoza and Antwerp metropolitan areas warrants our examination of them in this chapter, and is based on several criteria:

- From a spatial standpoint, these metropolises are located at equal distances from major European metropolises (Lille is at the center of the Paris/London/Brussels triptych, Zaragoza is between Madrid and Barcelona and Antwerp is between Brussels and Amsterdam);
- From an economic perspective, they all fall in the category of 'cities in transition seeking to restructure their economic model' as described by Peter Pol (Terrin, 2011);
- Demographically, they have comparable populations² close to one million inhabitants;
- From a political point of view, though they are not national capitals, they each have a well-established regional role;
- From a strategic standpoint, to borrow the words of J.P. Carrière (2008), they would like to become: "*intermediate spaces between highly visible global metropolises and other levels of spatial hierarchy*", which leads them to coincide large-scale urban development projects with the arrival high speed rail to their territories.

While there is relatively little research on stations from a comparative European perspective, studies from A. Delage (2013 and 2019) emphasize the standardization of planning efforts in railway station neighborhoods and the mimicry of the strategies undertaken by the actors involved, which build on the '*all-risk insurance*' value of these projects in their neoliberal approach. This assertion, supported by

¹ In that sense, as M. Foucault describes it, territory is defined by the form of power that controls it.

² Lille's urban area is comprised of 1,100,000 inhabitants, the district of Antwerp includes 1,000,000 inhabitants and Zaragoza's community holds 750,000.

fieldwork on Saint-Etienne and Liege, is stimulating but fails to recognize the specificities of high speed networks. Nevertheless, we can assume that these networks introduce distinct possibilities in the relationships between train stations and metropolises. At least, that is the viewpoint of C. Tiry (2011), who makes an international comparison using Turin, Barcelona and Rotterdam. She emphasizes the importance of train station locations as a response to demands for urban renewal and centralities where multi-scalar networks interact. She also briefly addresses the question of train station saturation, which constituted the heart of the thesis by N. le Bot (2019). This researcher has worked on a long-term comparison of the morphology and functions of four French (Paris Montparnasse and Lyon Part-Dieu) and German (Cologne and Stuttgart) super stations. Her work is based on the dichotomy between terminus stations and through stations. She presents this notion as key to understanding how their design changes with general increases in mobility and passenger traffic. N. le Bot thus focuses on components in the railway systems that serve metropolitan areas. She raises questions about how stations complement each other or the re-use of freight lines. Her work does not, however, go into great detail about the scale of urban projects in train station neighborhoods. All these recent works attest to the value of a transversal perspective on European metropolises, but also to the difficulty in establishing national models, even if some country-specific characteristics of the high speed rail system may draw distinctions in how each metropolis mobilizes this resource. In this respect, the notion of hybridization can provide relevant support to define the changes in the core principles of networking based on the territorial context at hand³, thus joining the idea of a Lamarckian⁴ evolution of networks driven by a two-pronged trend of internal complexification and reactions to external factors (Offner, 1993). Our approach will fit into this perspective and will first question the idea of a French model in terms of the relationship between high speed rail and the metropolis (I). Then it will attempt to provide the keys to understanding the diversity of spatial solutions that have been adopted or envisaged to respond to similar topical issues in two subject areas: the value, or lack thereof, in adding more TGV train stations in intermediate metropolises (II) and the integration of high speed rail in local rail line strategies (III).

I) Is there a French model of high-speed rail?

- **Core principles of French high speed rail**

France has a very large network of high speed rail lines (HSR). Inaugurated in 1981, it was the earliest HSR in Europe, and also the most extensive, behind Spain, with 2,800 km of high speed lines. The last section put into service is the Nîmes and Montpellier bypass (60 km), open to high speed trains (referred to as the TGV) on July 8, 2018. Since the 1980s, the development of the TGV network has accompanied metropolization efforts of major French agglomerations. Connection to high speed networks (rail and air) is seen as a major metropolitan attribute (Terrin, 2011; Conesa, 2010; Woessner, 2008).

France's high-speed network is based on three core principles (Menerault, 2012):

- **Specialization:** high speed rail lines are specifically dedicated to passenger traffic. There was an exception to this specialization principle with the TGV Postal network, which was abandoned in 2015.
- **Compatibility:** The rolling stock of high speed trains runs on both new lines and conventional tracks when electrified. This compatibility allows TGV trains to serve older stations and permeate the national territory. In France, nearly 200 stations are thus served by TGV trains.
- The **straightness** of the lines enables high speed: Lines are routed with for optimum nationwide efficiency by linking Paris as directly and as quickly as possible with the main regional and European metropolises. This principle has prompted the creation of new stations built on high speed lines to give the territories they cross access to TGV service.

These three principles together are what makes the French model of high speed rail specific in relation to other European countries. The State-backed network rationale confronts local territorial dimensions that alter its principles and diversify how high speed rail fits into metropolitan contexts.

³ See - POPSU 2 Symposium: *Lille: métropole créative et hybride*, January 25, 2017, Métropole Européenne de Lille.

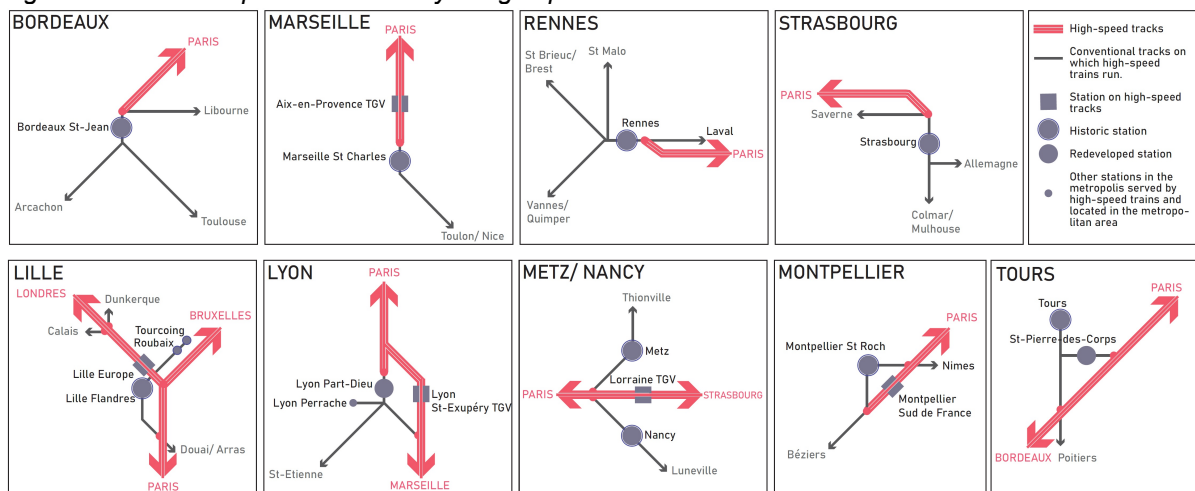
⁴ Lamarck argues that an organism can pass on to its offspring characteristics that the parent organism acquired through use. In the case of the giraffe, their necks got progressively longer as members of each subsequent generation stretched them to reach high branches for food.

- **The different ways French metropolises connect to the HSR network**

To establish a morphological panorama of how French metropolises connect to high speed rail networks, we have chosen inter-municipal cooperation establishments (EPCI) with the status of ‘Métropole’, excluding Paris. Among these, we selected those that are affected by one or more high speed lines in or near their perimeter.

One commonality in the way these French metropolises develop high speed rail in their territories is that they are all served by at least their historic station (Fig. 1). Because HSR lines and the conventional railways are compatible, interconnections are possible, allowing service to central stations where other transportation networks intersect. We then need to separate two cases: on the one hand, metropolises located at the high speed terminus, and on the other, metropolises with the HSR network running through them.

Fig.1 : French metropolises served by a high speed line. Source : authors



- *Metropolises located at the end of a high speed line (Bordeaux, Rennes, Marseille and Strasbourg)*

In this configuration, the high speed line interconnects with the conventional rail network upstream from the agglomeration in order to serve the historic central station. For Bordeaux, Rennes and Strasbourg, the historic central station is the only high speed access point in their metropolitan areas. The Aix-Marseille-Provence Métropole is particular in that a new station has emerged to split urban area service. The Aix-en-Provence TGV train station is like a gateway to Marseille’s metropolitan area, situated at the barycenter of several urban centralities and facilities, such as the Marseille-Provence airport between Marignane and Vitrolles. Though these metropolises are at the end of the HSR line, the TGV systematically continues on, permeating regional territories. Rennes, where the TGV continues its route to Saint-Malo, Brest or Quimper, is a good depiction of this. Incidentally, Brittany synchronized the improvement of its rail network and train stations with the realization of the ‘Bretagne-Pays de la Loire’ high speed line inaugurated in 2017.

- *Metropolises with one or more high speed railway lines running through them (Lyon, Lille, Tours, Nancy-Metz and Montpellier)⁵.*

For optimum efficiency, railway lines tend to bypass agglomerations at more or less far distances to limit detours and losses of speed. This configuration has most often spurred the creation of new stations on the high speed rail line. There are however exceptions to this model, the city of Tours being the first example. The Gare de Tours being the terminus of the high speed railway line until 2017, the Saint-Pierre-des-Corps railway station has acted as a TGV station built on the conventional network. With the high speed line extended all the way to Bordeaux, thus bypassing the city of Tour, train service is still offered through the Saint-Pierre-des-Corps or the Tours city center station. Similarly, in Le Mans or

⁵ Railway line partially connected to Barcelona.

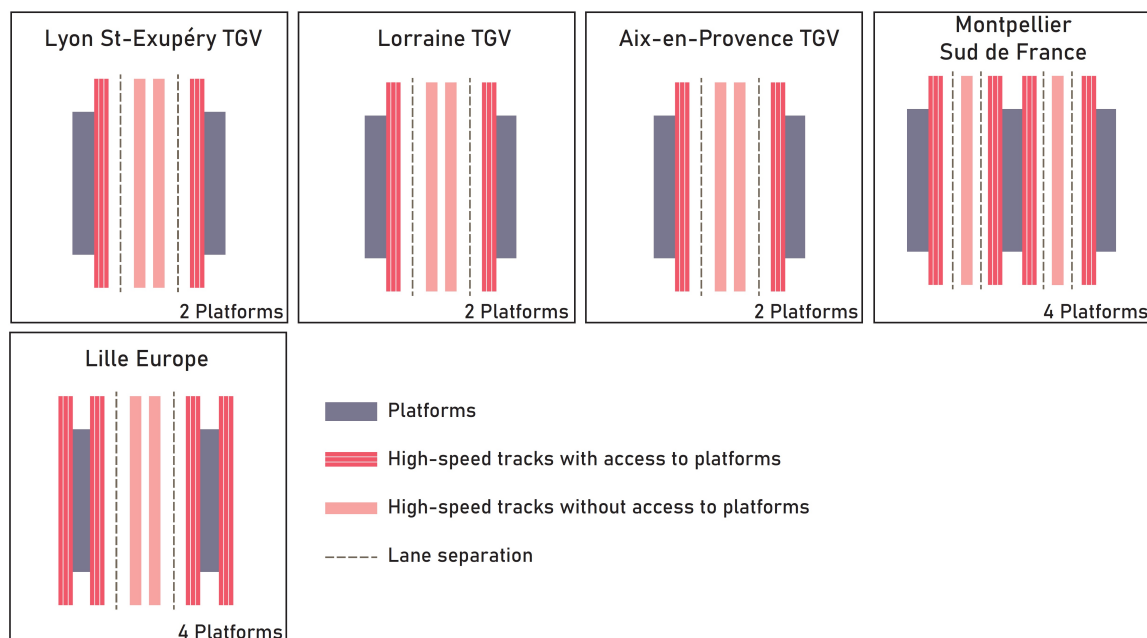
Poitiers, a coupling mechanism allows the trains to leave the high speed tracks to serve these cities without needing to build a new station on the high speed railway line.

Apart from the unique case of Tours, new stations were built on the high speed rail lines for metropolises with TGVs running through them (Lille, Lyon, Metz-Nancy and Montpellier). These stations split territorial TGV service according to their varying spatial configurations in relation to the historic station.

- **New stations on HSR lines: French specificities and diverse contexts**

The high speed system in France is partly characterized by the construction of new stations located on the HSR network. These stations on the new railway infrastructure attracted the attention of researchers (Zembri, 1992; Ollivro, 1994; Troin, 1995; Facchinetti-Mannone, 1999; Menerault, 2008; Facchinetti-Mannone et Richer, 2011). Their organization has one key point: all are designed so that high speed trains that run through them can do so without stopping and while slowing down as little as possible. In other words, these stations are built to offer the possibility of not stopping at them. The number of quays is generally reduced: 2 as a general rule, 4 in the case of Lille-Europe and Montpellier Sud de France (Fig.2).

Fig. 2 : The configuration of stations located on high speed rail lines in France. Source : authors



Though their configuration is characteristic of the French high speed model, HSR stations fit into a diversity of local contexts. Among the five 'other' types of stations in French metropolises, we have identified nearly as many possible situations:

- A new station uniquely located in the heart of the city, for example Lille-Europe. Apart from the Lille-Europe train station, all have peripheral locations more or less close to the metropolis' core city;
- A new station on the railway bypass, connected to the metropolitan airport (Lyon-Saint Exupéry). They are similar to Île-de-France stations, situated on the bypass and connected to major facilities;
- A new gateway station to serve the urban region, such as the Aix-en-Provence TGV, which is located at the epicenter of several hubs, and splits the service offered by the Marseille-St-Charles station;
- The Lorraine TGV train station is similar to the Aix-en-Provence TGV in that it is located between Metz and Nancy, though very isolated and poorly served;
- The final type of station is one located at the edge of a city, like Montpellier-Sud de France. Similar to Reims or Avignon, this type of location means the station can potentially interconnect with the metropolitan public transportation system. As with Lille-Europe, the Montpellier-Sud de France station is located within the perimeter of the metropolitan's central municipality.

So, the French model is structured on three core principles: passenger specialization, compatibility with the conventional network and straight railway lines. This model is based on enabling trains to run through without stopping when the metropolises are an intermediate location in the network. It almost systematically leads to the construction of new stations on the HSR lines that fit into a variety of local configurations. This diversity shows that the French model is negotiated in collaboration with local authorities and produces more than one form of spatial configuration.

II) High speed stations in intermediate metropolises: concentration or dispersion?

In France, the common duo of metropolitan high speed rail service consists of a historic station and a new station on a new line, as we have just shown, even if their metropolitan locations and the way in which they are paired can vary, helping create the complexity of the model. We will try to clearly define Lille's uniqueness in the face of this shifting trend, matching it against the choice of station locations in Antwerp and Zaragoza, in order to question the advantages and limits of accommodating larger amounts of traffic.

- **High speed rail in the Lille Métropole: A unique, hybrid project**

In the case of Lille, when designing the North-European TGV project that began at the end of the 1980s, a unique project developed thanks to an interplay of local and regional actors, and available community-controlled land on old, decommissioned fortifications. The analysis of this territorialization of high speed rail has been the subject of several research efforts to understand how it fit into a long-term approach based on existing principles of urban planning from the 1920s (Menerault, 2009), and also how it brought actors together to develop a solution initially rejected by the railway operator (Menerault, 1996 and 1997). We won't be revisiting these topics, but we would like to attract attention to two resulting physical characteristics: the concentration of stations and the hybrid nature of Lille-Europe. The decision to run the TGV line for travelers from the UK through the central part of Lille marked the opening of a new through station (Lille-Europe), situated at just 400 m from the city's old Lille-Flandres terminus station. This convergence of stations fostered the creation of an efficient interchange, forming what A. Barré (2001) referred to as a 'node', used to describe the extended space used for different modes of transportation. The hybrid morphology of Lille-Europe stems from the fact that, despite its central location in the city, it carries the traits of new-line peripheral stations, in other words, high speed trains pass through without stopping. In the case of Lille, the concourse is built atop two central through tracks for non-stop trains.

From a functional standpoint, significant passenger traffic at the Lille-Europe station indicates the value of such a location. In 2017, out of the 14 new stations on new rail lines in France, excluding Île-de-France, Lille-Europe, with its nearly 7.2 million passengers, ranks first in this category and has double the number of passengers of the Aix-en-Provence TGV station (3.6 million), ranked second. In 2017, Lille-Europe was ranked 14th among French provincial stations in terms of its passenger attendance.

However, this success has not kept institutional players from wanting to open a 3rd TGV station, this time with a peripheral location. Two arguments in favor of this orientation mainly came from the Chamber of Commerce and Industry, with backing from the former Nord-Pas-de-Calais region. They pointed both to the saturation of central stations in Lille and, in terms of international service, to the reduced profitability of Lille's railway as a result of the high speed rail lines between Brussels and London built in 2007, followed by the Amsterdam-Cologne railway line in 2009. To compensate for this falloff, proponents put forward the idea of a 3rd station, located on the axis between Lille and Brussels and which does not enter Lille. This option did not materialize, but rather raised questions about the convergence of stations and related emerging disagreement, as neither the city nor the urban community supported the idea. If we focus on accessibility, the analysis sheds light on the limits, at various levels: 1) at the metropolitan level, a station poorly connected to other modes of territorial public railway transportation (metro, tramway and regional trains) favors car travel, which goes against current ambitions; 2) at the international level, goals to reduce the travel time between Paris and Amsterdam⁶

⁶ This issue led the Netherlands to make a route on the new line that shunts the Hague, the seat of the government directly served by an international conventional rail line.

to 3 hours would put enormous pressure on Lille's peripheral station; 3) at the town level, a new peripheral TGV station would incite railway operators to spread out the current number of stops instead of increasing them, and this would take away the advantage of having a lot of centrally located stops with easy access to public transportation. These factors highlight the distinction between the presence of a station (network-support), potentially influenced by local contexts, and the intensity of service that carriers offer (network service). The above mentioned hybrid form clearly reminds us of this because, by traveling on the Lille-Europe central through lines, passengers on the Paris-London route do not stop in Lille.

This case illustrates the interactions between networks and territories. And it provides an opportunity to examine the different contexts we see in neighboring countries. It helps us better understand the specificities of the 'French model' of high speed rail and reinforces the theory of a 'Lamarckian-style network'. Antwerp and Zaragoza, with their differing high speed railway systems, both opted for the solution of just one station, at the cost of considerable construction.

- **Antwerp: seizing the opportunity of high speed rail to revitalize the central station**

In the case of Antwerp, there is just one centralized station in the metropolis. Behind this choice is an orchestration of principles in the framework of in-depth reorganization of railway circulation. In Belgium, the federalization process gives the regions a considerable role, despite the fact that railway jurisdiction remains national. This political context, reinforced by a geographical configuration whereby the high speed network runs through the country to serve its French, German and Dutch neighbors (Charlier, 2008), explains the coexistence of two distinct visions of high speed rail in this small territory. One vision is supported by Wallonia and follows the French model with new rail lines allowing trains to travel at 300 km/h. The other, defended by Flanders, is influenced by the German model and opts for upgraded rail lines on the conventional network, limiting the speed to a maximum of 250 km/h. In the case of Antwerp, high speed trains from Brussels run on upgraded existing rail lines. However, northwards, though this is considered Flemish territory, a new straight route offers quick access to Dutch towns with service⁷.

Though Flanders and Wallonia differ in the way they route their tracks, they do agree on the principle of a single, central station. The difference is that Antwerp decided to transform its existing station while Liege opted for a new building. Antwerp is a fantastic example of why such a decision was made because, before the high speed line to Amsterdam was put into service, the main station for international connections was in the suburban town of Berchem, located about 3.5 km from the Antwerp's downtown on a railway bypass that offered a direct junction in the Brussels-Amsterdam corridor. The fact that Antwerp Central is a terminus station has handicapped its development, and explains why international links are dismissed in favor of through stations that don't require trains to reverse or turn around. The European high speed network project has led the National Railway Company of Belgium (SNCB) and public authorities to redefine railway lines and service to this metropolitan area by partially transforming Antwerp Central into a through station.

Between 1998 and 2009, substantial investments into this undertaking solved the operational problems of this treasure of impressive, architectural eclecticism dating back to the pivotal period between the 19th and 20th centuries. The reconstruction gives a new image to this sober, exceptional building celebrated in the opening sequence of W.G Sebald's (2002) novel *Austerlitz*. The station works bear witness to the magnitude of the changes:

- 1) a 3.8 km-long tunnel was built between Berchem and Damplein. Then northwards, a bridge carries mainline tracks over others, and further on, this new alignment links to the high speed line, thus creating a partially through station;
- 2) with four levels, this historic station has been reformatted with tracks arranged differently according to circulation. A tunnel has been constructed at level -2 to permit the passage of trains under the city. Its four tracks all have quays for stops, and are used by high speed trains and domestic services towards the north.
- 3) there is a covered retail space thanks to the approach viaduct used for conventional trains. Several diamond merchants opened there in connection with the neighboring district. The glass arches in the approach viaduct create a porous environment in the railway infrastructure between districts previously separated physically and socially;

⁷ The Netherlands helped fund this axis by paying the additional cost of the new rail line in Belgium.

4) Before arriving to the central station, extending out from the elongated platforms, an ‘annex’ station was constructed, designed by J. Voncque. Its architecture and vast atrium echo the historic railway station. The whole scheme forms an ‘urban mangrove’ system, defined by David Mangin and Marion Girodo (2016) as a single, complex, connected urban system with metro and railway stations, as well as corridors linking them to commercial, service, recreational and cultural spaces.

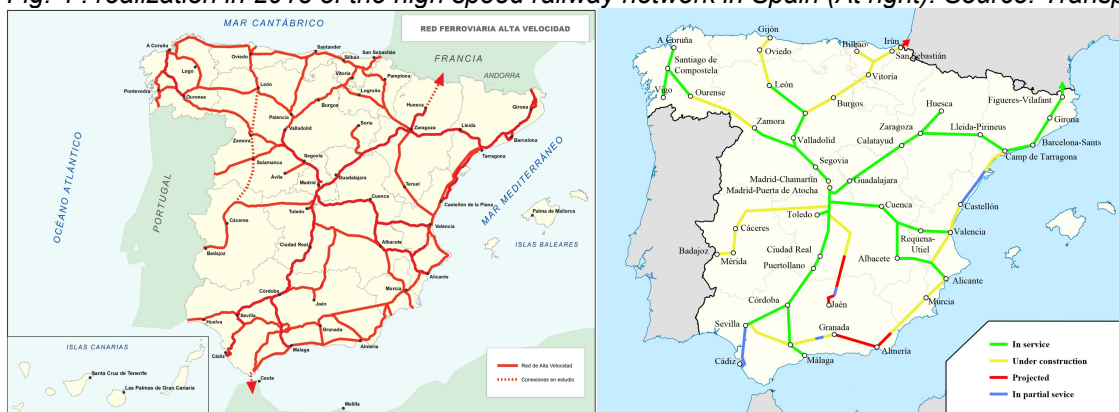
Another contextual dimension influenced the proactive choice to develop high speed rail service to modernize the central station: Antwerp is a major port city in the European landscape, where rail freight transport plays a strategic role (Beyer, 2011). Against this backdrop, the drive to boost the railway freight network encouraged efforts to converge and centralize the flow of passengers, while the bypass provided new routes to organize freight traffic from port activities. At the end of 2014, the Liefkenshoek tunnel added to the network, facilitating interchanges between the various port areas of Antwerp and those outside the country. One particular advantage was the revival of the *Iron Rhine*⁸, a railway freight line to Germany that competes with the *Betuwelijn* in the Netherlands.

- **Zaragoza: A new central station at the core of a large-scale metropolitan project**

In Spain, since the first high speed rail line was commissioned in 1992 (Madrid/Seville), the network has grown considerably and in 2018, it counts 3,240 km of tracks⁹, which is in fact the longest in Europe today (Fig. 3 et Fig. 4). A broad mobilization of European funds enabled Spain to achieve this network in a short time. It is the result of planning that has seesawed, depending on the governments in place, between a system that radiates around Madrid, which currently appears predominant, and a webbed system. In a technical sense, the Spanish model for high speed rail is characterized by a design that uses the Iberic guage tracks (1,668 m) of the conventional network, which differs from the new European guage tracks (1,435 m)¹⁰. The ambition to modernize infrastructure by replacing the conventional network with European guage railways is an extremely costly venture, and the idea seems to have been abandoned to the coexistence of both systems. These constraints have prevented the current principles of compatibility currently applied in France. And regional high speed train service is impossible without upgrading the tracks (adding a 3rd rail) or adapting the rolling stock (automatic modification of the axle spacing performed in equipped stations). This specificity reinforces the argument J.M. Ureña (2008) emphasizes, according to which “there has been pressure on Spain to move high speed rail lines away from the direct corridors between major cities so that they can serve more cities”. While a few cities of less than 100,000 inhabitants have peripheral stations, in all the intermediate metropolises with service, stations were built in the city center or in the immediate vicinity, which often required costly subterranean station works.

Fig. 3 : 2012-2024 projection of the high speed railway network in Spain (At left). Source : Plan de Infraestructuras, Transporte y Vivienda 2012-2024

Fig. 4 : realization in 2018 of the high speed railway network in Spain (At right). Source: Transportail.



⁸ The *Iron Rhine* is a railway freight line to Germany competing with *Betuwelijn* in the Netherlands.

⁹ Of which 567 km on Iberian guage tracks limiting the maximum speed to 250 km/h and 71 km on tracks with a 3rd rail.

¹⁰ The Spanish railway network also uses narrow guage tracks which are now operated by carriers in individual autonomous communities.

This is the case with the Madrid/Barcelona corridor, opened up in sections between 2003 and 2008 (Ureña, 2016). Unlike in Lille or Antwerp, this case new lines were not routed to connect to international destinations, but rather to create a far-reaching national axis between the two largest cities in the country. The new line enters the central Zaragoza, but there is also a bypass so that some Madrid/Barcelona high speed trains can run through without stopping. Spain's example highlights the particularity of the French model while it contrasts Antwerp's context wherein Zaragoza's downtown Portillo central station is not served by high speed trains. Moreover, it was dismantled and now only serves as a terminal for suburban commuter lines. It has been replaced by Delicias, a new station located 2 km to the north at the edges of the River Ebro (Lecardane, 2014). Its rail lines were recovered in view of a 9.3 ha urban renewal project. However, initially the Spanish Ministry of Public Works did favor the transformation of the central station to accommodate high speed rail. This vision collided with the proposals developed by the Aragon Architects Association, which offered a perspective consistent with the strategic plan for metropolitan development the *Ebropolis* Association promoted (approved in 1998 and revised in 2012) and with the general plan for urban development, voted in 2001. These plans have federated a diversity of local actors with a converging vision. Unlike Antwerp, where the central station sought to accommodate a larger amount of traffic terminating at the station, regional and local elected officials in Zaragoza argued that the city's historic station was unfit for that. And above all, it did not support Zaragoza's ambitions for urban and socio-economic transformation, while mobilizing railway land potentially offered the perfect vehicle for such goals. This widely debated point of view was finally shared and adopted by local and national actors, who planned to fund infrastructure work through capital gains made from the sale of old railway land property during urbanization efforts. To this end, the *Zaragoza Alta Velocidad*¹¹ Company, commissioned to finance and manage railway and urban transformation projects, was created in 2002 with low initial capital. After the economic euphoria at the turn of the 21st century, the country faced hardships from successive downturns, and this neo-liberal prospect therefore proved to be disastrous. Initial land management difficulties were followed by the collapse of the Spanish housing market and the effects of the Great Economic Recession between 2008-2012 (Bellet, 2016). Today, hardly any of the housing and facilities that were planned were actually built, leaving vast enclosed areas of brownfields in the heart of the city (site of the former Portillo Central Station) and beyond (the Zaragoza Milla digital zone), where forms of urban continuity were supposed to reach the new Delicias station and its global urban project (nearly 100 ha). In the meantime, Zaragoza *Alta Velocidad* is currently renegotiating its debt with the banks. Although urban actions remain incomplete, planning initiatives to accommodate the high speed rail network have however been accomplished. The closing of the Portillo station marked two key events:

- first, a large intermodal passenger station was created on the westside of the city, on the Delicias freight station site;
- secondly, the Portillo rail yard was relocated to *Plaza*, one of Europe's largest logistics platforms¹² near the railway bypass.

They are poignant examples of the importance of freight-related strategies in high speed rail projects, as we clearly saw with Antwerp, as opposed to Lille. Keep in mind that the idea of building a peripheral station in Zaragoza on the new line was in fact put on the table, but economic hardships put off this option, and new building projects, an integral part of the Spanish high speed rail model, are set to remain on the back burner for quite some time. Concomitantly, "Zaragoza's strategic vision for 2020 promotes urban compactness through revitalization and renewal" (Postigo Vidal, Pueyo Campos, Lopez Escolano, 2019). In light of this example, might we wonder about the request for a 3rd station in Lille? Mainly supported by economic actors, is it not just a means to open up land to urbanization, without any regard for the quality of high speed accessibility?

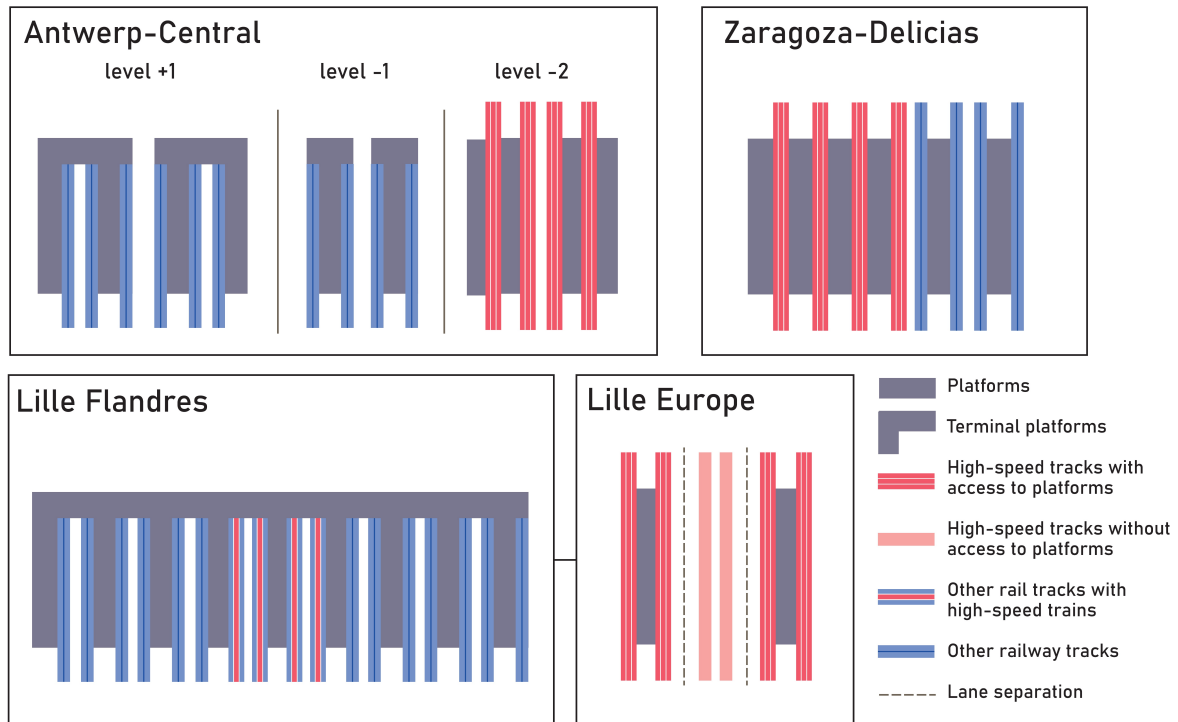
Overall, from a morphological standpoint, these three cases studies show three different forms adopted to ensure the same concentration of high speed rail service on one metropolitan site, where different scales of public transportation intersect. The duality of Lille's two stations corresponds to the vertical density of Antwerp Central Station, to which corresponds the transposition of the Portillo station to Delicias in Zaragoza (Fig. 5). In each of these scenarios, the advantages of more passenger railway service in the heart of the metropolis won over the dispersion that a peripheral station would have

¹¹ This company is comprised of State representatives, regional and municipal authorities, the Spanish state-owned infrastructure manager (ADIF) and the railway network operator (RENFE).

¹² A logistics platform with a surface area of 1,300 ha. It caters to Zaragoza's industrial sectors (i.e., Opel, Zara, Porcelanosa, etc.) and also hosts data storage for Barclays Bank.

created. But it is true that, in Lille as in Zaragoza, the temptation for an additional station was the subject of public debate, even if it did not come into fruition.

Fig. 5 : The configuration of Antwerp, Zaragoza and Lille stations. Source : authors



III) High speed rail in the metropolitan transportation system

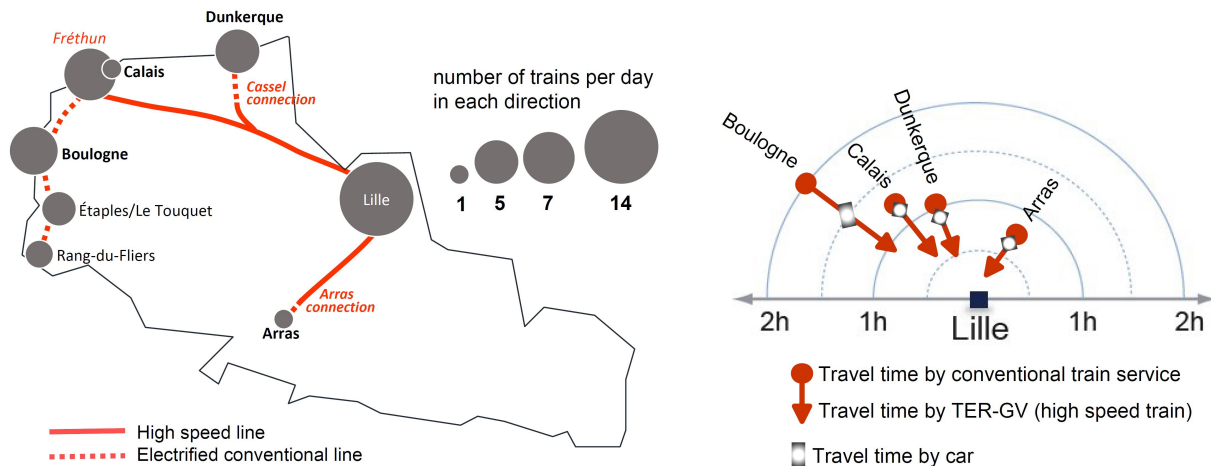
If we use international comparisons to examine the strategies of the French high speed rail model, the one pertaining to its role in connecting metropolises to their hinterland can reveal contrasting ideas about a territory's ability to innovate. Moreover, the 3rd phase of the POPSU research program focuses on building ties and interactions between metropolises and the small and medium-sized cities they influence. This perspective is the basis for investigating different ways in which high speed rail can be mobilized to physically establish such ties and their strategies in terms of planning. In France, short distance high speed rail lines are all but predominant. The Nord-Pas-de-Calais scenario draws attention to its singularity on the national landscape and to its differences with Antwerp and Zaragoza, two metropolises that demonstrate other ways to use high speed rail network for local service.

- **Regional high speed rail lines in France: the specific case of TER-GV around Lille**

In the 1990s, when the North-European TGV was being built, negotiations between the Nord-Pas-de-Calais region, SNCF and the State focused on how to create direct links between as many cities as possible in the region and Paris, by optimizing compatibility and railway service in the French high speed network. In terms of routes bound for coastal cities, this strategy culminated in a decision to electrify the Calais-Frethun/Boulogne axis and add a coupling mechanism at Cassel, enabling the TGV to leave the new line outside of Lille and link to the conventional line, thus serving Dunkerque. These upgrades were initially only meant to improve journey times between Paris and Dunkerque. Yet, at the end of the 1990s, the region's territorial development scheme sought to make Lille accessible to its main cities in one hour. It therefore designed and negotiated a new service with SNCF, using the high speed rail line and rolling stock for Lille-Dunkerque, Lille-Calais and Lille-Boulogne. Commissioned in the year 2000, these lines travel two times faster and the number of passengers gradually increased. As a result of successful passenger attendance, the system has evolved over time. Initially, it was limited to a few pre-existing Paris-Lille TGV lines extended to coastal cities, on which the Regional Council reserved seats for passengers traveling in Nord-Pas-de-Calais. From 2003 onwards, the region also chartered its own

TGVs (TER-GV) in response to a growing demand and to better adapt the schedules to regional mobility towards Lille Métropole. Another milestone was achieved in 2010 when service was added to Etaples and Rang-du-Fliers, following the electrification of the Boulogne-Rang-du-Fliers line (Fig. 6). And finally in 2019, when Nord-Pas-de-Calais and Picardie merged to form Hauts-de-France, (Law of 2015), railway service was extended from Arras to Amiens.

Fig. 6 : Regional high speed rail lines (TER-GV) around Lille. Source : authors



The TER-GV, a portmanteau for the hybridization of TER and TGV¹³, is a functional innovation in railway services, impacting the morphology of existing high speed rail lines. It also impacted topology and uses by turning Lille-Europe, initially devoted to international and national passengers, into a station that accommodates regional users, similar to Lille-Flandres. This regional dimension is far from negligible, and currently accounts for 27% of the Lille-Europe railway service, which is more than the international lines¹⁴. Blending passengers on European, national and regional routes reinforced the idea of one single node formed from two stations, which is consistent with the *Euroflandres* development strategy, another portmanteau popularized by the development corporation *EuraLille*, in reference to the hybridization of two stations and two scales (European and regional).

Keep in mind that the TER-GV contradicts the initial principles of French high speed rail, which targeted long-distance rail service as a way to compete with airplane and car travel. This break from the general rule results from the contextual convergence of interests between regional/metropolitan authorities and the railway operator. In fact, the new rail line between Lille and the Chunnel is far from being fully used by international connections. Authorities can still tap into railway capacity to create service between Lille and coastal cities. Establishing the TER-GV not only served proactive regional policy, but also enabled the SNCF to better exploit the Lille-Europe station, operating largely as a terminus for the TGV railway depot at the Fives site. SNCF was thus able to have the region pay for an easier overall management of the network. This particular situation is not widespread in France, where the high speed rail system intended to strengthen metropolitan access is in a league of its own. Until recently, the TER-GV system was designed for TGV trains. But for the first time in 2017, in connection with the opening of the new Bretagne-Pays de la Loire line, a conventional train was adapted (ZTER) to provide interregional service between Rennes and Nantes metropolitan areas. Perhaps this innovation signals a new era of the French high speed model, one that connects metropolises to their region. Moreover, the institutional reform of 2015, which called for the merger and birth of mega-regions, could help stimulate this new model.

- **Antwerp and Zaragoza: different forms of metropolitan high speed rail service compared to Lille**

Antwerp helps expand on this approach by showing another way to solicit high speed rail for local service. Given the small size of the country, we might think that the railway line between Brussels and

¹³ TER-GV is a contraction of TER (Regional Express Transport) and TGV (high speed train).

¹⁴ 13% of Eurostar rail service, plus 9% national railway lines which bypass Paris stations and extend to Brussels.

Antwerp, a distance of just 45 km, falls into this category. However, although high speed trains run this route, they do not exceed 160 km/h, in compliance with the Flemish design of the network that focuses more on upgrades to existing lines than on the quest for higher speed.

On the other hand, what is particularly interesting for our purposes is the line created to the north of Antwerp after the opening in 2007 of service to the Dutch border (*HST Zuid*). A stop located about 20 kilometers from Antwerp's metropolitan area was opened in 2009 on this new line. The railway station is in Noorderkempen, close to the small town of Brecht. This stop has four tracks: two in the center for international through traffic, and two outside tracks that serve the Campine region. In this scenario, rapid conventional equipment was combined with upgrades to Antwerp's central station, making the Noorderkempen/Antwerp journey possible in 17 minutes on conventional trains. When it opened, the SNCB created eight daily connections per direction on this journey. Moreover, an agreement was signed with the Flemish public transport company *De Lijn* to improve connectivity in the Campine region thanks to an interchange that includes a new bus station. As a sign of its vitality, this periurban railway service in the popular Campine region grew and, as of 2020, it counts 11 daily runs in each direction with intercity or suburban (peak hours) trains. Similar to Lille, available capacity on railways makes new services from the metropolis possible. However, Antwerp differs from Lille in three ways: (i) by the precedence of this strategy that, from the beginning, sought uses for the new line other than long-distance journeys, which would make little sense considering the small size of the country. Transportation plans date back to 1998; (ii) by the scope of the strategy, which breaks new ground in its approach to periurban service and (iii) by its technical system, which runs conventional trains on a new line, corresponding to the timid evolution recently seen in France.

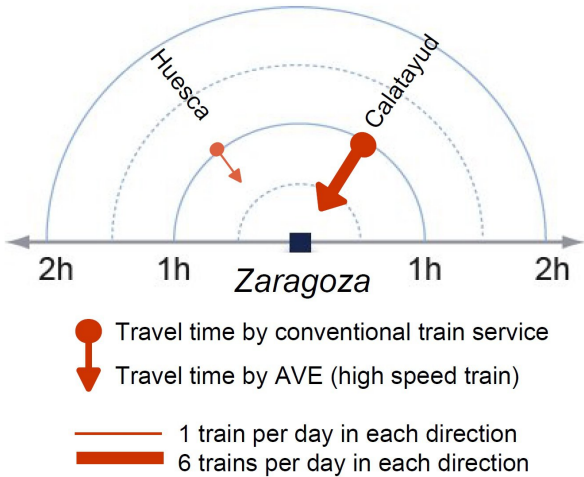
Spain, due to its size and centralized territorial organization, is a lot like France in that it has also developed high speed railway services to connect metropolises to their nearby towns. From a morphological standpoint, Spain developed the network in a way that put small and medium sized towns directly on the high speed railway map. However, this meant lengthening the routes to make up for difficulty in articulating high speed and conventional networks¹⁵. This strategy gave birth to a new short-distance service in 1992 on the Madrid/Seville axis, whose territorial characteristics have been the subject of several research efforts (Menendez-Martinez, Coronada-Tordesillas, Rivas-Alvarez, 2014). Catalonia offers another example, with the Madrid/Barcelona line that makes a detour in Tarragona. Catalonia authorities who wanted to develop a regional high speed rail network between the cities of Lleida, Tarragona, Barcelona, Gerona and Figueres succeeded in imposing this route. In Spain, high speed rail service for short and medium journeys, initially called *AVE Lanzadera* (shuttle), then *AVANT*, called for the production of specific rolling stock used on certain sections, such as the Madrid/Puertollano/Ciudad Real line. These trains are smaller-sized TGVs, less costly to operate and able to travel at 250 km/h on new lines. The Spanish model, in this regard, stands out from the other cases studied in this chapter and bears witness to the importance attributed to this kind of service. It is an approach made possible by the excess capacity available on new routes, allowing different speeds to be managed on the same infrastructure.

Two cities in the Aragon region are thus affected by the inter-regional railway service to the Zaragoza metropolis: Calatayud, 85 km to the south, and Huesca, 67 km to the north (Fig. 7). However, they do not have the same configuration nor do they offer the same performances in terms of accessibility to their metropolis via high speed rail. Calatayud is located on the Madrid/Zaragoza axis and benefits from a new line equipped to European standards. Since 2020, this small town of 20,000 inhabitants, with its rich historical heritage, has six AVE daily services to/from Zaragoza. This is comparable to the railway service between Lille and North-Pas-de-Calais coastal towns, but for a population 10 times smaller than Dunkerque's. Journey times are even faster, as it only takes 25 minutes to connect Zaragoza to Calatayud, which is a half an hour less than the time it takes for the same service via the regional train. While mobility between the two cities has been positively impacted by improved commuter travel, the new high speed rail line has triggered only very limited urban projects in the form of small-scale residential development near the station. The trajectory of development in this agglomeration has been consistent with Spain's overall trend. Following the significant 1998-2009 growth period, a recession ensued. From an economic and demographic standpoint, it was reflected in a loss of jobs and population, which gives credence to the idea that high speed rail is closely connected to a general urban dynamic. Huesca, with its 53,000 inhabitants, is the capital of a providence by the same name. Created

¹⁵ Coronado (J.M), "Redes regionales de alta velocidad en España", *Alta Velocidad y territorio, Cuadernos de Ingeniería y territorio*, 2007, No.10, p.61-70.

in 2003, the town's high speed railway service to Zaragoza is associated with the opening of the Madrid/Barcelona axis. However, the development was more of a way to test the relevance of having more AVE trains run on the preexisting national network, than it was a real objective in regional planning policy. This antenna consists of two sections. The first is a new single track with a European gauge, adapted to the low traffic of the Zaragoza/Tardienta line. The second is a dual gauge track to accommodate high speed and regional (Tardienta/Heusca) trains. The improvements in journey time initially announced were never achieved. The AVE train running between Zaragoza and Huesca takes 40 minutes instead of 30, as originally predicted. And above all, there is currently just one daily high speed Talgo passenger car making the journey, which makes this rail service nothing more than anecdotal. Regional conventional trains get passengers to Zaragoza stations in one hour and connect to AVE trains running to Madrid or Barcelona at the Delicias station.

Fig. 7 : Regional high speed rail lines around Zaragoza. Source : authors



Spain's case illustrates the range of railway service made available on new lines to connect metropolises to the nearby cities with which they interact. The creative solutions Spain developed in this field emerge from the need to optimize a network that high speed long-distance rail service alone could not support. The country's technical systems and spatialization are based on different combinations of infrastructure and rolling stock, which highlight the specificities and difficulties resulting from different track gauges, a situation that doesn't exist in France or Belgium. In this context, adapting high speed equipment to short- and medium-distanced railway service on new lines, sometimes used, is an original strategy that just might appeal to other countries.

Conclusion

The French model for high speed rail is built around the triptych of compatibility/ specialization/ straightness of railway lines, which has fostered the development of service at historic central stations as well as the emergence of new stations on new lines. The latter feature tracks without quays, thus allowing trains to travel through without stopping. In this way, those trains don't undermine railway service to and from intermediate metropolises. Set against the principles in neighboring countries, the specificities of the French model are obvious, but so is its potential to adapt under the influence of a two-fold movement involving: (i) transformation - in connection with a gradual opening of services to competition across various segments of the rail supply and (ii) redeployment - driven by strong demand from regional and metropolitan powers who want better connected territories. That's why while the morphology of the high speed rail network appears to have reached a certain maturity, the network of railway service continues to evolve. In particular, the complexity of the scales of service makes it possible to imagine different hierarchies within the levels of accessibility. Moreover, examples from abroad remind us of all the different ways territories can appropriate a high speed rail network, especially since they are more concerned than France about serving the regions and towns neighboring their metropolitan areas. In this game, the role of railway operators will be crucial, and liberalization could encourage hybrid forms of national models.

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