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Perspectives of territorial development linked to the future high-performance rail lines in Eastern Andalusia.

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Abstract

According to territorial and infrastructural planning in Andalusia, as well as to the proposed definition for the Mediterranean Corridor, this paper aims to explore, as its title indicates, the prospects for territorial development linked to the future high-performance rail lines in Eastern Andalusia. This is within the general objective of improving the territorial integration of future railway infrastructures in the planning stages, in the network of cities in Eastern Andalusia in order to take advantage of all its local potential and, in short, to increase its territorial capital.

Thus, in relation to other experiences and to the existing socio-economic reality, the processes of contraction of space are determined that will promote the new networks and the forecast of their territorial incidence. Future strategies are proposed around the new railroads for the proper use and stimulation of local potentials, the minimization of the tunnel effect and its polarizing consequences on the territory. In addition we consider the establishment of proposals for the optimization of the positive territorial impact of future rail corridors, with the proposal of spaces of logistic opportunities, to establish actions for intermodal coordination and with future territorial projects, etc.

Keywords: Territorial development, High Speed Rail, Eastern Andalusia.

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1. Introduction

The traditional isolation of Eastern Andalusia Giving the topographical difficulties of this area they have produced the traditional isolation of Eastern Andalusia with the rest of the country. They have traditionally defined the natural existing corridors which have also established a clear distribution of the territorial crossroads as can be appreciated in a first geographical approximation. See Figure 1.

Although the whole region has an equilibrated and integrated in the rank-size model urban system, and all the provincial capitals have a certain metropolitan structure, as it is presented in the Territorial Regional Spatial Plan (COPT, 2006). See Figure 2.

This paper will consider the rail lines in Eastern Andalusia which comprises the four eastern provinces: Almeria, Granada, Jaen and Malaga. To complete and to give coherence to our study the cities of Algeciras (120,600 Hab.), in the province of Cadiz, and Cordoba (328,300 Hab.) will also be considered. The line between Cordoba and Malaga (569,000 Hab.) could be considered the limit between Western and Eastern Andalusia. Within these provinces their capital cities and their main populations, their connections to the regional and national capitals –Seville (690,600 Hab.) and Madrid (3,166,000 Hab.)- and the eastern connection to Murcia (441,000 Hab.) will be considered.

Despite the traditional underdevelopment situation of the rail lines in Eastern Andalusia, the current scenarios and projects of the new high-performance rail lines allow new perspectives of future territorial development linked to them to be drafted. The former, present and future situations of the rail lines will be considered to evaluate their territorial effects.

Regarding these territorial effects it is necessary to pay attention to the multiple scales to be considered that have been tested in a previous work over this territory (Huertas, 2013), and to the diverse territorial dimensions. However in this paper, given the limitation in extension, they will be focused on the spatial implications of the inter-urban relations at a sub-regional scale.

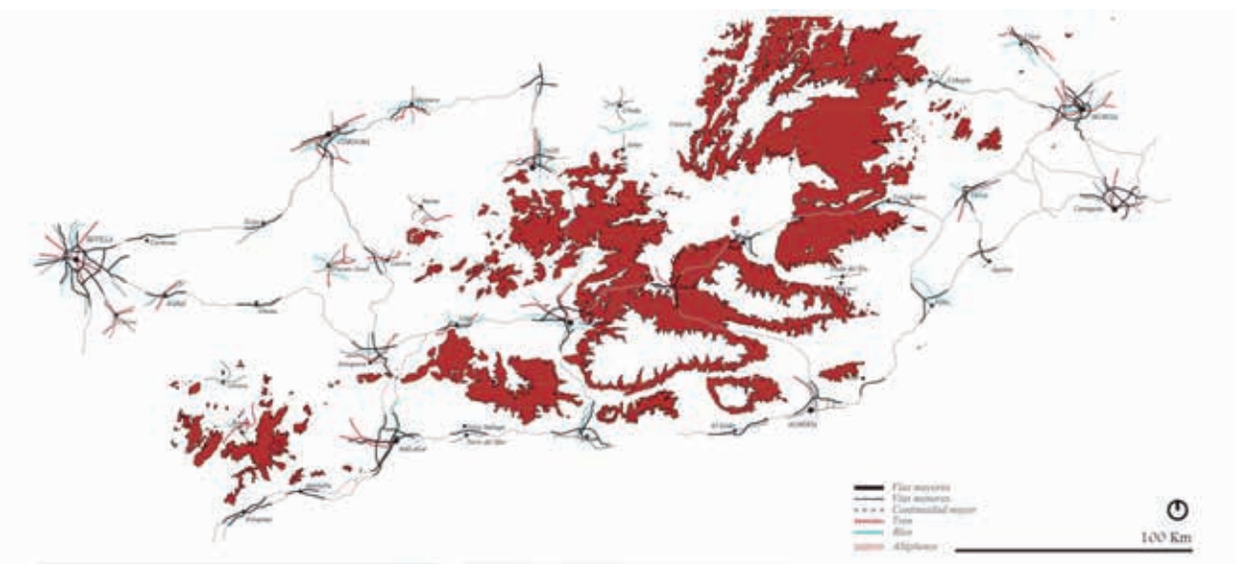

Figure 1. Territorial corridors and crossroads in Eastern Andalusia. Source: Huertas (2013).

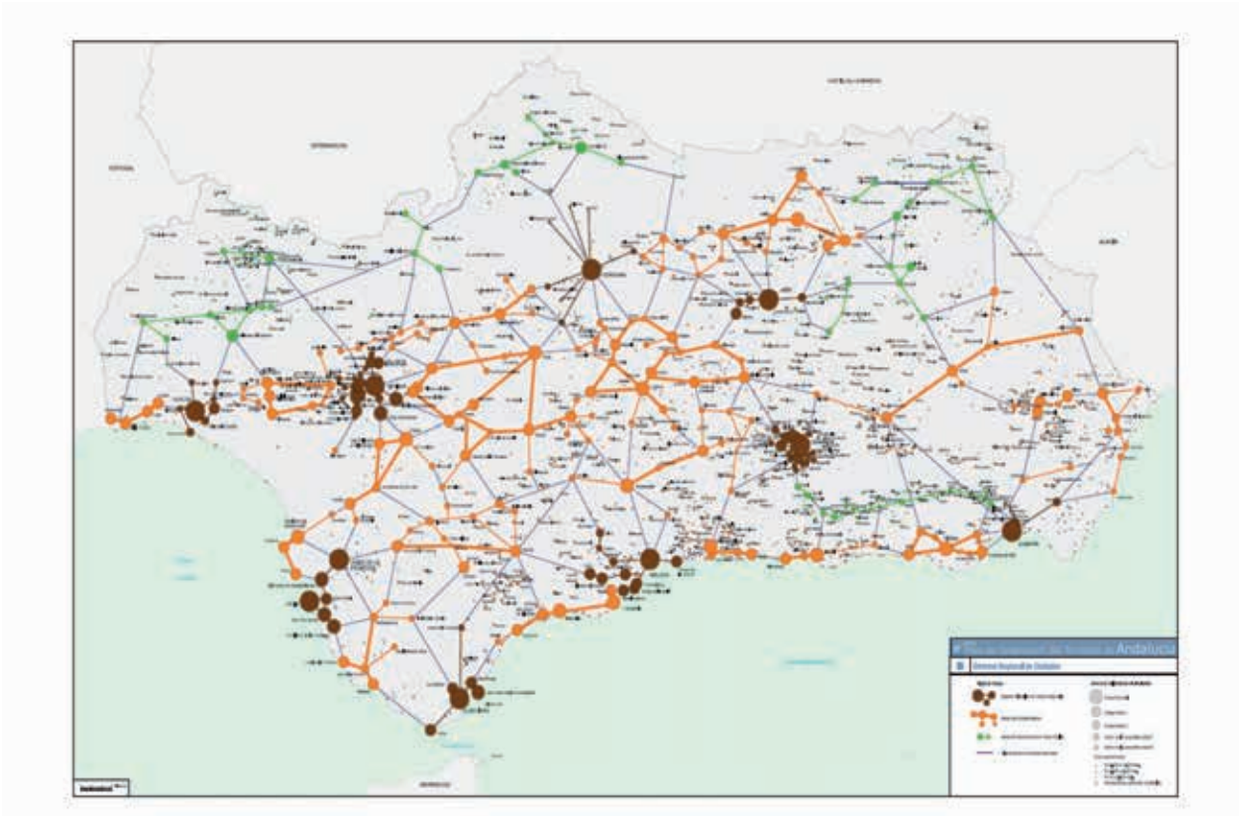

Figure 2. Urban System of Andalusia in the Territorial Regional Spatial Plan. Source: COPT (2006).

2. Former and present rail line situations In Eastern Andalusia.

The situation of the rail lines in Eastern Andalusia during the last decades of the past century was marked by its underdevelopment and an obsolescence process that had its most severe example with the closing and dismantling of the line between Guadix (18,800 Hab.) and Almendricos -towards Lorca and Murcia- in the nineties, which lost the unique direct eastern rail connection of the region. Since then it was necessary to take a big detour from Guadix to the station of Alcazar de San Juan at the same latitude as Valencia and continue to Albacete, Valencia or Barcelona. Then Almeria (193,000 Hab.) had a unique inland connection to the national capital or the east by a conventional single track and non-electrified line through Guadix – Moreda – Linares-Baeza and Alcazar de San Juan.

In contrast to this loss, in parallel the first High Speed Rail (HSR) line in Spain in western Andalusia connecting Madrid and Seville was being developed and opened in 1992. It started the process of development of new HSR lines following other international experiences, which have been developing with the standard international gauge (1435 mm) different from the conventional or Iberian gauge (1668 mm), and with these two different gauges co-existing in the rail network, the HSR for passenger traffic and the conventional for mixed passenger and freight traffic (Ureña, 2012).

During the first years of the last decade, the main actions in this area were the development and later opening of the HSR between Cordoba and Antequera (41,100

Hab.) (in 2006) and between Antequera and Malaga (in 2007), connecting these cities with the Madrid-Seville line, and reducing by more than an hour the time between Cordoba and Malaga. This new HSR line changed the orientation of the passenger services of the eastern cities of Granada (235,000 Hab.) and Jaen (114,700 Hab.) to Madrid, which since then use a mixed HSR-conventional long distance service, instead their conventional northern lines in their natural communication towards the nation capital. However the underdevelopment situation of the Eastern Andalusia's rail network was maintained, without direct train services between the neighbouring cities of Jaen and Granada, nor potential rail metropolitan services in this city (García, 2012). Thus the line between Cordoba and Malaga could be considered the limit between Western and Eastern Andalusia, since, as can be seen in the Figure 3 showing the existing rail lines and their stations -most of them without rail services-, there is a considerable gap in the current rail network development between the two areas of the region.

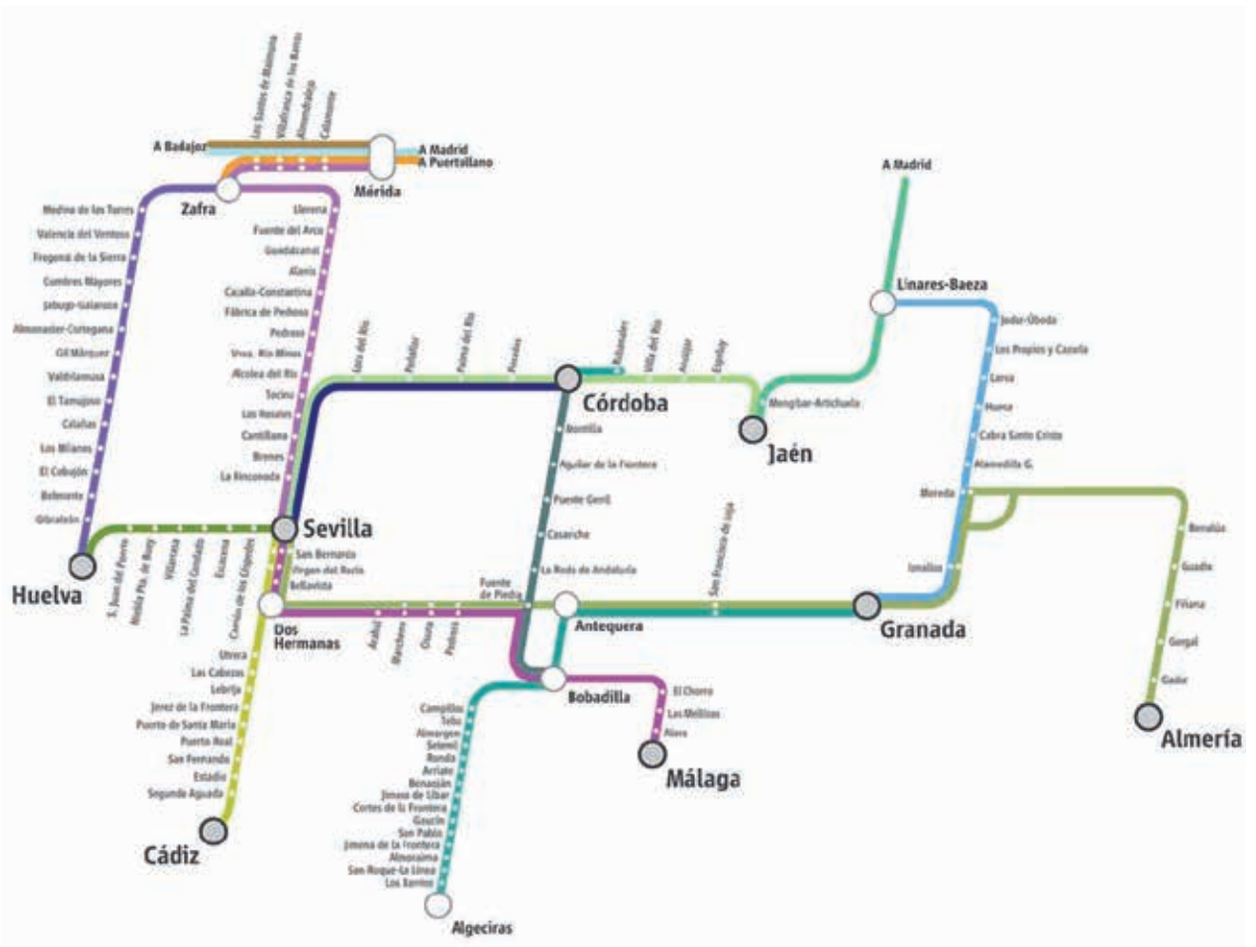

Figure 3. Present rail lines and stations in Andalusia. Source: RENFE

The stations´ location also limits its functionality and its relationship with the cities. In the case of the provincial capital cities they are adequately central, but in the case of the other stations they are distant from the city centres, as the lines were built in most of the cases for colonial reasons. As for example the Linares-Baeza station is 7.4 Km distant from Linares (58,800 Hab.),and the station of Moreda has a very weak relationship with the little village of the same name (590 Hab.) because it is 2.1 Km distant. Nevertheless in the current HSR development the railoriented logic is also imposed, as the location of the station of Antequera-Santa Ana seeks only an adequate rail connection but it is 20 Km distant from the city and isolated in the middle of the country only linked by a small road access. However they are now rebuilding Antequera's station at the edge of the city for the renewed rail line towards Granada.

With respect to the ports-rail links in Eastern Andalusia the inexistent and weak connections that were recognized decades ago are maintained (Gómez y Grindlay, 2001). Thus Almeria'sport is still without a rail link since the eighties and studies are being made as to whether this should be underground in the frame of a railway integration protocol in the city. The port of Motril had a cable connection which disappeared in the sixties, but historically lacks a rail link to the rail network. The port of Malaga located alongside the city centre has a weak rail link limited by various level crossings over the main urban roads. Recently attempts have been made to reuse the tracks for the transport of clinker towards Antequera during night hours but this has not been successful. The port of Algeciras has the most freight movement in Spain and has rail links at the most important docks, but has a limited rail access from the nineteenth century line Bobadilla-Algeciras, which passes by the city of Ronda (34,400 Hab.).

Therefore, at the beginning of the present decade the situation of the Eastern Andalusia rail network, excepting the indicated two new HSR lines, was a conventional single track and nonelectrified set of lines with limited speed in many sections. In addition for freight transport one of the most important limitations is the train length restriction of 500 m, due to the limited passing tracks when they should be at least of 750 m or longer to be competitive.

The next table demonstrates this severely underdeveloped rail network situation of Eastern Andalusia at the beginning of the present decade.

Table 1. Rail network situation of Eastern Andalusia in 2010 (HSR lines in bold):

LINE	LENGH (Km)	TRACK	GAUGE	ELECTRIFIED	MAX. SPEED (Km/h)	SERVICES
Algeciras - Bobadilla	176	Single	Iberian	Non	110 (limited)	Mixed Pass. & freight
Almeria - Murcia	Non-existing	-	-		-	-
Almeria - Moreda - (towards Granada or Madrid)	124	Single	Iberian	Partially	110 (limited)	Mixed Pass. & freight
Antequera - Malaga	55	Double	International	Yes	350	Passenger
Bobadilla - Antequera - Granada	131	Single	Iberian	Non	140 (limited)	Mixed Pass. & freight
Bobadilla - Malaga	80	Single	Iberian	Yes	160 (limited)	Mixed Pass. & freight
Cordoba - Antequera	100	Double	International	Yes	350	Passenger
Cordoba - Bobadilla	129	Single	Iberian	Yes	140 (limited)	Mixed Pass. & freight
Cordoba - Espeluy - Jaen	135	Single	Iberian	Yes	140 (limited)	Mixed Pass. & freight
Granada - Moreda	57	Single	Iberian	Non	140 (limited)	Mixed Pass. & freight
Guadix - Almendricos (towards Lorca -Murcia)	Dismantled	-	-	-	-	-
Jaen - Espeluy - Linares-Baeza - (towards Madrid)	61	Single	Iberian	Yes	140 (limited)	Mixed Pass. & freight
Linares-Baeza - Moreda - (towards Almeria)	126	Single	Iberian	Non	140 (limited)	Mixed Pass. & freight

Source: ADIF

According to this situation the connection times between Andalusian capitals has been excessively long, and there is no connection between some of them, for example Jaen-Granada or Almeria-Algeciras/Cordoba/Jaen/Malaga, as can be seen in the next table 2. As an example, the previous mixed services existing between Granada and Madrid took 4h. 35min. and the connection with the regional capital were 3h. 22 min between Granada and Seville and between Almeria and Seville was prolonged for more than 5 hours.

Table 2. Present rail travel time between Andalusian main cities and Madrid (hours:minutes).

	Algeciras	Almeria	Antequera	Cordoba	Granada	Jaen	Malaga	Madrid	Seville
Algeciras	-	-	2:54	3:14	4:20	-	4:00	5:35	4:31
Almeria		-	3:40	-	2:23	-	-	6:45	5:45
Antequera			-	0:37	1:11	-	0:21	2:16	1:29
Cordoba				-	2:30	1:33	1:00	1:44	0:45
Granada					-	-	2:31	4:35	3:22
Jaén						-	3:19	3:53	3:00
Málaga							-	2:20	1:55
Madrid								-	2:20
Seville									-

Source: RENFE

2.1 Freight rail transport and logistic situation

As it was indicated in a study about freight transport in the Mediterranean Corridor with traffic data of 2007, the rail transport mode is extremely weak in this southern area (Cadiz, Malaga and Granada provinces) with a participation only of 1.5%, against the 4% in the eastern area (from Murcia to Gerona) (INECO, 2011), and has remained thus over the last decades (Gómez and Grindlay, 2001). This is a consequence of the lesser development of the rail corridor in this area and the lesser potential volume of traffic, both due to the reduced distances because of reduced international traffic and due to its nature, with few minerals, cars or container flows. However a potential growth in the intermodal transport, and international cars and agriculture products traffics (INECO, 2011) was considered. However the main rail nodes of the area, Bobadilla and Moreda, have a limited logistic potential as they are located far from the high capacity roads and developed areas.

Since the previous regional infrastructures plan with horizon 2013, the regional administration has promoted the Logistic Andalusian Network with 11 main nodes, 7 with maritime connection and 10 with rail connection, and latterly they have been incremented to 13, linked to the main transport axes and consume/production areas (CFV, 2016). However in their development a great disparity east-west in Andalusia can be observed, as almost all the logistic areas of the western area have been developed already and the logistic areas of the eastern area are being developed, as can be seen in the next tables 3 and 4, and in the figure 4.

Table 3. Situation of the logistic areas of the Logistic Andalusian Network

Logistic Area	nº	Situation
Seville, Malaga, Cordoba and Algeciras Bay	4	On service
Antequera (Malaga), Nijar (Almmeria), Majarabique (Sevilla), Bailen (Jaen) and enlargment of Malaga	5	In phase of advanced planning
Andujar and Linares (Jaen), Motril (Granada), Huelva, and Granada.	4	In phase of study or elaboration of planning documents
TOTAL	13	

Source: CFV (2016)

Table 4. Gross surfaces of the logistic areas of Andalusia and their situation.

PROVINCE	LOGISTIC AREA	GROSS SURFACES (Ha.)						
		ON SERVICE	%	IN DEVELOPMENT	%	IN PLANNING	%	TOTAL PROVINCE
Almería	ZAL Almería					200		300
	N.L. Níjar			100				
Cádiz	Z.L. Las Aletas			159				452
	ZAL Bahía de Algeciras (4 Sectores)	86		145		62		
Cordoba	P.L. Córdoba	23				13		36
Huelva	C.L. Huelva					18		18
Granada	C.L. Granada					120		150
	C.L. Motril					30		
Jaen	Puerto Seco de Linares			99				210
	C.L. Bailén					32		
	A.L. Andújar					79		
Málaga	CTM Málaga Trávenez	27						392
	CTM M. Buenavista			37				
	Puerto Seco Antequera			328				
Sevilla	CTM La Negrilla	25.5						232.5
	C.L. Majarabique			207				
TOTAL		161.5	9	1,075	60	554	31	1,790.5

Source: Author based on data from CFV.

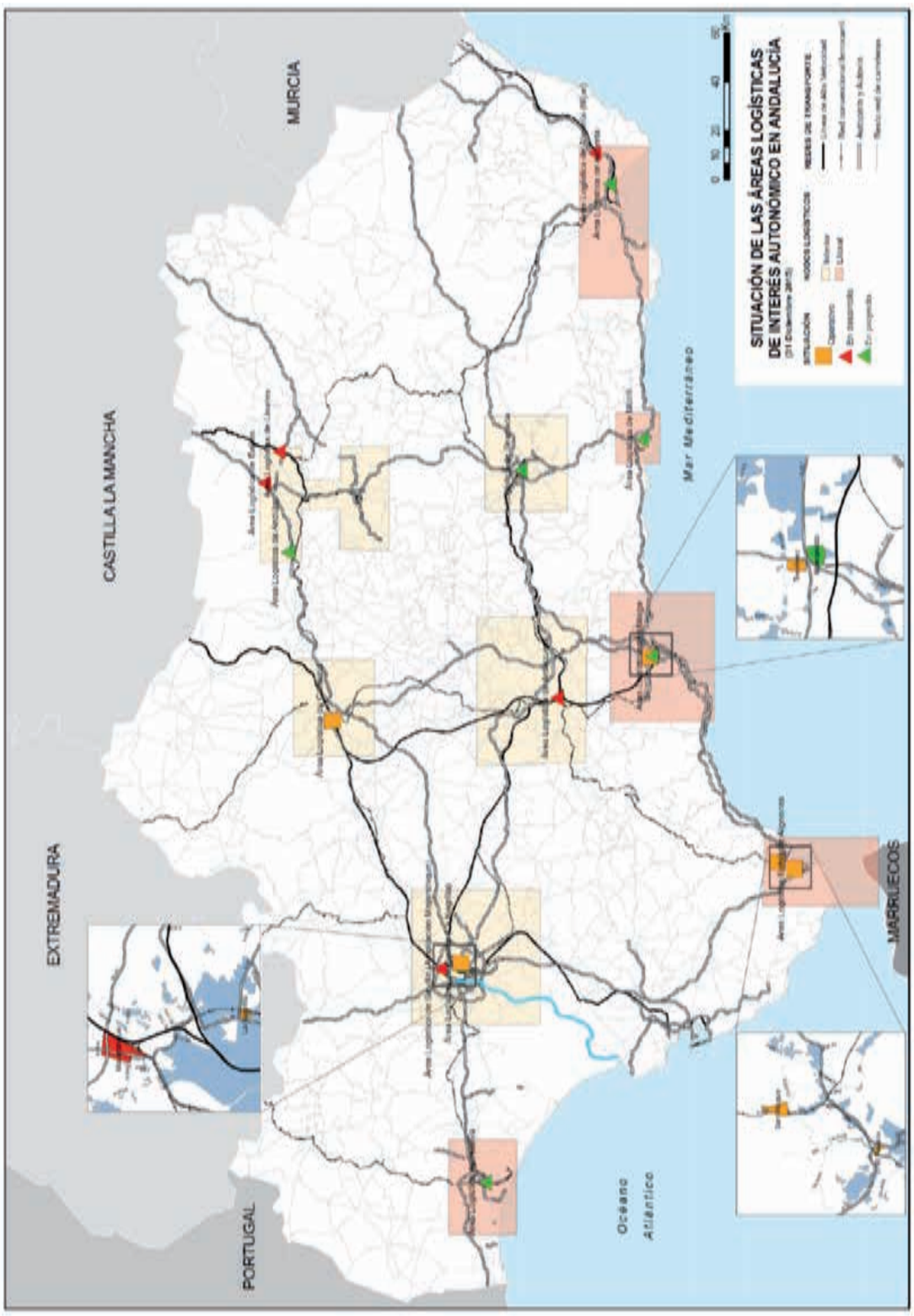

Figure 4. Surfaces of the logistic areas of the Logistic Andalusian Network. Source: CFV (2016)

3. Present rail deveolpment and future scenarios

The current rail development in Spain is guided by the infrastructure politics established in the last national infrastructure plans. They will set out the future scenarios of the rail system. The actions to transform this system in the central element to articulate the intermodal transport services, for both passenger and freight were determined as a priority (Ministerio de Fomento, 2005).

The present national infrastructure plan, the Housing and Transport Infrastructure Plan (PITVI) 2012-2024, establishes a long term complete objective network, as a planning final image for the national HSR network. Figure 5 (Ministerio de Fomento, 2015). It constitutes an extraordinary and non-realistic picture of a complete set of HSR lines all over the country. In Andalusia these lines were also previously considered in the regional territorial plan (COPT, 2006) (Figure 6) and later appeared as high-performance rail lines –as they will have less speed than the first HSR developed- and studied corridors in the regional infrastructure plan and its last revision (CFV, 2016). These include the eastern lost connection of the transversal rail axis from Granada to Lorca (Murcia), and the difficult connections from Granada to the coast (the city-port of Motril), and the coastal rail line connecting from Almeria to Malaga and Algeciras.Therefore the revised regional infrastructure plan (PISTA 2020) include all these proposed actions of the national plan as studied corridors: Almeria - Malaga-Algeciras; Madrid – Jaen; Cordoba – Jaen; Granada – Motril; Granada – Lorca (CFV, 2016), and they could be considered for a more distant scenario.

Figure 5. Spanish High Speed Rail Network expected in the Transport Infrastructure Plan.

Source: Ministerio de Fomento (2015)

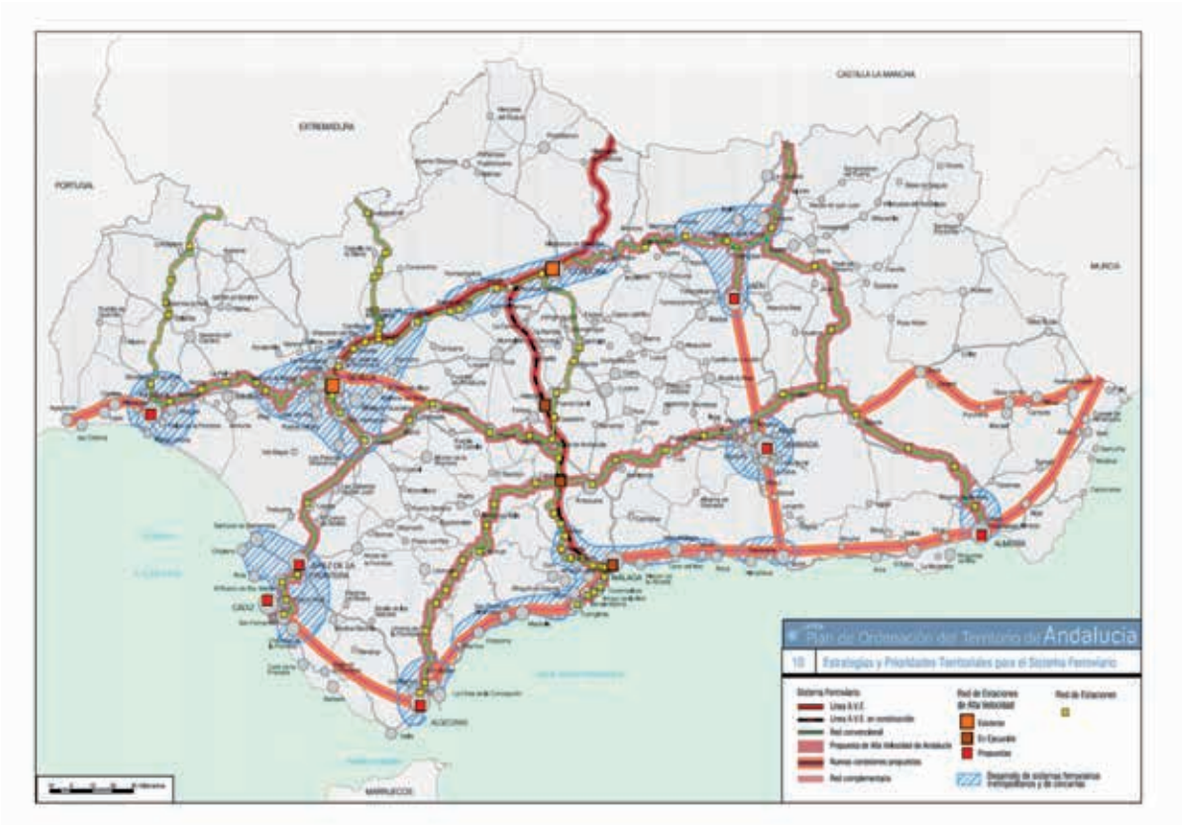

Figure 6. High Speed Rail lines proposed in the Regional Territorial Plan of Andalusia.

Source: COPT (2006)

However this ambitious scenario is going to be framed by the Trans-European Network Transport (TEN-T), established in the nineties but deeply revised and last defined in 2013. In this area the network is constituted by the European Mediterranean Corridor in its two lines: one inland, Algeciras – Bobadilla –Madrid – Zaragoza – Tarragona, and another with two sections, first inland Sevilla – Bobadilla – Almeria, then coastal to Murcia and Tarragona – Barcelona to connect with the French border at Portbou (Ministerio de Fomento, 2015). The natural course of the second line of the Corridor should have been all littoral from Almeria to Algeciras, according to the proposed connections of the national and regional infrastructure plans. However the topographical difficulties of the Andalusian Mediterranean coast imposed the longer inland route (more than 200Km) of the Corridor. See Figure 1.

The actions planned for this transport corridor are going to set a more realistic first scenario, thus these actions should be in service, according to the European directive, by 2030 (CFV,2016), however the current projects and works, which are financed by European funds, should be finished by the end of 2023, matching the final year scenario of the contemporary national infrastructure plan (2024). Thus the actions of the European Mediterranean Corridor will help to define the considered intermediate scenario (2030), and the rest of the lines studied and proposed at the national infrastructure plan could be considered for a distant scenario (2050).

The Mediterranean Corridor has a high strategic importance for Andalusia, because it connects the region with the more economically dynamic areas of the country and with the rest of Europe, where great transport demands for both passenger and freight are produced. Thanks to this the whole rail infrastructure from the French border to Almeria is being improved and from

there to Algeciras in an inland route through Granada and Bobadilla, which passes by the city of Loja (20,600 Hab.), with a high travel time reduction and a complete functional segregation of passenger and freight traffic. The final image of this transport corridor integrated with the European network will include a basic and competitive freight rail line which guaranties the continuity and capacity needed, connecting ports and logistics platforms, allowing the circulation of 750 m length trains and making freight independent from passengers. It also considers for passengers a continuous high-performances rail line all through the corridor connecting the main cities (INECO, 2011). Figure 7. The actions that are currently being developed for the Mediterranean Corridor are a new direct connection Seville - Malaga / Granada via Almodovar and La Marota, the new line for mixed services between Antequera and Granada, a new line for mixed services between Murcia and Almeria, and the renovation and improvements of the conventional lines between Algeciras and Bobadilla, and between Almeria and Granada, with the change of all platforms and its complete electrification in international gauge and for mixed services (Ministerio de Fomento).

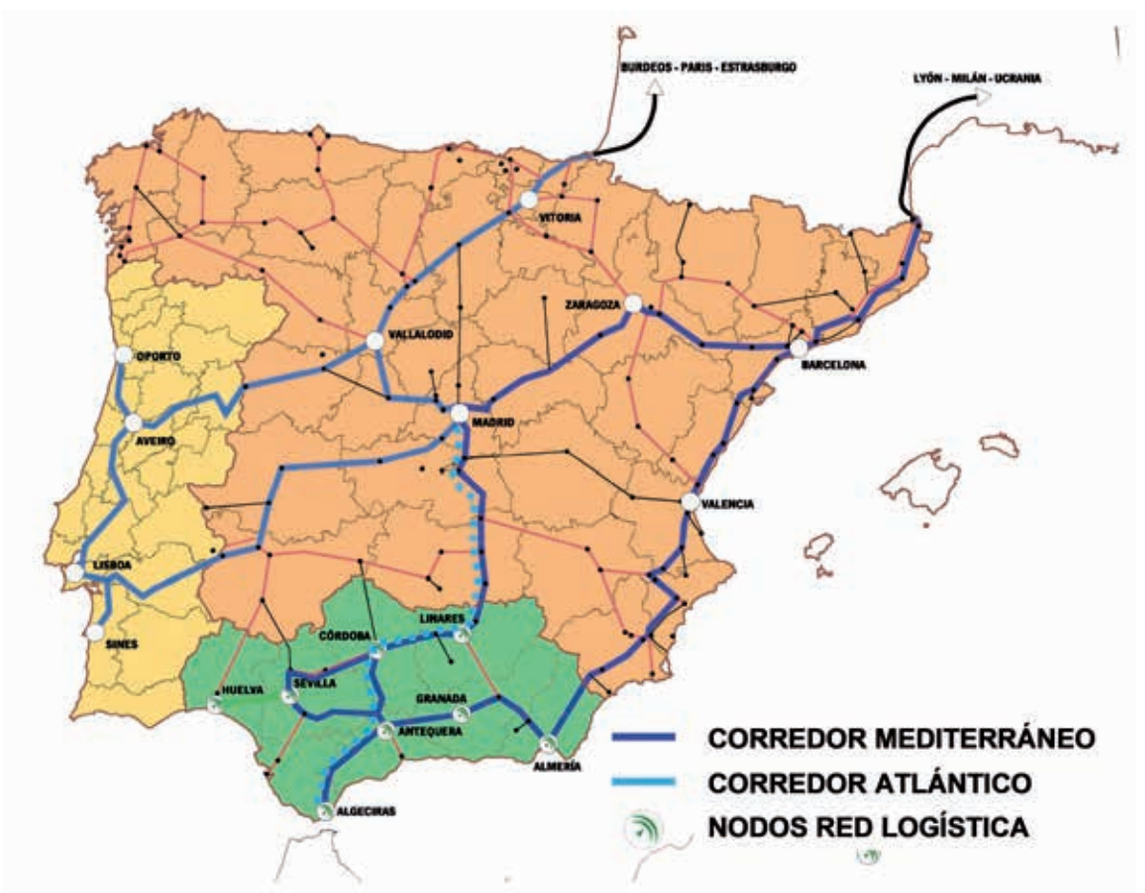

Figure 7. The Mediterranean Corridor and logistic nodes of Andalusia. Source: CFV (2016)

The expected situation of the rail network of Eastern Andalusia for the intermediate scenario around 2030 is shown in the next table 5:

Table 5. Rail network situation of Eastern Andalusia around 2030 (HSR lines in bold):

LINE		LENGH (Km)		TRACK (*)	GAUGE (**)	ELECTRIFIED	MAX. SPEED (Km/h)	SERVICES
Algeciras – Bobadilla	Algeciras-Ronda	160	50	S/D	Int. & Iberian	Yes	160	Mixed Pass. & freight
	Ronda-Almargen		40				220	
	Almargen-Bobadilla		70				350	
Almeria - Murcia		199		Double	International	Yes	300	Mixed Pass. & freight
Almeria – Moreda – (towards Granada or Madrid)		124		S/D	International	Yes	300	Mixed Pass. & freight
Antequera – Malaga		55		Double	International	Yes	350	Passenger
Antequera – Granada		125		S/D	International	Yes	300	Mixed Pass. & freight
Bobadilla – Antequera - Granada		131		S/D	International	Yes	300	Mixed Pass. & freight
Bobadilla – Malaga		80		Single	Iberian	Yes	160 (limited)	Mixed Pass. & freight
Cordoba – Antequera		100		Double	International	Yes	350	Passenger
Cordoba – Jaen		135		Single	International	Yes	300	Mixed Pass. & freight
Granada – Moreda		57		Single	International	Yes	300	Mixed Pass. & freight
Guadix – Lorca (towards Murcia)		In Project/Construction?						
Jaen - Linares-Baeza - (towards Madrid)		61		Single	International	Yes	300	Mixed Pass. & freight
Linares-Baeza - Moreda – (towards Almería)		126		Single	Iberian	Non	140 (limited)	Mixed Pass. & freight

Source: ADIF

(*) S/D: There will be sections with single and others with double track

(**) There will be sections with both Iberian and international gauge but the intention is to adopt international gauge finally.

According to the actions mentioned the expected travel times between the main cities where stations are probable have been estimated:

Table 6. Estimated rail travel times between main Andalusian cities in the intermediate scenario around 2030 (hours:minutes):

	Algeciras	Almeria	Antequera	Cordoba	Granada	Guadix	Jaen	Linares	Loja	Malaga	Madrid	Murcia	Ronda	Seville
Algeciras	-	3:13	1:40	2:08	2:18	2:43	2:48	3:02	2:03	1:57	3:40	4:12	1:08	2:21
Almeria		-	1:32	1:57	0:55	0:30	2:11	1:52	1:10	1:46	3:27	1:00	2:09	2:17
Antequera			-	0:30	0:35	1:00	1:10	1:29	0:20	0:17	2:12	2:31	0:37	0:47
Cordoba				-	1:03	1:27	0:40	0:59	0:50	0:47	1:42	2:57	1:07	0:40
Granada					-	0:25	1:51	1:33	0:15	0:52	2:47	1:55	1:12	1:23
Guadix						-	1:41	1:23	0:40	1:16	3:05	1:30	1:37	1:47
Jaén							-	0:18	2:06	1:27	1:53	3:11	1:47	1:20
Linares								-	1:48	2:25	1:35	2:52	2:06	1:33
Loja									-	0:35	2:32	2:09	0:57	1:08
Malaga										-	2:20	2:46	0:53	1:04
Madrid											-	2:40	2:50	2:15
Murcia												-	3:08	3:17
Ronda													-	1:16
Seville														-

Source: Authors. Times have been estimated theoretically from the expected medium speeds. The real service times will be defined by the operators.

Times theoretically estimated are slightly less than current rail service travel times but future improvements in the existing rail lines and more efficiency in the services and their connections have been considered. The weakness of the eastern connections of Jaen can also be observed due to the limitations of the Linares-Baeza - Moreda rail line if it is not renovated. There probably won't be direct rail services between Granada and Jaen if this line is not improved, as the travel time is double than that by road, and paradoxically Jaen's airport is the same as Granada's.

As has been indicated, another more distant scenario could be considered regarding the projections of the national infrastructure plan which foresee a complete number of connections. For this remote scenario around 2050 could be estimated as the completion of the rest of connections: The littoral rail line Almería-Motril-Málaga-Algeciras, and the inner connections Granada – Motril and Guadix-Lorca, which will reduce these travel times to Murcia. The improvement of the line between Linares and Moreda should also be considered.

4. Territorial implications linked to the future High-Performance Rail Lines in Eastern Andalusia.

4.1 Territorial effects associated to the passenger flows.

With respect to the passenger flows, thanks to the Mediterranean Corridor an extraordinary increase of passenger transport demand from Almeria towards Catalonia is foreseen (they could be multiplied by 20) and even more from Murcia and the Valencian Community (which could be multiplied by more than 300), while the global passenger transport demand in the rest of the Corridor, including our study area, would be multiplied by 2.5 (INECO, 2011). Nevertheless it is probable to consider greater increments in the future scenario.

As they have been widely studied in many cases, the main effects associated to the future high-performance rail lines in Eastern Andalusia are linked to the great travel time reductions which are gained, but focused around the stations giving a polarized development model.

In the present case these effects will be associated not only with the significant travel time reductions but also to the emergence of new direct relations between the main close cities which now are not connected.

With respect to the widespread diversity and dimensions of the territorial effects that need to be covered, in this paper they will be focused on the spatial implications of the inter-urban relations at sub-regional scale.

According to other national and foreigner experiences, deeply studied by Prof. J.M. Ureña and his research group, the spatial implications of the new HSR lines can be summarized "in three different processes: changes in functional integration of HSR cities, spatial and urban hierarchy reorganization, and city restructuring" (Ureña et al., 2012, p. 132). Thus the new HSR services will allow the appearance or consolidation of commuting inter-urban relations in one hour, and business, often day return, travel in 2 to 3.5 hours´ travel time, as has been recognized (Ureña et al., 2012, pp. 133-134).

In synthesis, as stated by Ureña et al. (2012, p. 140), the inter-urban territorial implications of the new HSR lines are: "Increased metropolitan processes at half and hour's and one hour's HSR travel time; re-articulation of medium-sized cities to the system of metropolises; new isolated transportation poles; and collaboration between small, distant cities". The first one comprises two processes: "discontinuous metropolitan expansion at one hour's HSR travel time", and "metropolitan reinforcement at half an hour's HSR travel time". In addition "there is evidence that discontinuous metropolitan expansion is happening in small cities with an HSR station

within one hour's HSR travel time (200 Km) from the centre of metropolises" (Ureña et al., 2012, pp. 141-161).

In connection with the above mentioned similar processes can be anticipated in this case according to the foreseen changes in accessibility, as following:

- The future rail direct connections between all the Andalusian main cities, and the expected competitive services, will enable the high mobility that characterized the named current world "metapolis" (Asher, 2005).
- The fact of the balanced urban system formed by the provincial capitals of Eastern Andalusia and their equivalent functional level, and given the historical loss of the centrality of Granada with respect to the coastal capitals, this will predictably give an equilibrated relationship between them which will imply around an hour or an hour and a half rail travel time. However the increase of the flows for specific functions and services offered in each one of them is expected. Thus the greater attractiveness of the metropolitan capital of the sunny coast and its socio-economic and cultural attractions will become more important.
- In this sense an equilibrated relationship between them, and cooperation policies to reinforce the present polycentric urban system, would be desirable, and consolidating the regional metropolitan structures into a complex urban network, as other cases in the world (Boix, 2003; Marull et al., 2015). Thus the conformation of the Southern European's Polycentric Metropolis can be predicted, as other mega-city regions in Europe (Hall and Pain, 2009).
- − This reinforcement of the adequate polycentric urban system existing according o the European and Regional spatial strategy and Plan (EC, 1999; COPT, 2006) also helps to balance the regional spatial development patterns in the national context (Ureña, 2012).
- As has also been identified in other cases, decentralization opportunities will also appear in this area, especially in the case of Antequera. The new east-west rail link will reinforce the existing north-south axis between Cordoba and Malaga and the recovery of its central regional geographical situation. It would be a great political opportunity for the regional equilibrium against the prominence of the regional capital.
- The relationship with the regional capital, currently poorly served by public transport (as, for example, nowadays there is no service to Seville from Granada arriving before 11:30am, and there is a limited air service from Almeria), will obviously be reinforced as the new rail travel times will be very competitive as seen in Table 6. However, given the mentioned equilibrium existing between cities a limited solely metropolitan integration with Seville can be expected as the considered conformation of the Southern European's Polycentric Metropolis.
- The competition between air and future rail services in the direct relationship between Almeria and Seville -currently with more than 23,000 passengers per year by plane (CFV, 2016)- will be limited as the future train services duration will be more than double that of current air services (55 min), but if total air travel time is considered including airport displacements and waiting times, the rail services can be competitive as they will be relatively similar.
- Due to the political-administrative dependency, the natural tendency is to reinforce the relationships between the medium cities with their provincial capital, as is seen between Puente Genil and Cordoba (Ureña et al., 2012), or will probably be in the case of Antequera and Ronda with Malaga, and Linares with Jaen. However currently there is a lack of metropolitan integration of Antequera with Malaga by rail because of the 20 Km distant existing station that will be solved by its renewed station close to its city centre for the new rail line towards Granada. In the case of Ronda the new rail travel time to Malaga of less than an hour will increase their reciprocal relationships.

- The exception could be the case of Algeciras in the province of Cadiz, only linked to the provincial capital by road and a recently built highway, where the improved rail link will reinforce its relations in the contrary direction towards Eastern Andalusia. A certain integration between Guadix and Almeria -just half an hour distant- is also possible, but this city remains a little closer to its provincial capital.
- In the province of Granada, given the reduced travel time between the capital and the cities of Loja and Guadix, the reinforcement of metropolitan relationships between them, and the incorporation of these two populations of a circle of medium cities around the provincial capital (Cabrera, 2010), to the present metropolitan area of Granada will be clear.
- The relation with the national capital will be highly increased for business, and there will be numerous, often day return, journeys, as all the Andalusian capitals will be situated from 2 to 3.5 hours' rail travel time to Madrid.

For the remote scenario the new connections will probably give rail access to the littoral relevant populations of Almeria, Granada and Malaga provinces such as El Ejido, Motril, or Velez Malaga-Torredelmar, and inner populations of Granada province such as Baza. Some of these will be firstly connected to the rail network in the case of the coastal cities –except Velez-Malaga which was connected to Malaga-, and will recover the lost connection in the eastern link in the case of Baza. Naturally the coastal capitals of Almeria and Malaga would reduce the rail travel time between them.

With respect the stations' location, as Ureña et al. (2012, p. 137) recognizes, "central locations in small cities help their competitiveness", and the intermodal connection with the public transport system will also be very relevant. In the study area the stations of the capital cities are adequately central, and they are well connected to the urban and metropolitan public transport systems. The current arrangements of the HSR lines are also linked to the developments in the stations of the area, with actions of enlargement, renovation and urban integration in the stations of Algeciras, Almeria, Granada and Jaen (Ministerio de Fomento, 2015). These physical transformations will generate changes in the mobility patterns and land uses and will have impact on economic and social structures and dynamics, which will produce other physical transformations caused by the new patterns and increased mobility, as has been studied in other cases (Bellet at al., 2012). As can be expected, these improvements in the stations will also encourage the passenger increase in future rail services.

4.2 Increase of freight traffic and the logistic potential

The end of the proposed and projected actions to complete all the rail lines of the Mediterranean Corridor, which should be in service by 2030, will give a continuous and competitive way of a more sustainable transport. In addition there is a great coincidence of the lines of this corridor with the location of all the logistic areas of the Logistic Andalusian Network and their expected surfaces, which also should be completed and in service by the same horizon. All of these will possibly provide a complete integration of the regional rail and logistic network with the national and European transport networks. The rail freight, which is competitive for distances longer 500 Km, will reduce the peripheral character of this area and will connect it with central Europe.

These existing and future logistic areas will improve the port-rail and road-rail inter-modality for an easy change of transport mode and will increase the integration of different transport modes.

Naturally these improvements in the rail and logistic transport system will produce relevant increase of freight transport demands, mainly in the relationships with origin/destination of this southern area. According to the strategic plan for the freight rail transport impulse it is

expected to multiply by more than twice the current low participation quota of the railway freight transport. However the mixed use of the railway lines for both passenger and freight will have reduced maintenance costs but serious management problems (INECO, 2011). According to the last national infrastructure plan the foreseen evolution of transport demand shows an average increase of 1.5% annually for freight transport until 2024 (Ministerio de Fomento, 2015).

Finally thanks to the development of all the proposed intermodal areas and the improvement of the rail lines, reducing freight times and increasing competitiveness the increase of the global logistic potential of all this area can also be considered.

5. Conclusions and Proposals

Among the above mentioned territorial effects the foreseen future formation of the Southern European Polycentric Metropolis in Andalusia can be underlined, and the reinforcement of their existing adequate polycentric urban system. Also the gain of regional territorial centrality of Antequera, with its new station located at the edge of the city centre, which will give new opportunities of political-administrative facilities decentralization, and its metropolitan integration with Malaga is to be highlighted.

The new metropolitan relationships among medium cities and their provincial capitals should be emphasized, and the expected intensification of the relationships with the regional and national capitals for administrative and business purposes.

The Mediterranean Corridor will offer a continuous and competitive way of a more sustainable transport and will enable a complete integration of the regional rail and logistic network with the national and European transport networks.

As the corridors and crossroads are topographically clearly defined, the location of the proposed logistic areas of the Logistic Andalusian Network are linked to the main transport axes and consumer/production nodes. However there is a lack of a logistic area that is clearly needed in the crossroads of the A-92 North and South within the rail line near Guadix linked to the provincial road network, as has been previously recognized (Grindlay, 2014). This area offers a space of real logistic opportunity.

The need for the connection of the two lines of the Mediterranean Corridor, not only between Antequera and Cordoba but also between Moreda and Linares-Baeza, is also proposed. Moreover, the improvement of this line is demanded from the Jaen province to reinforce the logistical role of the dry port of Linares and the connection of the Almeria area with the centre of the peninsula (CESPJ, 2017).

The minimization of the tunnel effect will come with an adequate connection of future rail proximity services with a complete territorial public transport system for a suitable intermodal coordination with a great multimodality as proposed in the European spatial strategy.

The future new developments to be proposed around the new railroads should stimulate the local potentials and should focus on its multiscale and it multidimensional reality, compatible with a multifunctional use.

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