

LOCATION OF HIGH SPEED RAIL STATIONS IN FRENCH MEDIUM-SIZE CITY AND THEIR MOBILITY AND TERRITORIAL IMPLICATIONS

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Abstract : In France, the extension of High Speed Rail network has come with the creation of new stations and a diversification of territorial configurations in which the stations fit. If the reduction in travel time allowed by high speed train increases mobility and contributes to the economic development of metropolitan areas, the implications of these stations on local mobility and territorial development depend on the station's location. The example of mid-sized cities allows us to analyze the part played by the location of stations in spatial organization. The impact of HST on local mobility and territorial development differed depending on whether the metropolitan area is served by a central station, a peripheral one or if it is connected to the high speed rail network by both stations.

Keywords : High speed train station, mid-sized cities, local mobility, territorial development, sustainable development.

Currently, the French High Speed Rail network stretches over 1875 km of new lines and recent government commitments to sustainable development are going to speed up network extension. In the wake of the "Grenelle of the Environment" national roundtable on environmental policies, the French Government has decided on the construction of 2000 kilometres of new rail lines by 2020, and 2500 kilometres more before 2050. This new impulse for the extension of the high-speed rail network meets the challenges of sustainable development. The reduction in travel time allowed by high speed train increases mobility and contributes to the economic development of metropolitan areas. High Speed Train can also be a substitute to inter metropolitan air and road passenger transport, and thus, it contributes to the reduction of pollution, greenhouse gases emissions and traffic congestion.

At the metropolitan area level, the development of a high speed rail network also brings changes to spatial organization. Indeed, network expansion involves a refitting of conventional stations and the creation of new stations in

city centres or in more or less distant suburbs. Therefore, we chose to focus on these different locations of stations in order to analyze their implications on local mobility and territorial development. Are these choices of location consistent with the sustainability issues underlying the network's expansion ?

1 - The diversity of station's locations

First, it's necessary to specify that the diversity of HSR stations locations arises from characteristics of the French High Speed Rail system. The exploitation of High Speed Rail network is based on two principles :

- the exclusive use of new track by high speed passenger trains
- the compatibility of new lines with conventional network, which allows a ramified servicing of the territory.

Thanks to specialization, high speed trains can travel at 300 km an hour on new lines totally independent of the conventional network. Responding to a logic of effectiveness, the de-territorialisation of infrastructures from spaces they run across allows direct and fast connections to major cities. Often compared to a "planes on rail" (Auphan, 2002), high-speed trains enhance the accessibility of central stations with a greater potential for passenger traffic at the expense of intermediate areas whose cities have been excluded from the new HSR network. Most small and medium cities are thus connected to the high speed rail network through the conventional lines or through new peripheral stations built specifically on high speed lines. These new stations, built more or less in urban periphery, offer several advantages over central stations : they reduce travel time, they broaden the catchment area of the station to a larger region and they are freed from technical and financial impediments associated with urban density (Facchinetti-Mannone, 1999).

The extension of HSR Network has come with a diversification of territorial configurations in which the stations fit (**Fig. 1**). Several types of configurations can be identified according to :

- the size of served cities and their situation within the railway network
- the station's location within the urban area
- and the characteristics of their railroad service

In most cases, compatibility with conventional network allows HST to serve city centres through the original, historical stations. These have been more or less refitted in order to accommodate railway traffic growth. When conventional stations did not offer sufficient surfaces for receiving HST, new stations were built downtown. For instance, in Lyons or Lille, the European and interregional connections which pass through the town serve the new central

station, while most of the regional lines and high speed train to Paris stop at conventional stations. However, high costs and difficulty with urban insertion mandates that building a new central station is reserved for largest cities. In this way, most of the new HST stations have been set up on the outskirts of cities.

Fig.1. HSR stations : stations inserted into various territorial configurations



These peripheral stations form part of several contexts according to the size of cities near which they are built and to what degree they complement the train services of conventional stations (Facchinetti-Mannone, Richer, 2008) :

- In the case of small and average cities which are located on a secondary line of the national network, the setting up of new peripheral stations has deeply altered the hierarchy of access points to the network. HST stations indeed replaced the historical station for nationwide travel, and the central station is no more than a local and regional node. Both stations constitute two juxtaposed nodes which polarize catchment areas of different scales.

- In medium-sized cities situated on a major line, the implantation of a new HST station involves a duplication of railway service. In some urban areas (Valence, Avignon), this splitting took place for the benefit of the new peripheral station. It gathers most of the high speed train connections, whereas

the conventional station keeps on hosting regional trains, national connexions and a few HS trains using conventional track at lower speed. In other cities, a balanced division of traffic took place between both stations : the central station preserves its function of regional and national service and hosts more specially HST which join Paris, while peripheral stations are served by HST providing interregional connexions.

- Finally, in the case of HST stations built on high speed lines bypassing the largest cities, a peripheral station is only a complementary pole; the central station remains the main node towards which most regional and national services converge.

Research on the territorial impact of HSR has shown that these effects differed according to various factors : the size of cities (which determines the frequency of service), the station's location within the metropolitan area (Facchinetti-Mannone, Bavoux, 2008) and strategies carried by political and economic actors to take advantage of reduced travel times (Ollivro, 1999 ; Troin, 1997). In order to clarify the part played by the location of stations in spatial organization, we have chosen to compare various rail configurations, using the example of mid-sized cities characterized by different choices of locations. Selected cities spread their influence on urban areas with population ranging from 100 000 to 300 000 inhabitants. Their decisional functions are limited because they are subjected to the polarization of major cities in the shade of which they are growing, polarization that high speed train accentuates.

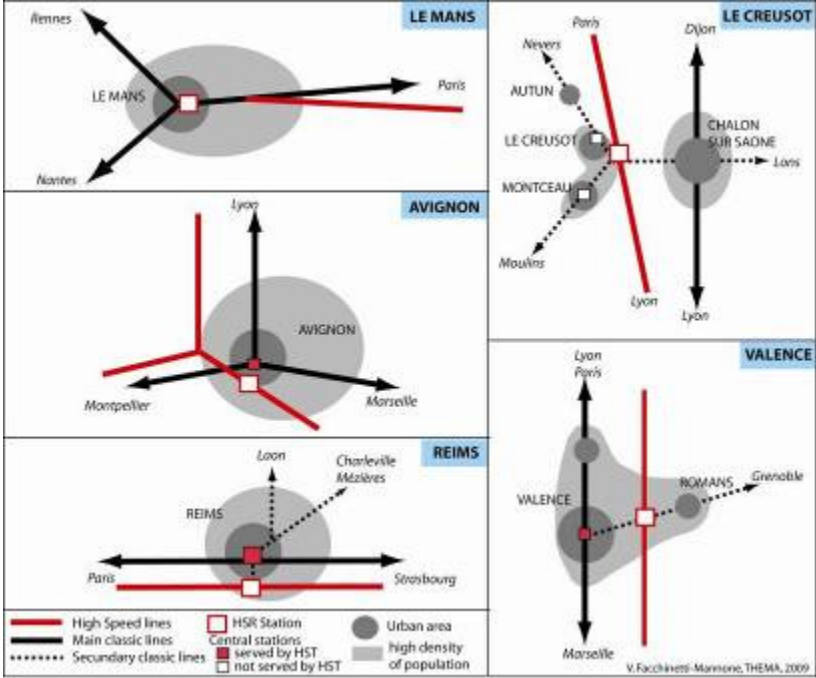
Le Mans has been served by The Atlantic TGV since 1989 through a new central station built on the same site as the conventional station (**Fig. 2**). This implantation resulted from a strong mobilization of local authorities against SNCF plans to build a peripheral station on a new line by-passing the city by the north to reach more directly Rennes and Nantes (Bellanger, 1991). Finally, the high speed line from Paris was connected to the conventional network east of the city, allowing HST to serve the central station. However, as the original railway station located on the north side of the railway tracks did not have sufficient capacity to handle the expected traffic growth, available land on the site of former industrial and railway facilities on the South side was used to build a new station. The new rail terminal is linked with the northern station by an underpass which reduces the barrier effect due to the railroad.

In Burgundy, the HST station "Le Creusot", built on the Paris-Lyon high speed line in 1981, is located in open countryside, 7 km from Le Creusot and 16 km from Montceau les Mines. Its creation also resulted from a pugnacious mobilization of the local authorities, who in order to develop their territory,

sided against SNCF who had planned only a technical halt (Facchinetti-Mannone, 2006). The new station is located in the centre of gravity between the urban axis “Autun - Montceau les Mines” in the west and Chalon-sur-Saône 30 km to the east (**Fig. 2**). Proximity to national road 80 offers easy road accessibility to the station but the HST station is not connected to the older central stations which have become small regional stations.

The other three cities studied are connected to the high speed rail network by both stations (**Fig. 2**). Established in 2001 on the Mediterranean HSR, the peripheral stations of Avignon and Valence have become the main access gates to the urban areas they serve (Facchinetti-Mannone, 2002). These stations benefit from high frequency services to various destinations, whereas central stations are served by a few HST to Paris, as well as regional connections. These two new stations are in different situations. In Avignon, the new station was built at 4 km from the centre, at the southern edge of the built-up area. In the case of Valence, the peripheral station, located at the intersection between the high speed line and a conventional track connecting Valence to Grenoble, is in a suburban situation, 10 km to the northeast of the city. Finally, since 2007, Reims has benefited from a new peripheral station built on the East HSR, close to town. In this case however, the central station, point of origin and destination of high speed train towards Paris, has remained the major station of the metropolitan area. This new station is served by interregional trains which are complemented by a few HST between Paris and Strasbourg.

Fig.2. The location of HST stations in mid-sized cities



The diversity of the cases analyzed allows us to estimate the influence of station's locations on local mobility and territorial development.

2 – The implication of the location of high speed stations on local mobility

If at the national level, high speed rail promotes a modal shift of traffic to railway, its impact on local mobility depends above all on the integration of stations into local and regional transport networks. Now, this quality of integration largely depends on station location (Facchinetti-Mannone, Richer, 2008).

In fact, central stations benefit from better integration to urban and interurban transport networks. The choice to serve the conventional station facilitates connections between high speed network and regional rail services, without important modifications except for schedule adjustments. The historic station is usually the focal point for intercity bus connections and a major hub of the urban transportation system. Its inclusion in a densely built district certainly hinders access by car, because of the congestion of the urban street system, but it allows access by walking or cycling. Thus, the choice to serve a central station encourages intermodality and sustainable mobility (Keller, 2009), when at the same time the arrival of high speed trains in most cases comes along with a total restructuration of the rail station neighbourhoods in order to improve its accessibility.

In Le Mans, for instance, the implantation of the Atlantic high speed line was accompanied with an expansion of parking capacities and an upgrading of urban streets in order to rebalance car flows between the southern and northern stations. The station is also served by five bus lines (three in the north and two in the south) and has been integrated, since 2007, into the new tramway network which serves the city. The start of tramway service in the city has been an opportunity to transform the station into a multimodal interchange hub (Communauté Urbaine Le Mans Métropole, 2007) (**Fig. 3**). The northern station was enlarged and renewed, new underground parking facilities were created and bicycle racks installed on each side of the station. The bus terminal, formerly located near the city centre, was moved to the rail station site, and the station place was entirely reshaped into a pedestrian square. In front of the station, a new glass roof was erected above the area used as a link between all modes of public transports serving the station. The project, which has just been completed, changes the station into a focal point for all transportation modes, and allows connections at all mobility levels.

Fig. 3 : The new multimodal interchange hub in Le Mans



On the other hand, peripheral stations suffer from an inferior integration to the public networks of the urban areas they serve. They are not generally connected to the railway tracks which served the towns, although, as in Le Creusot, this connection was technically possible. Mostly located outside of the urban transport perimeter, these stations are not served by the bus network. Connections by shuttles have been organized to mitigate their remoteness, but these passenger services stay under used because they impose a supplementary transshipment. Finally, their location away from an urban core excludes access by walking or cycling.

The case of Le Creusot is representative of the difficulties to put in service an efficient collective transport towards these ex-urban stations. HST station is served by specific shuttles towards Le Creusot and Montceau les Mines and interurban bus lines to Chalon-sur-Saône, Autun and Roanne. This supply, largely exceeding demand, had suffered important fluctuations over time. For instance, the connection toward Chalon, put into service at the opening of the station, was cancelled from 1983 to 2008. Low patronage of these shuttles led to the implementation of mixed service systems, which associate local service transports with connections to the station. It has proven difficult to justify both services across sparsely populated territories. At the Urban Community level, the establishment of shuttles connecting directly the station to the city centre is realized at the expense of a widespread territory served by the HST station ; in reverse, the increase of in the number of bus stops has lengthened the time needed to reach the station.

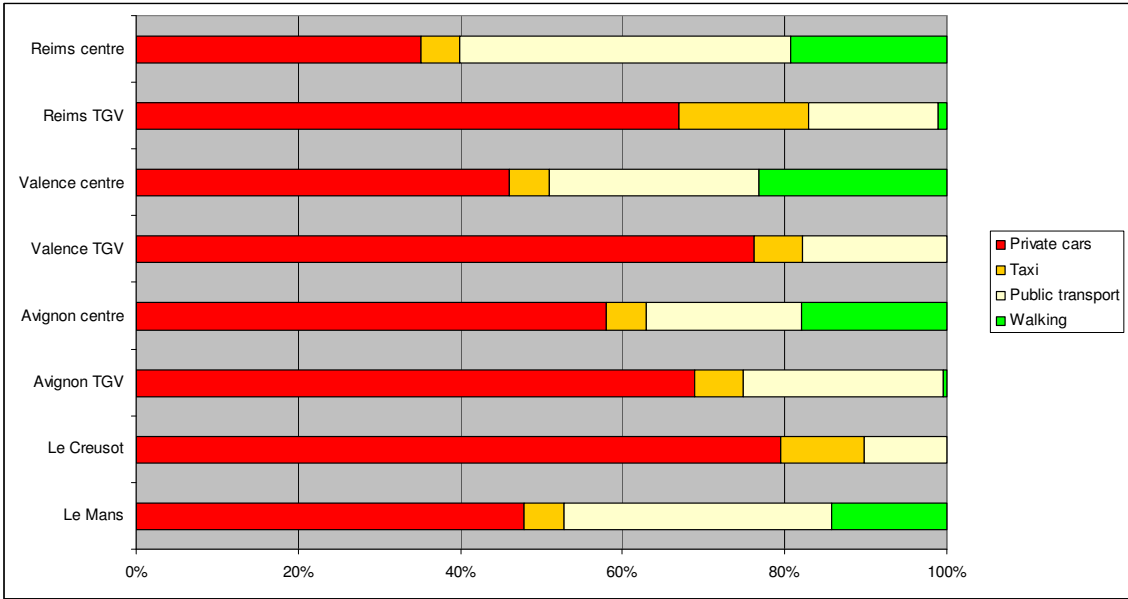
In the case of a duplication of high speed train services, the question of the relations between both stations takes a particular importance. The performance of this relationship determines not only the conditions for an efficient intermodality, but also the more or less successful territorial integration of the peripheral station (Facchinetti-Mannone, 2002). Avignon high speed station, built in close outskirts, is not linked to a classic network which serves the central station. A project of railway connection exists, but it has been delayed on several occasions because the various actors are unable to come to an agreement on the project financing. A shuttle bus connects directly HST new station to the city centre with an intermodal offer based on fare and schedule integration. However, several weaknesses must be pointed out. The exploitation of these shuttles is dependent on general road traffic, and this situation involves delays or connections disruptions in the rush hours. Moreover, the central stopping point of these shuttle services is a few hundred metres distant from of coach and railway central stations. This situation imposes to the travellers transferring between the two stations a supplementary transshipment, and finally public transport is neglected for the benefit of private car.

In Valence as in Reims, both stations are connected through a rail link, but the supply of transfer service can be considered as uneven. In Valence, the new high speed train station is located at the intersection of the high speed line with the conventional line linking Valence to Grenoble, and regional trains connect both stations. However, there is no systematic schedule integration between HST and regional trains because regional services are firstly organized to meet the needs for commuting travel. So, nearly half of the high speed trains which serve peripheral station do not benefit from any efficient connection. To compensate insufficient service of regional trains and a location outside urban transport perimeters, departmental local authorities have set up an abundant supply of intercity buses. Served daily by 74 bus connections, the new station has a full interurban road service. In Reims, a specific rail link was built to connect the new station to the conventional network and high speed trains benefit from connections to the central station or other regional stations. The proximity of city has also allowed to insert the station into the urban transport network. The bus line serving the southern districts has been extended up to the station, where tramway service will start in 2011.

A comparative analysis of travel modes used by long-distance travellers to access the station allows us to estimate more accurately the efficiency of modal transfer and to assess the effects of station location on local mobility (**Fig 4**). Central stations are characterized by a good balance between different access modes, whereas private cars prevail to reach peripheral stations. The

overwhelming share of car usage results from the convergence of several factors: located close to major roads, these peripheral stations enjoy easy road accessibility ; they dispose of large parking lots (in the case of Le Creusot parking is even free), and their public transportation supply is less developed than in central stations. Access by taxi is also more important because of this lowest integration to public transport networks and of the larger share of business customers. On the other hand, walking access is marginal because of the remote location of these stations.

Fig. 4 : Repartition of travel modes used by long-distance travellers to reach the stations



Now, if we compare access modes to the peripheral stations, we are not surprised to see that modal distribution reflects the quality of station integration into the public transport networks. The more complete the public transport supply of the station is, the more this supply is used to reach the station. The distance to the centre also seems to have an influence on the proportion of public transport users. This seems especially relevant for stations located close to central cities. Finally, observed differences between peripheral stations are due to population distribution. The share of public transport is higher in urban areas which, such as Reims, are characterized by a strong concentration of population, that in others cities where population is much more dispersed.

Thus, at the local level, peripheral stations have a role in the increase in road traffic ; directly because their location involves trips by private car ; but also indirectly because the rail traffic split between both stations induces more transfers and therefore reduces the number of travellers likely to use regional

railway services. Establishment of direct rail links between both stations minimizes these opposite effects, on the condition, however, that regional transport services which assure the transshipment are efficient. This integration is especially necessary because the increasing road traffic toward the peripheral stations is source of many harmful effects and dysfunctions. Road traffic growth increases air pollution, environmental nuisances and traffic jam. Besides, parking lots established near peripheral stations are regularly saturated. In Valence as in Avignon, the surroundings of stations are flooded by cars parked illegally, and this situation imposes a capacity extension of parking lots, extensions which consumes a lot of space. Finally, if we consider the social dimension of sustainable development, peripheral locations reduce equity of access to the station because only motorized households have an easy access to high speed train network. Several conditions are necessary in order to transform new peripheral stations into vectors of sustainable mobility at the local level :

- a connection to the classic rail network in order to serve optimally central stations and whole stations of regional area
- integrations of fare, schedule and information in order to reduce waiting time and to offer transshipment public transports as efficient as private cars.

The performance of the territorial integration of the station by local and regional transport networks is also one of factors which condition the territorial development.

3 – The implication of the location of high speed stations on territorial development

The reduction of travel time increases the accessibility and attractiveness of territories. This relation between territorial development and high speed network expansion is confirmed in the case of biggest cities, but it is less systematic for mid-sized cities. In these cities, development projects which were accompanied the arrival of HST have had sometimes limited effects because of little-diversified and somewhat lethargic economic activities or because of strategies of valorisation poorly adapted to the local context. Most of the studied cities have carried out development projects in order to transform the train station into an economic hub. So we chose to confront these various projects in order to assess the influence of station location on territorial development.

Arrival of the high speed train in central stations has led to implementation of projects in order to reinforce the centrality of station districts by developing business centers. In Le Mans, for instance, the new station built south of the tracks has been integrated in a new business centre built on

industrial and railway brownfields (**Fig. 5**). “Novaxis Center”, launched as early as 1986, is developed by a planning office associating all the local authorities. The business centre, which currently groups 80 companies and employs 2500 people, has been developed in two phases (Bellanger, 1991).

Fig. 5 : The business centre “Novaxis”



The first stage was based on the establishment of local companies looking for new buildings to extend their activities. In the second phase, the quality of real estate supply and the reduced travel time towards Paris (only 55 minutes) have attracted tertiary firms from Paris to “Novaxis Center”. Its success rests on several elements : an early mobilization of local authorities through development strategies adapted to the potentialities of local economy, a diversified real estate supply of good quality and an efficient accessibility. The station area has not only asserted itself as a major tertiary pole of the city, but it constitutes also a complete urban planning operation. The business centre has been complemented by residential programs and new urban infrastructures. The operation also allowed to reduce the barrier effect due to the railroad and to reintegrate the formerly forsaken districts located South of the railroad into urban spatial dynamics. A similar operation is being realised in the neighbourhood of the central station of Reims. The area at the back of the station, characterized for a long time by abandoned industrial and rail sites, is subject to an important renewal program. The project, under development, is based on the construction of 80 000 square meters of office space, with additional residential operations and equipments. The business centre hosts about fifty companies, and the restoration of central station has allowed to install new urban dynamism into this area. So, the arrival of HST in central station is an opportunity to strengthen the centrality of station’s district and to reconnect these areas with the city from which they had become marginalized.

In the case of peripheral stations, it seems more difficult to foster the growth of new business parks in the outskirts of mid-sized cities. The case of Le Creusot is emblematic of these difficulties. In 1981, the implantation of a high speed station was considered by policy-makers and economic actors as the tool that would lift the region out of its industrial crisis by stimulating new economic activities. A first business park of 2,5 ha was planned near the new station, but it did not develop. In the early 1990s, local authorities set up a more ambitious project of a "high-tech park", covering more than fifty hectares, intended to receive tertiary activities and high technology industries. This project has experienced, however, only small success. The site, which remains largely unoccupied, accommodates today only about fifteen companies and the tertiary pole initially planned is reduced to two small "temporary" office buildings (Facchinetti-Mannone, 2006). Slowly, the industrial park has welcomed various industrial activities, but much less than the technologic ambitions initially displayed. This failure shows first that HST is not enough to create a new spatial dynamics into a region heavily marked by the industrial recession. In addition, the development strategies put in place were inadequate with the local context. Local authorities gave priority to the conversion of pre-existent industrial sites and did not want to develop the "HST pole" for fear of devitalizing their urban centre.

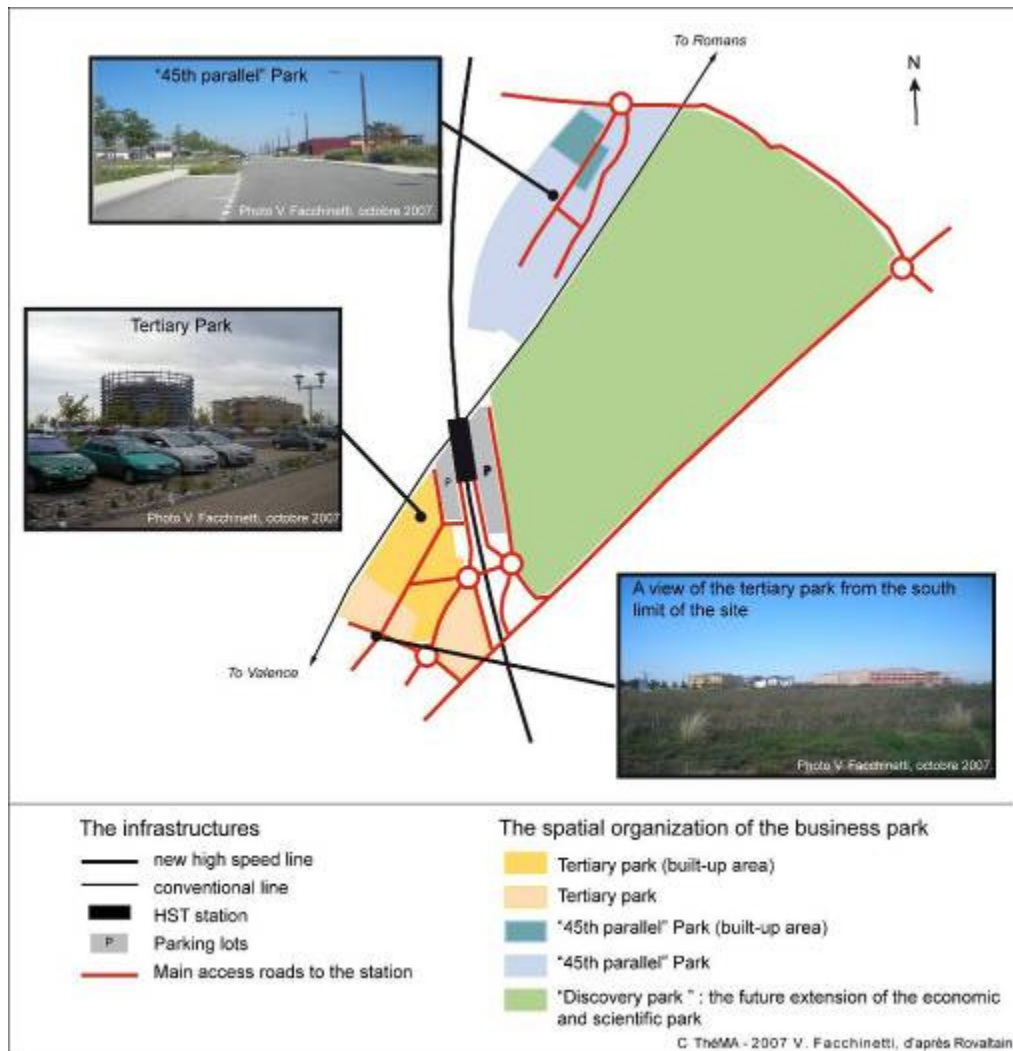
In the case of cities characterized by a duplication of high speed services between both stations, the projects developed around the new station differ according to the distance separating the station from the city. In Valence, development strategies are focused on the site of the new station to transform it on a structuring economic centre of regional territory (Facchinetti-Mannone, 2008). The project covers 162 ha divided into three areas (**Fig.6**) :

- on the west side of the station, a tertiary park of 10 ha is under way. Construction works of this new economic centre began in December 2003 and the occupation of the site, totally marketed, continues
- the northern part of the planning area is occupied by the "45th parallel", a business park of about twenty ha intended for hosting small industrial and tertiary firms
- lands located to the east will accommodate a vast economic and scientific park dedicated to high technology and sustainable activities.

The business park hosts about fifty companies adding up to 700 jobs. In order not to compete with the other activity areas of the Valence basin, the planning office "Rovaltain", responsible for the development of the site, placed its bets in exogenous development, but the first establishments remain local and of regional origin. Finally, the remoteness of the park in regard to the main

towns, hinders its development. Located 10 km from Valence, in a suburban area, the business park has, despite the efforts undertaken by “Rovaltain”, a deficit of their service supplies.

Fig. 6 : The business centre “Rovaltain”



Development projects set up around the new high speed stations in Reims and Avignon, much less advanced, rest on the implementation of a new mixed-use urban district with economic activities, residential spaces and urban equipments. In the southern part of the Reims urbanized area, the new station is located in an urban extension area of 172 ha. In front of the station, a tertiary park of 60 ha will be built. The first phase of this project, totally marketed since the beginning of year 2008, will host tertiary activities and banking groups. In north and east of the village of Bezanne, two low density residential districts are planned. They will receive between 350 and 400 residences within twenty years. The operation will be supplemented by a recreation and facilities areas of 30 ha

which gather a racetrack, a golf course, hotels, utilities and shops intended for the new inhabitants (Carrouet, 2008). The close cooperation between local authorities, the proximity of a metropolitan area and the integration of this new district to the urban territory by means of the railroad and the future tramway constitute so many assets for the creation of a “new piece of city”. However, optimistic projections of project phasing may be delayed by the financial crisis and competition of Clairmarais district which is developing near central station. In the case of mid-sized cities characterized by a dual high speed service, we can wonder about the competition between both station districts. When the peripheral station became the main rail access to the city, as in Valence or Avignon, the central station’s district experiences a decline of its vitality and commercial activities. When, as in Reims, the HST service is split evenly between both stations, the establishment of a business centre around the central station obviously leaves in the shade any development of a new growth pole around the peripheral station.

These various projects emphasize that the implication of high speed train on territorial development vary according to the location of the station. It seems easier to create a new development pole near the central station than around peripheral one (Facchinetti-Mannone, 2007). Business centres built around central stations strengthen the centrality of station’s district. However, HST is only an element among others of these new territorial dynamics based on the existence of important land availabilities and development strategies adapted to the pre-existent regional context. The arrival of high speed train in the city centre constitutes the opportunity to take advantage of land left available by deindustrialization and to strengthen centrality by leaning on the amenities related to the closeness of the city centre : concentration of utilities and successful integration into transport networks serving the agglomeration (Bazin et al., 2006). The restoration of central stations is the occasion to set up urban planning projects which enable the recovery of these forsaken areas by restoring the central functions of the station and solving the specific dysfunctions of these areas (particularly the “barrier effect” of tracks). Station districts offer significant potential to develop projects which meet the challenges of sustainable urban development. Indeed, recent projects rely on the densification of built space, the planning of operations mixing economic functions and social classes, and a reorganization of transport in favour of pedestrian and public transports.

Peripheral stations do not allow the implementation of similar urban projects of development, whatever the valuation strategies developed (Facchinetti-Mannone, 2003). The sites where these stations are located present

several advantages : an efficient rail and road accessibility, large availability of land less expensive than the central real estate offer. However, the development of business parks near these stations is subject to several constraints : the remoteness of urban utilities and an under integration to public transport networks serving the city. Despite inter-municipal strategies of development, these peripheral parks are often regarded as rival poles of the central sites. Examples of Le Creusot and Valence show that it is difficult to involve municipal authorities in territorial development projects outside the institutional perimeters in which they exercise their competence. Finally, projects developed around peripheral stations are an inadequate answer to the challenges of sustainable development. They contribute to urban sprawl, they generate significant road traffic and make difficult any functional mix. The diversity of territorial configurations in which new HST stations were established makes it possible however to moderate this report. Stations located in close urban suburbs may foster the emergence of a “new piece of city” integrated into the agglomeration and meeting the requirements of urban sustainability. Moreover, the influence of the station on territorial development depends not only on its location, but also on the characteristics of high speed service (service frequencies and variety of the offered destinations), on the functional division between central and peripheral stations, and on the quality of its local accessibility. The complementarity between both stations is an important question especially in the case of medium-sized cities whose economic potential is not sufficient for developing a tertiary pole around each station.

In France, the extension of high speed rail network came along with a diversification of the territorial configuration in which the stations are built. The comparison of these various territorial configurations shows, from the examples of mid-sized cities, that the impact of high speed rail on local mobility and urban development vary according to the location of stations and the characteristics of their high speed services. The choice to serve central station appears as the most favourable to develop intermodality and new business centers near the stations. However, for the medium-sized cities of intermediate territories, high speed service of the central station calls into question the time saving brought by high speed rail. The edification of a station in periphery appears then as the most adequate solution, even if these peripheral stations remain under-integrated into the local and regional transport networks, and have a limited impact on territorial development. It is so difficult to conciliate the objectives of national service with the challenges of development and mobility sustainable at local level (Reusser et al., 2008).

However, this dilemma can be solved by the establishment of the peripheral station close the limit of the urbanized areas, as it was the case of stations built during the 19th century on the conventional network. This proximity makes it possible to insert them into public transport networks serving the metropolitan area, and to integrate them, by appropriate development strategies, into the spatial dynamics of urban area, this without reducing time travel on the new line. Several conditions are necessary for an efficient integration of peripheral station. If a rail connection between central station and peripheral station allows to overcome the opposite effects of the duplication of railway services, this integration also depends on how traffic is split between both stations. Examples of medium-size cities show that with a balanced and complementary division of traffic, central stations do not suffer too much from the creation of a new peripheral station. This situation raises many questions about the constitution of a new centrality out of the city. The cases we studied show indeed that a balanced division remains favourable to the centre, which besides a powerful accessibility benefits from all the synergies necessary for the development of tertiary activities. They also emphasize the important part played by policymakers' strategies to support the integration of the new station into the territory they serve.

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