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New high-speed rail lines and small cities: locating the station

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Abstract

This paper studies the effects of high-speed railway stations, mainly on urban development of small size cities. For this purpose, we have analyzed twelve European cases and they have been sorted into different groups depending on the station location related to the city. Three categories have been defined: central station, edge station, and external station. As a result of this, for each group of European stations advantages and disadvantages, in terms of urban development and mobility, have been detected. This report will help planners to define some criteria to design and locate new high-speed railway stations in small size cities.

1 Study targets

Up to now, the main target of new high-speed lines has been connecting two big population areas which size justifies the public investment required for its construction. But also, small and medium size cities are generally included in interior points of these lines. In these small cities, the new infrastructure is perceived as an important tool for the economic development and urban dynamism, and this is why local authorities must find the way to adapt the city to its new situation, in order to get the maximum benefit from it. There are several experiences in France and Germany of cities of this size, where strategic plans have been implemented in order to define the optimum conditions for the location and design of the rail station and surroundings. In other cities, urban plans have paid less attention on this matter, so it seems necessary to study what

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the location and operation of this stations are nowadays, better than comparing different theoretical plans designed years ago.

This paper shows the most relevant conclusions obtained from a research project performed by the Civil Engineering School of Ciudad Real (Escuela Técnica Superior de Ingenieros de Caminos, Canales y Puertos) and financed by the Spanish Public Works Ministry (Ministerio de Fomento). Each of these twelve cities was visited by a member of the research group and a valuable graphic material (photographs and maps) and statistical data were collected. The criteria established to select these twelve cities were as follows:

- Station located in a high-speed rail line, serving a population under 130.000 inhabitants.

- Rail services offered by the station must connect the city with an attracting center (usually located in the extreme of the high-speed line) with a travel time lower than 90 minutes. The frequency of this connection must be of at least eight services in a day (both ways). This figure, if the timetables are suitable, may allow the existence of commuters.

As result of the criteria mentioned above, the chosen cities turned out to be twelve: Mâcon, Le Creusot, Montbard, Vendôme and Valence (France), Göttingen, Würzburg and Fulda (Germany), Arezzo (Italy), Katrineholm (Sweden) and Ciudad Real and Puertollano (Spain). From the analysis of all these cities, lastly three different typologies of station have been distinguished attending to its location relative to the city.

2 Station Typologies

During the previous analysis and once each study case was visited, five different possible typologies were identified:

a. The first case is the *central station*, which generally comes from the adaptation of the existing station and preservation of the nineteenth century railway lands.

b. The second case is the station located *at the edge* of the consolidated city, reproducing the situation generated in the vast majority of European small and medium cities when the first railway networks were constructed.

c. The third case represents an evolution regarding the last typology (b). The new railway line runs far away from the city and so, the station is *separated from*

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the urban soil and, as a consequence, the pedestrian access to the station becomes nearly impossible

d. The forth possibility consists of *two stations* attending the same city, as a mixture of case (a) and (c). This often takes place when the city has a railway by-pass with a station besides the line, but also keeping the central station.

e. The fifth and last possibility could be *a station located between several cities*, attending to all of them but any in particular. A good example of this situation is the Haute Picardie TGV station in France, located halfway between St. Quentin and Amiens, 25 kilometres away from both cities. In French it has been called 'une gare au mileu dès bettraves', a 'station in the middle of the beets'.

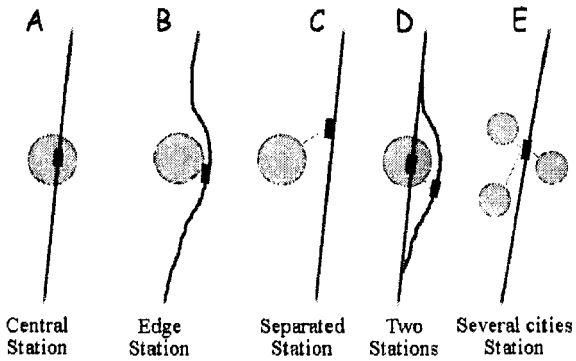

Figure 1: Station typologies.

These real cases experience has evinced for each typology different impacts and consequences on urban development, on station access distribution, and on the viability of the different kinds of activities attracted by the station. Even though, it has been possible to define a less complicated classification into three groups.

Case 1: Central Station

This type of stations very often comes from old stations that once were located at the edge of the urban centre. As time went by, new connections with the city were developed (streets, roads, new neighbourhoods). Owing to this fact, as a curious hint, in these central present stations, it's easy to find a street called "the station street", old connection between the station and the city. In this context, when high-speed trains were implemented, the old station was reused, and in a few cases, replaced by a new nearby, as happened in Puertollano.

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Case 2: External Station

Rail lines often are located at a certain distance from small cities, placing the station at the outskirts of them. One of the reasons we have found for this location is the scarcity and complex geometry of existing opened land near these urban centers; opened land that should allow a quite straight geometry of railway line. Over and above this first reason, there is a second argument based on the lesser interest of railway companies to serve small cities in contrast the greater interest in adequately serving big cities, where the number of potential users is higher. Moreover, commercial travel time between big cities decreases if trains stop in every small city with station. In this research, stations located in-between several cities or serving a region, have also been included in this group.

Case 3: Station located at the edge of the city

This location, which was very usual in the nineteenth century at small and medium cities, could be included inside case 1 or case 2, taking them to their limits. Cities should have well defined boundaries between urban and rural lands to permit high-speed lines getting at the edge of the built city. We have included only one studied case owing these properties (case 3): Ciudad Real. In Ciudad Real, the station is only ten years old.

3 Selected stations analysis

3.1 Central station

This group is made up of all the German selected cities (Würzburg, Fulda y Göttingen) together with Arezzo (Italy), Katrineholm (Sweden), Puertollano (Spain), and the French cities Montbard and Valence (old station).

Station-city connection

Coordination between rail companies and city council usually promotes the development of the "station street", which is most of the times pedestrianized, and tends to increase commercial activity.

Traffic flows are normally heading towards the parallel street to the main facade of the station building. Private cars and public transportation vehicles access to the station using entrance and exit itineraries connected to this parallel street.

Accessibility to the station

Pedestrian traffic is, for this type of stations, as important as road traffic. German studied cases boosts to be the best served by public transportation. In these cities bicycle plays a relevant role together with the high number of urban buses that serves the rail station. Würzburg even is provided with a tramway with a stop

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near the rail station. Most of the German cities have located their interurban bus station close to the rail station and not only the timetables are thought to allow connecting with other modes of transportation, but also this information is available, supplied and promoted (for example, inside the bus station, the information board announce rail immediate departures). This German system totally guarantees transport modal interchanging. In Valence, the regional bus station is also located closed to the rail station and it has been projected to be used as a modal interchanger. However in Arezzo, although the bus station remains near the rail station, no coordination is supplied between high- speed services and interurban bus ones. Lastly, in Puertollano, there are no urban or interurban bus lines with stop or direct connection to the rail station.

Figure 2: Göttingen Station located besides the historic center.

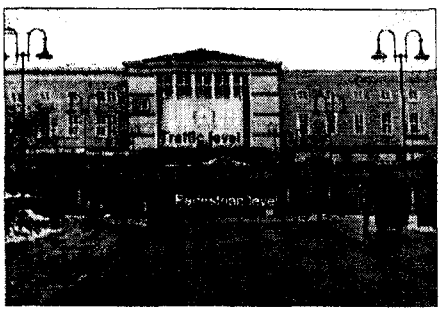

Figure 3: Fulda Station. Different levels for pedestrian and traffic.

In relation to the traffic movements at the station, Fulda constitutes an interesting exception, as it works with a segregated model of entrances and exits. It is achived because of the existence of a level difference between pedestrian access and rail tracks. This scheme is quite common at some airports. Katrineholm case is even more curious: the façade is oriented towards the outskirts, while tracks are closer to the city than the station building. In Valence, vehicles and pedestrian itineraries are also divided, placing a traveler area besides the underground parking.

In cities like Fulda, Montbard, Valence and Katrineholm, the tunnel under the tracks is designed with the purpose of improving the permeability between the two areas in which the city is divided because of the rail line. The tunnel works like a pedestrian road linking two neighborhoods. Puertollano rail station, instead, has failed like a liaison between the city and neighborhood on the other side of the tracks.

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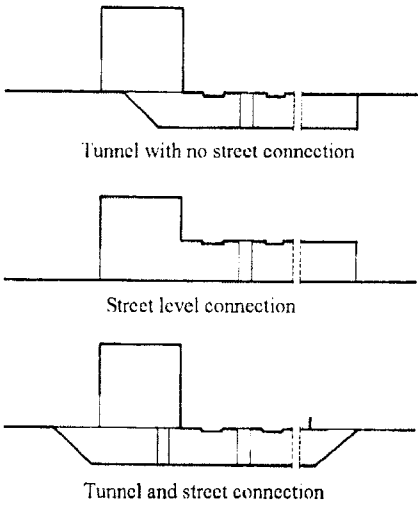

Figure 4: Different kinds of tunnels

Activity at the station building

All the German stations are provided with business premises that are open even during weekends, being more used by the station neighborhood than by travelers themselves. The reasons for these circumstances have something to do with the fact that the rest the shops in German cities used to be closed on weekends.

At the rest of studied cities, it's easy to find at least a newsstand and a coffee shop at the station, although the variety of business premises is lower.

3.2 Case 2: External station

This group is composed of the cities of Mâcon, Le Creusot, Vendôme and the new station of Valence (opened only some months ago).

Station-city connection

This typology of station is generally well connected to urban centers through a high-capacity road network, with not congestion or traffic jams. This network offers cities a new development corridor, in which industries, hotels or leisure centers try to find their place. This type of scheme is always designed to be used by car drivers, never by pedestrian and rarely by public transportation.

Accessibility to the station

The lack of space at the surroundings has never been a problem for this type of station. The majority of these stations are provided with wide car parking lots

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and even most of them have been extended because of the demand increase (Le Creusot and Mâcon). After new high-speed rail lines were implemented, services of 'navettes' started operation in these French stations. They were buses that connected the nearest cities to the rail station, so their timetable was perfectly coordinated with main high-speed services. Navettes companies have always been asking for public subsidies because the business has turned out to be not as profitable as it was thought. The massive car use together with the low population density of the region make public transportation difficult to work.

Activity at the station building

Special attention has been paid to high-speed service characteristics to understand the role played by the station, which, in this French sample, it's not a place to wait or rest. Number of services in a day with stop in Mâcon, Le Creusot, Vendôme and Valence is very reduced, although the punctuality is very high. Besides this argument, ticket-selling methods have improved (machines or internet) and you don't have to queue for a time to get a ticket. According to this, business premises are almost inexistent or unsuccessful.

3.3 Case 3: station located at the edge of the city

The only case selected in this group, as mentioned above, was Ciudad Real (Spain). More than 20 high-speed shuttles a day connect Ciudad Real with Madrid, 175 kilometres in almost 45 minutes.

Figure 5: New activities besides Ciudad Real Station

Station-city connection

Pedestrian access is possible given the close situation of the station to the center, and the size of the city, although more than 50% choose private vehicle. Research works conducted by Menéndez (Menéndez et al, 2001) appear to be relevant on account of the way to access to the station in Ciudad Real.

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Table 1. Access to Ciudad Real Station.

Transportation mode	% Modal split
Pedestrian	12
Bus	16
Car	57
Taxi	15

As at the nineteenth century stations, the location of the station at the edge of the city might be regenerating urban development in the surroundings of the station. Some interesting residential uses, as well as tertiary, and the opening of new axes of development are now taking place after ten years of the arrival of the high speed train to the city of Ciudad Real. These areas are now being regenerated, as they were part of denigrated city suburbs. Distance to the city center is the main issue in this typology. Also dimension of the area around the station will determine the scale of the urban development and the possibilities of regenerating a new consolidated area around the city.

Accessibility to the station

Both, urban and regional bus services, must be adapted to the new high-speed train station location. The more these services are combined with the train the more high-speed benefices will be spread to the local territory. In Ciudad Real the interurban bus station is placed far away the present rail station, so this modal transfer is impossible. Urban Buses Company offers a new line with a stop besides the rail station, with a coordinated timetable.

The circumstance of locating the station at the edge of the city will also bring the possibility of building new modal interchanger in the surroundings of the station. But this chance has been, until now, wasted in Ciudad Real

Activity at the station building

Uses not directly related with train services are also altered, just like happens at previous cases. This location might have the opportunity of supplying services to neighbours of this new suburban area. Ciudad Real, in Spain, shows how these commercial activities have a ceiling, for it is difficult to shadow downtown's attraction.

4. Conclusions

Each of the situations analyzed shows clear advantages, but also urban development lacks. Due to this complex situation, we will try to conclude analyzing some considerations summing up both positive aspects and weaknesses of cases.

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4.1 Central station

Since the station has such a potential of attracting new uses and activities, it can be a very useful tool for the recovering of old, and sometimes empty downtown's. When urban planning authorities and rail companies offer a coordinated plan, interesting developments appear. Usually remodeling of the surrounding of the station is done in exchange for new urban space that companies might be interested in selling to the city. Very often, the old building is transformed for the new uses, but preserved its patrimonial value, so its reference to the city is not lost.

In terms of accessibility, access to downtown stations is very easy for most of citizens, since it is already located in a "naturally " accessible area. Very often, locating new infrastructures of high-speed services inside the old city means that inexpensive space is hard to be found. Due to the interaction with the rest of urban traffic, it seems difficult to organize flows near the station. Lastly, the new line might emphasize negative effects on the development of our urban spaces. Residential areas might be affected by the existence of this line in their potential growing spaces, and there for, the city will end up divided into two separated and different areas.

4.2 External station

In this particular case, both design of the geometry of the line and type of operation haven't been modified by previous urban characteristics. This means that plenty of inexpensive space is available and so, for planners, the surrounding of the station is a space easy to work with. In connection with tertiary land use, industrial or technological activities very often see in the surrounding of big infrastructure facilities a good location. So it happens with high-speed train terminal. The new station is pretended to be the heart of a new urban operation, since it is a good opportunity for incorporations searching for inexpensive land well connected to not only one city but also national network.

In terms of transportation, private car mobility from neighbour areas is easier, especially when good motorways are connecting the station to these areas, while the existence of public transport is quite limited. As a result of this station function, travelers spend very little time on the station, which does not allow the development of commercial activities. Also, since the station is located far from the city, no other potential client can be attracted.

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4.3 Stations at the edge of the city

This strategic location, close to the city center but far enough so that there is space available, makes of it the best accurate typology in terms of the relation between the investment of the project and the quality of the service. A new opportunity of development is also considered at the surroundings of the new station, the opportunity of developing a new area, according to the new users and the new infrastructure. Public planning strategies must be designed in order to organize the future of these areas, for market cannot be the only way to rule this concern.

Concerning transportation ways to reach this type of station, access is still easy by foot. It is also possible reaching the station by bus or private vehicle, for it is usually well connected to urban arteries. Considering commercial areas into the station, the facilities offered by them are used, in this typology, by two different kinds of clients: those who are going to travel or just did, and those who live in the neighbourhood and use the station facilities for commercial purposes. This circumstance is well seen by commercial responsible at the station for it guaranties the activity trough the whole day. Even though these new areas are growing up slowly by themselves, public planning strategies must be designed in order to organize the future of this areas, for market cannot be the only responsible for controlling this development.

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