



The direct and indirect effect of the high-speed rail on urban development

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ABSTRACT

The direct and indirect effects of high-speed rail on urban growth at the regional, urban, and station area levels are discussed in this study. Also, the impact of high-speed rail on urban growth is discussed. Reconstruction of the urban spatial system, urban regeneration, agglomeration and diffusion effect, economic efficiency impact, and tourism behaviour influence are covered in the literature evaluation. Short journey times would have a direct impact. Factors such as regional, urban, and station growth, would have an indirect effect on urban development.

KEYWORDS

High-Speed Rail, Regional Level, Urban Level, Station-area Level.

1. INTRODUCTION

The invention of the wheel paved the way for developing the rail system. People wanted to travel long distances and reach faster than walking. Intercity travel and people moving from one city to another city accelerate commercial activities.

High-speed rail is a rail framework that works at a normal speed of 250 km/h or above, It works as a coordinated arrangement of specific moving stock and devoted tracks.

Urbanization is a multidimensional process that involves three interconnected processes, each of which is facilitated by transportation.

First, rural populations use transportation capacity to relocate to metropolitan regions, fueling urbanisation. Then, when cities extend their spatial footprint and install urban mobility infrastructure in previously undeveloped terrain, rural regions are altered. Finally, the percentage of non-agricultural economic production increases in and around cities, aided by the mobility infrastructure that supports supply chains and high-value-added service face-to-face interactions.

Over a period, a city's urban development trajectory is heavily impacted by its location within a transportation network, particularly its relationship to, or function as, a transportation hub.

The point of this review is to distinguish the immediate and circuitous impacts of High-speed rail, and its influence on the metropolitan turn of events. This report assists with distinguishing the boundaries that influence Urban Development.

2 Literature review

2.1 Direct effects

2.1.1 Reduction in travel time

One of the most important effects of high-speed rail is the reduction in journey time. People are more likely to travel because of the shorter trip time. For example, on the Rome–Naples route, 71.2 percent of HSR users said the shortened trip time is the main reason they choose HSR.

Country/line		Journey time: conventional railway	Journey time: HSR	Change	Distance (km)	Year opened	Source
Japan	Tokyo–Shin Osaka	6 h 30'	4 h'	−38.33%	515	1964	Sands (1993)
	Shin Osaka–Hakata	8 h 30'	4 h 40'	−45.10%	554	1972/1975	
France	Paris–Lyon	–	2 h 20'	–	427	1981/1983	Bonnafous (1987)
Germany	Frankfurt–Cologne	2 h 13'	59'	−55.64%	177	2002	Ahlfeldt and Feddersen, (2010)
Italy	Rome–Naples	1 h 45'	1 h 5'	−38.10%	213	2005	Cascetta et al. (2011)
Spain	Madrid–Seville	5 h 55'	2 h 30'	−57.45%	535	1992	De Rus and Inglada, (1997)
Sweden	Stockholm–Eskilstuna	1 h 40'	1 h	−40.00%	115	1997	Fröidh (2005)
South Korea	Seoul–Busan	4 h 10'	2 h 40'	−36.00%	441.7	2004	Chang and Lee, (2008)
	Seoul–Mokpo	4 h 40'	2 h 58'	−36.43%	414.1	2004	
Taiwan	Taipei–Zuoying (Kaohsiung)	4 h 50'	1 h 34'	−67.59%	345	2007	Yung-Hsiang (2010)

Table 2.1.1. Travel times: HSR versus conventional railways

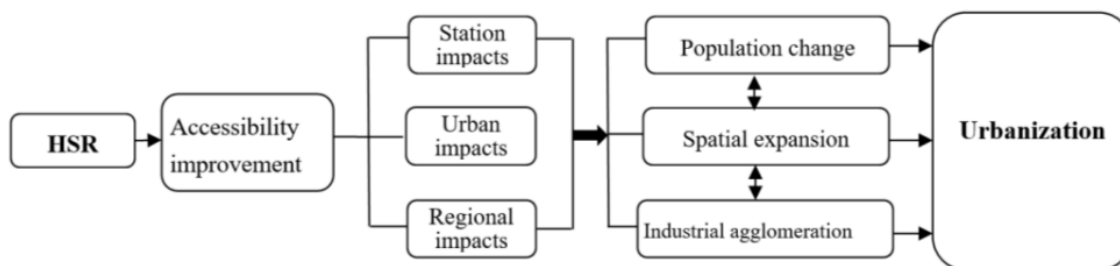


Fig.2.1.1 Relationship between HSR mobility and urbanization (based on Understanding the urbanization impacts of high speed rail in China,2021)

2.2 Indirect effects

When the development impacts of HSR are analysed at three geographic scales: regional, urban, and station area, the picture becomes clearer. These three layers are interconnected and work together to shape urban development.

HSR accessibility in the station area can have a direct impact on the surrounding land uses, as well as broaden the breadth of that area's effect by making development more accessible in comparison to the rest of the city.

HSR tends to modify spatial layout at the urban level by concentrating urban population and enterprise dispersion around station sites.

At the regional level, HSR can change the connection and accessibility between cities throughout a region, affecting the economic geography of that region.

2.2.1. Regional level

Reduced travel times facilitated by HSR tend to boost travel volume, encourage the growth of trade, logistics, and other businesses, and eventually aid in the formation of a unique and integrated metropolitan network structure. (Verma et al., 2013).

HSR alters the absolute and relative accessibility of different cities on a regional scale. This enhances transportation options for entrepreneurs and visitors, allowing them to travel larger distances. HSR influences the choice of location for individuals (housing, place of employment) and businesses (office sites) by changing the relative accessibility of centres, resulting in regional spatial redistribution.

The prospective impact of a HSR service on intermediate and secondary cities can be determined by three criteria: city size, network location, and distance from central cities. A city's development potential is determined by combining all three factors.

The size of a city and its metropolitan region, the first criterion, has been highlighted as a crucial determinant in how HSR service affects the development of that city.

For intermediate cities, the second criterion, network location, is a critical element. The HSR network acts as another mode of transport for the users.

Travel time between an intermediate or secondary city and the centre city has a significant impact on the third criterion, distance from central cities (usually the capital city).

2.2.2. Urban level

The urban development impact of HSR

It is preferred to site HSR stations on the outskirts of town or at the outskirts of suburbs in order to boost economic growth. There are two possible explanations for this. First, land acquisition prices in the city centre are substantially greater than in the suburbs, restricting the variety of economically feasible enterprises in the established core. Second, with proper design, newly constructed suburban HSR stations in the areas may emerge into an extra economic growth node outside of the centre, further supporting the total urban economy's development.

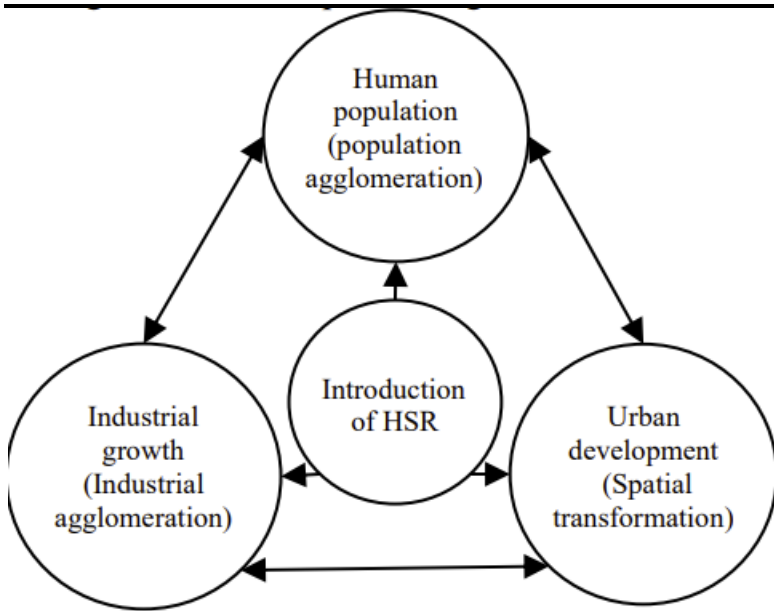


Fig. 2.2.2 Relationships between population, Land development and industrial growth in urbanization(based on Understanding the urbanization impacts of high speed rail in China,2021).

According to Long et al. (2018), HSR has the ability to change metropolitan spatial organisation resulting in physical city expansion. In the long run, putting the HSR station in the suburbs and properly managing the station area development might encourage the city to expand in a multicentric manner. HSR tends to affect the spatial dynamics of the entire city by not only influencing the development dynamics of newly developed districts but also by redeveloping and enhancing the urban centre.

HSR is a catalyst for urban system restructuring and reconfiguration.

According to the specific locations of HSR stations in a city, Hall (2009) identified three types of urban impacts of HSR based on station locations.

- (i)The station's proximity to or within the traditional CBD enhances or supports the CBD's appeal as a business investment location.
- (ii)The Station is situated on the outskirts of cities, close to but apart from main urban centres. This can aid in the development of complementing sub-centers.
- (iii)The station's location outside of the city's peripheral aids in the development of a new commercial edge city.

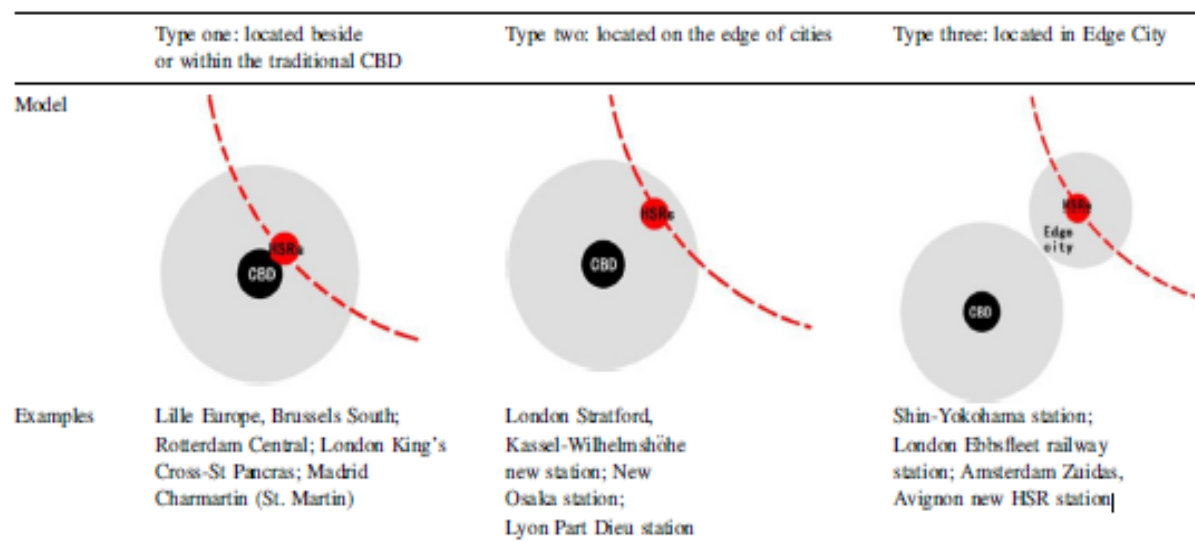


Fig 2.2.2 Models and examples of three kinds of HSR station (based on Hall,2009).

2.2.3. Station area level

Land use around the HSR station area

As a result of the increased accessibility benefits of the space surrounding railway stations, HSR station areas frequently attract more money, technology, and skilled labour than other metropolitan areas.

The quick aggregation and dispersal of passengers at the HSR station coincides with the arrival and departure of trains, allowing for rapid circulation across wide regions. As a result, the flow of people in and around the HSR region is dynamic in both space and time. This large number of people on the move raises the demand for services like food and lodging. As a result, the construction of a HSR station and related service sector activity boosts land demand and may result in the formation of new commercial centres.

(a)Core station area:

The region surrounding a transit stop or station in which pedestrians will make up the bulk of all transit trips generated. Land use and urban design aspects have the biggest impact on transit usage in this area.

(b)Primary catchment area

The region surrounding a transit stop or station that is easily accessible by foot and where a considerable majority of all transit trips generated will be made by foot. Land use and urban design elements, as well as the accessibility and directness of access to the stop or station, have a significant impact on transit ridership in this area. This is also the broad area where station area land use and transportation network design will be concentrated.



Fig 2.2.3.1 Area of influence(based on National Transit Oriented Development Policy (2017)).

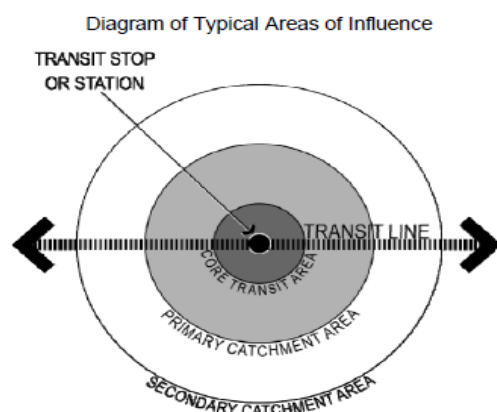


Fig 2.2.3.2 Typical Area of influence(based on APTA Development standards program(2011)).

(c)Secondary catchment area

The region surrounding a transit stop or station where the bulk of all transit journeys using the stop or station occurs. The principal ways of access to and from the stop or station in this region are bicycle, feeder transit, and automobile. Transit patronage is most influenced by the accessibility and directness of access to the stop or station.

Accessibility to HSR node of different types of developments.

	Primary development zone	Secondary development zone	Tertiary development zone
Accessibility to and from the HSR station	Direct 5–10 min on foot or by seamless transport	Indirect <15 min, by complementary transport modes (including travel and transfer time)	Indirect >15 min, by complementary transport modes (including travel and transfer time)
Location potential	Location for high-grade (inter)national functions	Secondary location for high-grade functions. Specialised functions related to specific location (cluster)	Variety of functions depending on specific location factors
Building density	Very high	High	Depends on specific situation
Development dynamic	Very high	High	Modest

Source: Schütz (1998).

2.2.4. Regional polarization development

The position of core cities is strengthened by high-speed rail.

According to growth pole theory and polarisation effect theory, high-speed rail's space-time compression phenomena creates a metropolis with multiple competitive advantages. With the impacts of scale effect, agglomeration effect, and multiplier effect, the core region will take more market share and develop a bigger economic scale. The growth of the periphery region, on the other hand, maybe hampered. The region has a proclivity for divisiveness.

2.2.5. Regional integration

High-speed rail reduces travel time and distances while also promoting regional connectivity.

Since the Shinkansen began operating in the 1960s, passenger numbers have risen steadily, with the exception of a brief decline owing to the economic downturn. In August of 2000, Japan's Transportation Policy Committee proposed a one-day travel programme based on Shinkansen that would allow travellers to arrive in all of the country's major cities in under three hours after departing from Tokyo, Osaka, Nagoya, Sapporo, and Fukuoka.

The growth of regional integration requires a one-day trip effort. The constant construction of regional transportation infrastructure has impacted the increase of one-day travel distance and modified the accessibility of various cities in the region.

2.2.6. High-speed rail has great influences on tourism.

High-speed rail allowed for face-to-face contact, and its impact on companies was mostly seen in the sphere of productive service (Kobayashi & Okumura, 1997). Bonnafous (1987) believed that high-speed rail would lower travel time, affecting the tourism business in two ways: first, round trips became more convenient, reducing the number of visitors who remained overnight; and second, the extension of travel range spurred new tourism requirements. Furthermore, High-speed rail provides opportunities to tiny communities with unique tourism resources.

2.2.7. HSR impacts on urban industrial development

The impact of improved HSR on industrial growth is largely determined on the transportation costs of certain products. The greater this percentage of transportation expenses, the more effect HSR might have, for example, by boosting pre-existing infrastructure capacity by luring traffic away from other modes and therefore cutting shipping prices by traditional train and road. By facilitating passenger movement, the HSR has a substantial influence on the growth of tertiary industries, particularly the service sector. A site with a high level of accessibility is more appealing to corporate offices.

3. CONCLUSION

The new motto for reshaping intercity travel as a revolutionary transportation choice in the twenty-first century is high-speed rail. High-speed rail (HSR) has emerged from the growth of rail transportation during the previous five decades, ushering in the "second era of rail." HSR networks cut travel time between cities in half, making it easy to commute intercity.

HSR is inextricably linked to an intricate web of urban–regional functions and human life's geographic expanses as a sort of infrastructure. These overlaps add to the complexity, but if developed as a whole, they can yield major results for the welfare of society in the days to come.

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