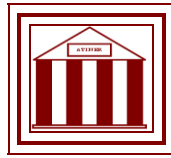


**Athens Institute for Education and Research  
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ARC2015-1747**

**Between Permeability and Isolation:  
A Comparative Urban Life Study of Inner-  
City Railway Stations and their Node Precincts  
in China**

**Shan He  
Candidate  
University of Western Australia  
Australia**

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Athens Institute for Education and Research  
8 Valaoritou Street, Kolonaki, 10671 Athens, Greece  
Tel: + 30 210 3634210 Fax: + 30 210 3634209 Email: [info@atiner.gr](mailto:info@atiner.gr) URL:  
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**Between Permeability and Isolation:  
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**Abstract**

Conventional railway station precincts in Chinese cities have a reputation of being chaotic, dirty, crowded, and even unsafe. This negative image prevents them from integrating into the surrounding urban fabric. Past decades have witnessed a large scale redevelopment of rail infrastructure across China, new relationships between the station and city have been shaped through this period. This paper studies this phenomenon as part of a research that investigates the planning and design practices of the emerging new towns oriented at high-speed rail (HSR) in China. Data collected from 30 surveyed inner-city stations is analyzed to support this study. The author starts with building the scenarios of the existing relationships between inner-city railway stations and their node precincts, through defining and categorizing the concept of SIDA (station and influenced development area). Selected cases, including Xi'an and Beijing South Stations, are then studied to disclose the quality of station-city integration in different SIDA scenarios through the analysis of urban life permeability. The conclusion points out that the integration in studied SIDAs is generally weak. The emerging HSR stations and new towns around them should consider re-inventing permeable lives between both precincts.

**Keywords:** Integration, Railway station, Urban life

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## Introduction

In today's Chinese cities, people normally have negative impressions of the conventional railway station and its node areas. Most station visitors consider it to be chaotic, dirty, crowded and even unsafe. Fu-shou Guo reports that visitors of the Zhengzhou Railway Station have complained about eight major problems: soliciting, begging, illegal transport services, un-licensed coaches, un-licensed taxis, parking infringements, sale of counterfeit items and criminal gangs.<sup>1</sup> Hui-min Li summarizes the urban experiences of the Hangzhou Railway Station precinct as 'un-paralleled urban development from neighboring areas, which suffers from heavy but chaotic traffic, terrible environmental quality, few green lands or rest installations, as well as comparatively low quality commercial facilities.'<sup>2</sup>

This negative station image prevents itself from the potential of developing comprehensive lives beyond a transport node. For most urban residents, travelling on a train is the only reason to visit a station.

On the other hand, China has witnessed 'an era of fast developments'<sup>3</sup> in its national rail infrastructure since the first issue of *Middle to Long Term Railway Network Planning* by the State Government in 2004. This development was particularly highlighted by the Chinese high-speed rail (HSR) network expansion. In a comparative study of HSR construction projects between China and three precedent countries, Japan, France and Germany, Chen-hui Lin et al. report that China has created around 14,500 km of new HSR tracks in the ten years since the first HSR line was built and opened. In the same period, however, the three other countries have extended only about 680 km of their networks.<sup>4</sup>

This rapid Chinese railway development further challenges the relationship between stations and their immediate urban areas, especially as 'HSR lines and stations are generally located on the edge of urban footprints ... [which] pushes forward the suburbanization of Chinese cities.'<sup>5</sup>

The above-mentioned negative experiences associated with living near a station will undoubtedly be an obstacle for new stations intending to integrate and reinvent urban lives. It is therefore important to research and understand

<sup>1</sup>. Fu-shou Guo (郭富收). "郑州火车站广场将修建10座人行天桥," in *Henan Business Daily*, A20, 13 October (2011) <http://bit.ly/1HPXNR6> [accessed November 24, 2015.]

<sup>2</sup>. The original text in Chinese is: "与周边区域的不协调发展, 交通拥挤拥挤, 环境质量恶劣, 周边缺乏绿地与休憩设施, 商贸服务设施水平较低或商业中心也偏低" Hui-min Li (黎敏), "The Study of the Development of History and Design of Hangzhou Station," Master Thesis (Zhejiang University, 2012), 53.

<sup>3</sup>. The original text in Chinese is: "快速建设时代" Jiao-e Wang and Jin-xue Ding (王皎娥, 丁金学), "High-Speed Rail and Its impacts on the Urban Spatial Structure of China," *Urban Planning International* 26, no. 6 (2011): 49.

<sup>4</sup>. Chen-hui Lin (林辰辉) et al., "高铁及城市轨道交通对城市发展影响的研究综述" in *中国大城市交通规划研讨会论文集* (Suzhou, China, 2010), 666.

<sup>5</sup>. The original text in Chinese is: "高铁的站点选择和线路走向通常位于城市边缘地带, ... 推动了中国城市的郊区化进程" Tao Yu et al., "Characteristics and Mechanism of High Speed Rail-driven Suburbanization in China: A Case Study of Beijing-Shanghai High-speed Rail," *Scientia Geographica Sinica* 32, no. 9 (2012): 1041.

the mechanisms that shape the relationship between station and city, especially the permeability of urban lives in between. This permeability allows stations to foster a more sophisticated urban life and serve as more than a homogeneous infrastructure node. In fact, the character of station hubs can help define urban lives. Through this permeability, future stations will have the potential to promote a higher quality of life around their node areas.

Therefore, inner-city stations are targeted in this paper to examine the established station–city relationship. The author visited a total of 30 inner-city railway stations in 24 Chinese cities in early 2014 to support this study (Table 1).

**Table 1.** *Summary of Visited Inner-City Stations, Jan.-Feb. 2014*

City (name in Chinese)	Station	Accessibility	Location to City	Train Services Provided	Operation	Station Development	SIDA on Either Station Side
				NR=Normal Rail HSR=High-Speed Rail			
Beijing (北京)	Beijing	One Side	Inside	NR	Operation	C	I/D
	Beijing South	Two Sides	Inside	NR/HSR	Operation	Exp	II/II
	Beijing North	One Side	Inside	NR	Operation	Exp	II/II
Tianjin (天津)	Tianjin	Two Sides	Inside	NR/HSR	Operation	Ext	I/II
Xi'an (西安)	Xi'an	One Side	Inside	NR	Operation	C	I/D
Zhengzhou (郑州)	Zhengzhou	Two Sides	Inside	NR/HSR	Operation	Ext	I/II
Wuhan (武汉)	Hankou	One Side	Inside	NR/HSR	Operation	Ext	I/D
Guangzhou (广州)	Guangzhou	One Side	Inside	NR	Operation	C	I/D
	Guangzhou East	One Side	Inside	NR	Operation	Ext	II/D
Nanjing (南京)	Nanjing	Two Sides	Inside	NR/HSR	Operation	Ext	I/II
Zhenjiang (镇江)	Zhenjiang	Two Sides	Inside	NR/HSR	Operation	Ext	I/II
Changzhou (常州)	Changzhou	Two Sides	Inside	NR/HSR	Operation	Ext	I/II
Wuxi (无锡)	Wuxi	Two Sides	Inside	NR/HSR	Operation	Ext	I/II
Suzhou (苏州)	Suzhou	Two Sides	Inside	NR/HSR	Operation	Exp	II/II
Kunshan (昆山)	Kunshan	Two Sides	Margin	NR	Operation	Ext	I/II
Shanghai (上海)	Shanghai	Two Sides	Inside	NR/HSR	Operation	Ext	I/II
	Shanghai South	Two Sides	Inside	NR	Operation	Exp	II/II
	Songjiang	One Side	Edge	NR	Operation	C	I/D
	Fengjing	One Side	Edge	/	Closed	C	D/D
Jiashan (嘉善)	Jiashan	One Side	Margin	NR	Operation	C	I/D
Jiaxing (嘉兴)	Jiaxing	One Side	Inside	NR	Operation	C	I/D
Haining (海宁)	Haining	One Side	Margin	NR	Operation	C	I/D
Hangzhou (杭州)	Linping	One Side	Edge	/	Closed	C	D/D
	Hangzhou	One Side	Inside	NR/HSR	Operation	C	I/D
Zhuji (诸暨)	Zhuji	One Side	Remote	NR (HSR Ready)	Operation	R	R/D
Yiwu (义乌)	Yiwu	One Side	Remote	NR (HSR Ready)	Operation	R	R/D
Quzhou (衢州)	Quzhou	One Side	Remote	NR (HSR Ready)	Operation	R	R/D
Shangrao (上饶)	Shangrao	One Side	Remote	NR (HSR Ready)	Operation	R	R/D
Shaoxing (绍兴)	Shaoxing	One Side	Edge	NR	Operation	C	I/D
Ningbo (宁波)	Ningbo East	Two Sides	Inside	NR (HSR Ready)	Operation	Exp	II/II

Information was correct at the author's visit.

The paper begins with a theoretical analysis of the physical scope of research. Two station cases with their node areas, Xi'an and Beijing South Stations, are selected from the visited samples for closer study. In conclusion, the author analyses and summarizes the observed problems to inform future practices of new towns around remote HSR stations.

## Scenario

Ferrarini Alessia observes that in early European railway stations ‘the station building ... was sort of limit or boundary between the space of the railway and the traditional urban fabric.’<sup>6</sup> In the past, the building envelope of a station set boundaries for station activities, which means the interactive relationship between station and city is mostly defined by the physical station building. Along with the operation of rail services, urban living, especially around station nodes, has been substantially reshaped by the rail infrastructure. The ‘station life’ experience has expanded beyond the building façades into the fabric of the urban context. In the following paragraphs, this area is described as a *Station and Influenced Development Area (SIDA)* for further analysis.

*SIDA* is also visible around today's inner-city railway stations in Chinese cities. Using the Zhengzhou Railway Station as an example, the station plaza is heavily occupied by passengers and vehicles connecting to the station. Moreover, this hustle and bustle is extended into nearby roads, affecting the population and demonstrating strong impacts on the rail infrastructure on urban living (Figure 1).

**Figure 1.** Zhengzhou Station Plaza and Node Area



Source: Author.

<sup>6</sup>. Alessia Ferrarini, *Railway stations: from the Gare de l'est to Penn Station* (Milan: Electaarchitecture, 2005), 6.

### *SIDA in Theoretical Scenario*

First of all, a theoretical definition should be identified for *SIDA*. Physically, *SIDA* is part of the built urban fabric, defining a ‘gateway’ area into the city. It works collaboratively with other parts of the city to deliver a full range of urban functions.

*SIDA* has not been theoretically defined by Chinese research. Weiyi Pan compares railway station node areas from a qualitative perspective but provides no clear scope and boundary to define *SIDA*.<sup>7</sup> Chun-sheng Ying and Dong-lu Pu, as well as Lei Min and Huan Huang discuss station node area developments through respective case studies of Hangzhou and Hankou Stations. However, vague understandings of the definition of ‘station node area’ lead to vast differences in the size of the affected urban areas despite the similar sizes of the stations: the former encompasses 23.51 hectares while the latter affects a 324-hectare area, over 13.7 times larger.<sup>8</sup>

It is essential to understand that *SIDA* covers an area extending from a station node into nearby urban precincts, with fabricated urban activities that are influenced by rail infrastructure. Xiao-xing Zhang and Xiao-shu Cao et al. combine this extended station and node precincts into a ring structure, comprised by a ‘core area’ and a ‘peripheral area’, which are functionally connected. In fact, the integration between a station and its node area is woven by seamlessly connected urban lives, or the permeability of urban lives. This integration is supported by urban traffic running through the combined areas, which defines a legible scope of *SIDA*.<sup>9</sup>

From this perspective, *SIDA* is heavily influenced by urban traffic or ‘flow’. The available ‘flow’ options around today’s Chinese inner-city railway stations are normally limited to walking or the use of vehicles. Walking is advantageous because it supports the integration of urban life between a station and its node areas. Jan Gehl supports this idea, noting that pedestrians smooth the contact interface between humans and the urban environment, making urban lives more inviting. Vehicular flows are faster and more isolated and thus not well integrated for stretch activities between stations and urban areas.<sup>10</sup>

The above analysis allows us to hypothesize on *SIDA*’s permeability according to its observed ‘flows’. It is also feasible to configure the *SIDA* size based on walkable distances, ranging about 500–1,000 m away from the station. This hypothesis will be further verified in the case studies.

<sup>7</sup>. Weiyi Pan, “From Separating City to Creating Communication: A Case Study on Progression of Railway Station Renewal in the View of Urban Design,” *Huazhong Architecture* 4 (2010): 89-92.

<sup>8</sup>. Chun-sheng Ying (应春生) and Dong-lu Pu (濮东璐), “杭州城站地区城市设计,” *New Architecture* 1 (1999): 44; see also Lei Min and Huan Huang, “Urban Design of Comprehensive Transport Hub: A Case Study Of Hankou Railway Station,” *City Planning Review* 33, 8 (2009): 78.

<sup>9</sup>. Xiao-xing Zhang, “Development of the Urban Form in the Guangzhou Railway Station Area under the Transformation by Rail Transit Methods,” *Journal of South China University of Technology (Natural Science Edition)* 30, no. 10 (2002): 24-8; see also Xiao-shu Cao et al., “Research on function combination and spatial structure of construction land in Guangzhou railway station and railway eastern station area,” *Geographical Research* 26, no. 6 (2007): 1265-1272.

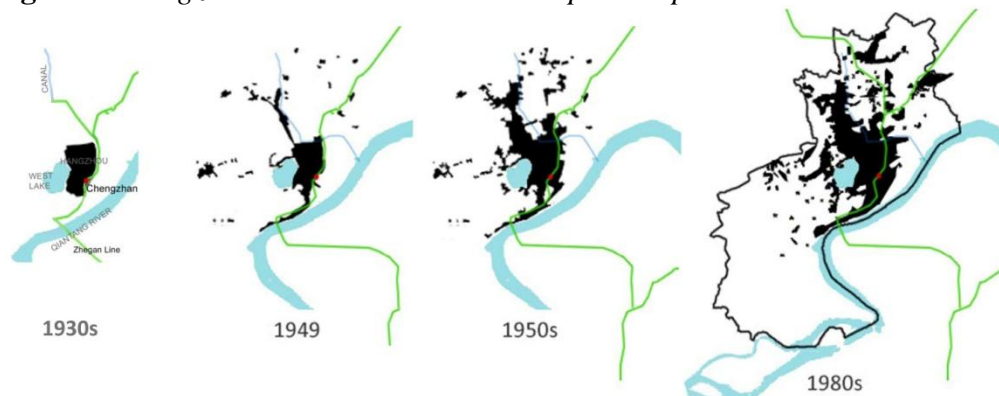
<sup>10</sup>. Jan Gehl, *Cities for People* (Washington, DC: Island Press, 2010), 43-46.

It should be noted that a large number of conventional stations have been upgraded/redeveloped during the recent rail infrastructure development process. This has substantially reshaped the relevant *SIDAs*, which are categorized and studied separately in scenarios one/two as below.

#### *Scenario One: SIDAs of Conventional Stations*

Chinese railway history dates back to the late imperial time of the mid-1800s, when most stations were sited on the edge of cities. With the sprawl of the urban footprint in the years that followed, most conventional stations were transformed into inner-city locations or even metropolitan centers. Figure 2 shows the Hangzhou Railway Station in the urban footprint of Hangzhou City between 1930s and 1980s as an example.

**Figure 2.** *Hangzhou Station and Urban Footprint Expansion*



Source: Author, image based upon Google Earth and literature synthesis.<sup>11</sup>

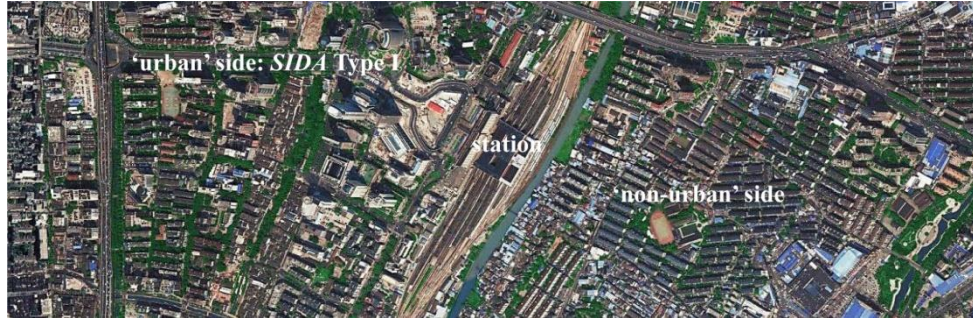
However, the early edge location has shaped most stations, which are accessible from the ‘urban’ side only, while the other side is isolated. This substantially unbalanced accessibility led to developments that vary sharply from one side to the other. The ‘urban’ side has the advantage of connections and therefore provides opportunities for large-scale developments to present a ‘gateway’ image. The ‘non-urban’ side, physically disconnected from the station and eventually dead-ending in urban roads, does not attract equal development interest and in some cases, has become a home to slums.

To summarize, we may observe one type of *SIDA* along the ‘urban’ side of a conventional inner-city station, featuring adaptive developments oriented at station operations. On the ‘non-urban’ side, there are spontaneous developments disconnected from station activities, thus not applicable to the *SIDA* definition as above (Figure 3).

<sup>11</sup>. Wei-min Que (阙维民), *杭州城世暨西湖历史图说* (Illustrated History of Hangzhou City and West Lake), (Zhejiang People's Publishing House, 1999); Hangzhou Archives (杭州市档案局), *杭州古旧地图集* (Collection of Hangzhou Ancient and Old Maps, (Zhejiang Ancient Books Publishing House, 2006); Jian Feng, “Spatial-Temporal Evolution of Urban Morphology and Land Use Structure in Hangzhou,” *Acta Geographica Sinica* 58, no. 3 (2003): 343-353.



**Figure 3.** 'Urban' (Left)/'Non-Urban' (Right) Sides across Hangzhou Station



Source: Google Earth.

*Scenario Two: SIDAs of Re-Developed Stations*

Along with recent improvements of the Chinese rail infrastructure, many conventional stations have been upgraded/re-developed to meet the increased rail demands. Three approaches to regeneration can be summarized from the observed cases:

'Extension': the conventional one-sidedly accessible station buildings were extended across the tracks to activate development on the 'non-urban' side. The isolated side is connected by modern urban transports, and in most cases, the redeveloped side expands far beyond its old footprint into the neighboring urban areas (Figure 4).

**Figure 4.** 'Extension' of Wuxi Station



Source: Google Earth.

'Expansion': old stations were demolished and rebuilt on the same location but with a much increased size and scale. In this case, the expanded stations' footprints cut into established urban areas around both sides of the old station nodes (Figure 5).



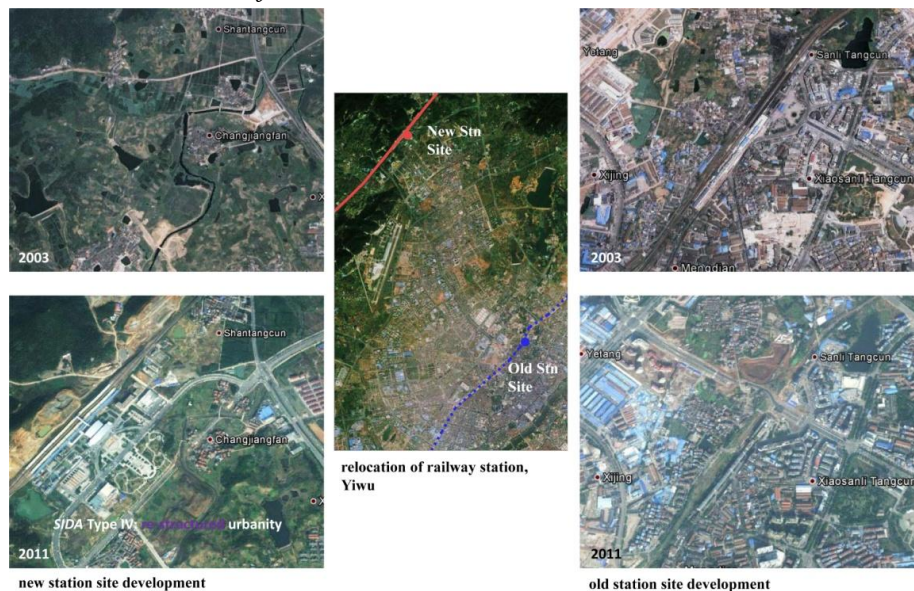
**Figure 5. 'Expansion' of Beijing South Station**



Source: Google Earth.

'Relocation': old stations were demolished and moved away from inner-city environments to eliminate the negative impacts of the rail tracks cutting through a city.<sup>12</sup> Thus, new stations are mostly relocated on the edges or even in remote areas away from cities (Figure 6).

**Figure 6. 'Relocation' of Yiwu Station**



Source: Google Earth.

<sup>12</sup>. Xinyu Wu and Leqi Jiang, "Making the Disused Railway Lines as the City Fast Traffic Track - Taking the Relocation of Yiwu Section of Zhegan Railway in its Electrification as an Example," *Planners* 21 (2005): 43-6.

Each of the above-mentioned station redevelopments results in a substantial reshaping of the established *SIDA*. In the extension/expansion mode, highly infrastructured new station development cuts into old urban fabrics, and the relationship between rail infrastructure and urban living experiences new challenges. This is summarized as Type II *SIDA* in the following discussions.

Developments around new stations relocated in urban peripheral areas are similar to the urbanization around the HSR stations. Proposals are often made for new towns of significant size around station sites, mostly oriented as self-sustaining satellite towns. This is beyond *SIDA* as a functional fragment in an urban context, therefore it will not be further discussed.

### *Summary of SIDA Types I–II*

The focus below is on *SIDA* Types I/II, both of which feature inner-city locations and, developing conversations with the immediate urban areas. However, different station–city relationships are observed in these two *SIDA* Types. In Type I, the conventional stations are comparatively mono-functional and rely heavily on facilities from immediate urban areas to support daily operations. In Type II, however, stations are well designed to integrate supporting facilities, for example, various transport connections.

## **Case Studies**

In this part, *SIDA* Types I and II are further studied through selected station cases: Xi'an and Beijing South Stations, respectively. Observed flows will be traced from inside a station to its node areas, to facilitate the analysis of *SIDA* permeability.

### *SIDA TYPE I: The Railway Station and Plaza Study*

Initially built in 1936, today's Xi'an Railway Station building was rebuilt on the same site between 1984 and 1990, with a total of about 28,000 square meters of floor area.<sup>13</sup> According to Yue Peng's statistics, this station served 29.94 million passengers in 2012,<sup>14</sup> gaining a reputation as 'one of the ten most important stations in China.'<sup>15</sup>

As a typical conventional railway station, Xi'an Station is sited near the outside of the city walls built during the Imperial Ming (late 1300s to mid-1600s). Because the boundary of Xi'an's urban footprint has expanded far beyond the old walls, today's location of the Xi'an Station has transformed from marginal to central in the metropolitan area (Figure 7).

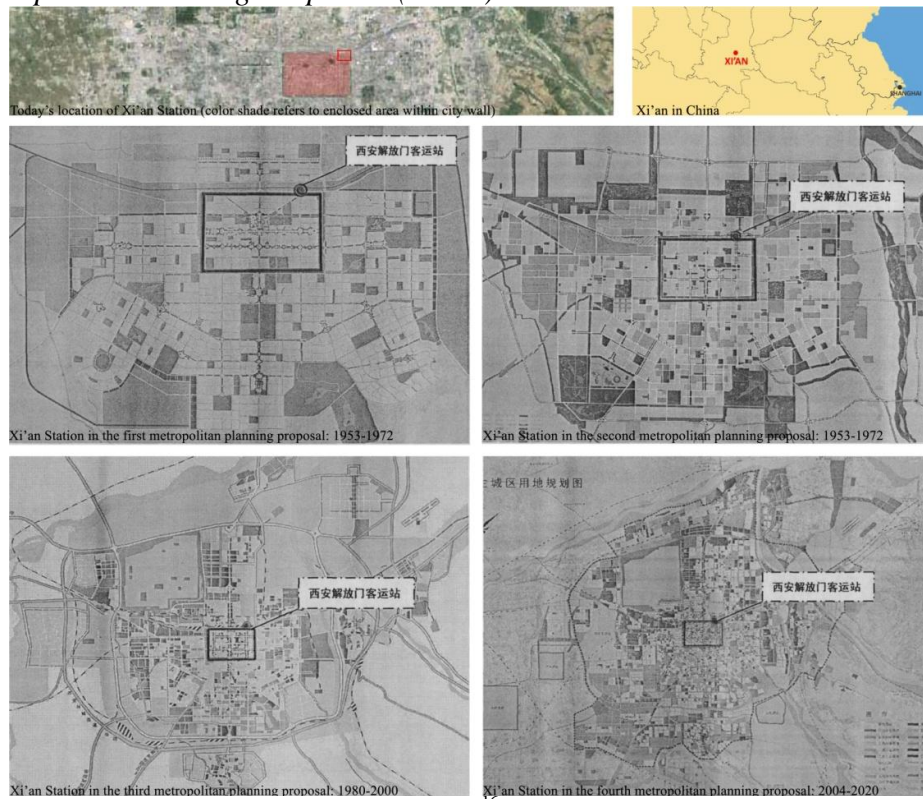
<sup>13</sup>. Tao Yang (杨寿) et al., “既有铁路站房改扩建形成综合交通枢纽的设计对策” *Railway Economic Research* 6 (2013): 74.

<sup>14</sup>. Yue Peng, “Study on Traffic Connection in Xi'an Railway Station Area,” *Value Engineering* 5 (2013): 126.

<sup>15</sup>. The original text in Chinese is: “我国十大特等客运站之一” Guo-hui Wang and Shu-xian Li (王国辉 李淑贤), “西安铁路客运站与城市交通的衔接研究” *Railway Operation Technology* 14, no. 2 (2008): 43.

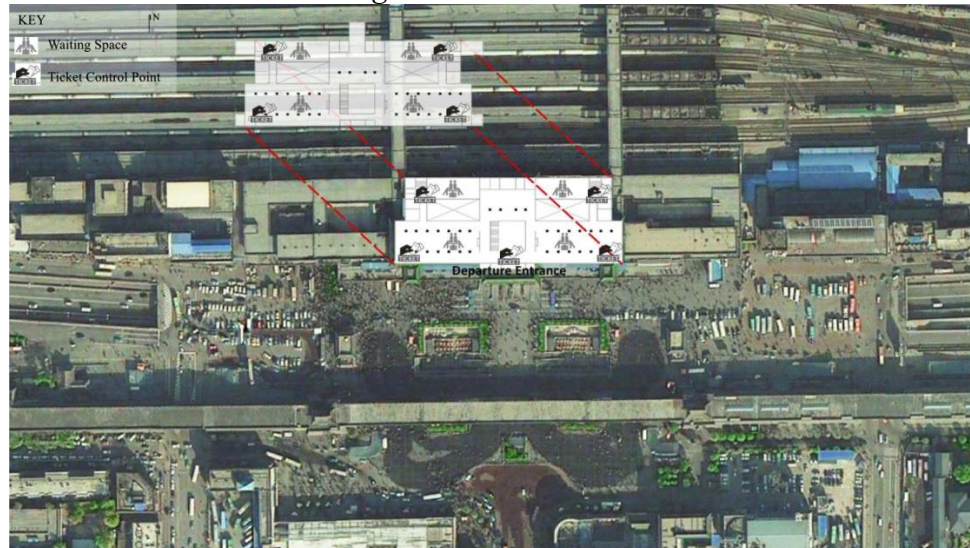


**Figure 7.** *Location of Xi'an (Up); Location of Xi'an Station in Four Metropolitan Planning Proposals (Down)*



Source: Google Earth; Image source: Lei Huang.<sup>16</sup>

**Figure 8.** *Xi'an Station Plan Diagram and Plaza Satellite Photo*



Source: Google Earth/China Railway.

Figure 8 shows a building plan diagram of Xi'an Station. A cluster of waiting lounges, serving departure passengers, comprises the main internal

<sup>16</sup>. Lei Huang, *Study on Planning for Xi'an JieFangmen Passenger Transport Hub*. Master Thesis (Xi'an University of Architecture and Technology, 2008), 70-71.

spaces. This waiting-oriented layout, strongly featuring stationary activities, represents one of the fundamental principles in the Chinese railway station design. Most of the lounges are mono-functional, with little or even no commercial facilities available.<sup>17</sup> This means that waiting is possibly the only activity available for most departing passengers.

In addition, ticket controls from the station plaza to the platform create a string of barriers, allowing departing passengers to move in only one direction (and vice versa for arriving passengers). The inflexible station flows, along with the waiting spaces that function like reservoirs to hold station users, defines the station as a non-permeable precinct for nearby urban residents.

The plaza, a large urban open square in front of the station building, has a size of 120 m north-south by 410 m east-west. It accommodates all the local connection services for the station. According to Yue Peng, the eastern end of the plaza is occupied by a tourism bus parking, the western half is for taxi queues and coach services connecting to regional destinations can be found on the south-western corner. Bus riders find service on the southern round about across the plaza.<sup>18</sup>

In general, as Xi'an Station is not connected to the metropolitan metro network<sup>19</sup>, the station's local connection services are mostly provided by vehicular transports squeezing within and around the plaza area. For pedestrian passengers, the plaza is huge and requires walking a long distance to access the station building. We may therefore find highly mixed 'flows' of people and vehicles on the plaza surface. These flows vary in scale, direction and speed. Despite its significant size, the plaza must achieve a sensitive balance between different flows. This results in a complicated layout of fenced lanes that direct traffic arriving/leaving the plaza, forcing all surface movements into one-dimensional activities.

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<sup>17</sup>. Jian-hong Zhou (周建宏), "论近期我国特大综合型铁路旅客站建筑创作" *Architectural Journal* 4 (1990): 11.

<sup>18</sup>. Yue Peng, "Xi'an Railway Station Area," 126.

<sup>19</sup>. At the time of the author's visit, there was no metro service available in Xi'an Station.

**Figure 9.** Xi'an Station Plaza: West, Middle, East (Up)/Panorama (Down)



Source: Author.

As a whole, the station plaza is fully dedicated to local connections with rail services, creating another homogeneously functioning urban space beyond the station building. Ironically, there are two sunken spaces in the middle of the plaza providing dining facilities for passengers. However, as Yue Peng suggests, these sunken spaces should be transformed as they ‘seriously split the plaza into fragments and create un-smooth passenger flows; detours around increase walking distances and generate further crossings.’<sup>20</sup>

The functionally un-inviting plaza discourages use by other urban users from nearby urban areas and inhibits the potential to develop comprehensive urban lifestyles, presenting itself as a huge, busy urban area without desirable amenities (Figure 9).

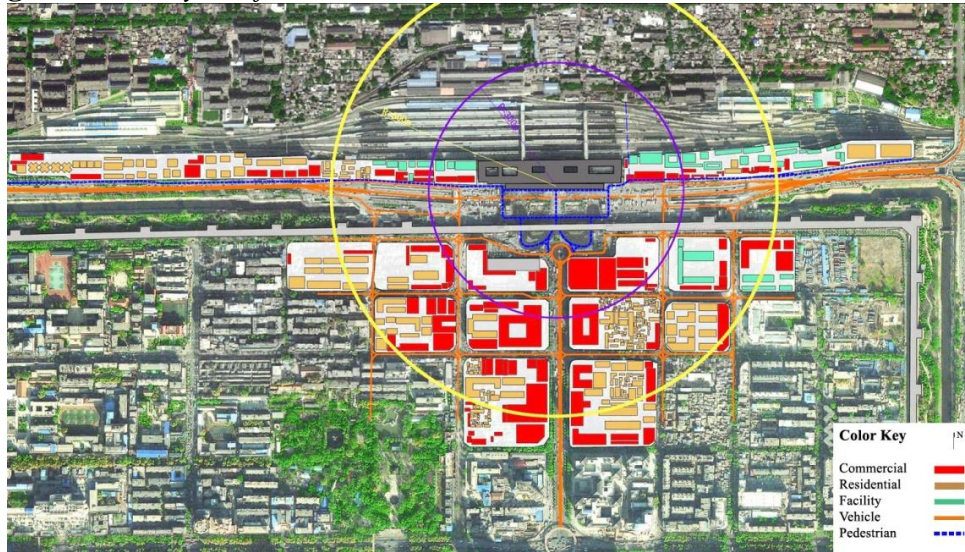
#### *SIDA TYPE I: The Station Node Precinct Developments*

Extending studies into the station node’s urban fabric, we may find two different ‘flows’ shaped along two directions: perpendicular (north-south) and parallel (east-west) to the rail tracks. Urban developments along these two paths are influenced accordingly, generating urban lives with unequal qualities (Figure 10).

<sup>20</sup>.The original text in Chinese is:  
“对广场起到了严重的分割作用，使得乘客流线不够畅通，经过的客流需绕道而行，走行距离远且交叉严重”  
Yue Peng, “Xi'an Railway Station Area,” 128.



**Figure 10.** *Analysis of Immediate Urban Areas around Xi'an Station*



*Source:* Google Earth.

First, in the north-south direction, local connections are dominated by vehicular traffic. This is the prime direction linking the railway station to the most metropolitan destinations. Vehicles are heavily used for travel here as no metro infrastructure is available. Walking between the station precinct and nearby areas in this direction is mostly done by passengers travelling between the station and its facilities in the urban area; for example, the bus/coach station and commercial buildings on the southern edge of the plaza. Beyond this scope, passengers normally travel with vehicles to/from metropolitan destinations.

The two blocks next to the southern edge of the plaza function fully oriented to the station's demands. The western block is occupied by a coach station, and the eastern one features a hotel, restaurant and retail shops. Both blocks lie within a 150-m radius away from the station building, and, as observed, they are heavily visited by people heading to/from the station.

Beyond these two ‘station dedicated’ blocks, influences from the station are still visible, but they gradually fade as distance increases. An example of this is the shrinking size of commercial facilities that serve station passengers, from block-scale high-rise complex buildings near the station to street-edge ground-level shops farther away. This influence extends about 450 m away from the station.

Secondly, in the east-west direction, there is an artery road linking to regional destinations in Xi'an. Vehicles travel faster on this 60-m-wide road, which creates not only a barrier for road crossers but also a pedestrian corridor along the road for station users travelling shorter distances in this direction. In fact, pedestrian flows stretch much further in this direction than in the north-south direction.

The urban development here also corresponds to the pedestrian flow. The un-crossable road pushes pedestrian traffic exclusively to one side, and therefore development happens only within a linear space between the road and rail tracks, extending about 1 km east-west on both sides of the station. Urban

blocks in the east-west direction are courtyard structures and generally 50 m deep; only half of the depth of those blocks along the other direction.

Within the linear developments, there is a mixture of urban functions rooted deeply in the rail's infrastructure, including rail facilities such as apartments (for rail employees), electrical services and logistic warehouses. In addition, passengers can find food and beverages, accommodation (hotels) and grocery stores along this road. Architecturally, the street edge is partly occupied by shops with similar widths and is decorated by billboards that range widely in color and style. The buildings are mostly 2–3 stories high, and none are higher than 6 stories. Generally, urban images and experiences are comprised of a cluster of widely varied buildings for different people that are closely involved in station living.

To summarize, along the two directions that extend from the Xi'an Railway Station, we may find urban development and lives that were shaped by the different qualities of permeability, as discussed above and further explored below (Figure 11):

**Development scale:** Large-scale developments occupying an entire city block present a grand image along the north-south direction, where strong 'planning wills' are evident. On the eastern-western direction, the much-smaller developments indicate a kind of 'spontaneous growth'.

**Function/user:** Developments along the north-south direction are comparatively homogeneously defined. Retail shops and hotels are the most common facilities apart from transport, and they are fully targeted to station passengers. Along the east-west direction, urban blocks are used for residential buildings, retail shops and industries serving the station and its infrastructure. In this scenario, users are still closely related to the station but come from varied backgrounds with diverse purposes in urban life.

**Influence radius:** Station-related developments along the east-west direction stretch much further than those along the north-south direction. This is a response to the different pedestrian flows along the directions, as analyzed above.

**Figure 11.** *Paranomas along East-West (Up)/North-South (Down) Directions*



Source: Author.

*SIDA Type II: The Railway Station and Plaza Study*



According to Zhi-qi Li and Song-tao Li, today's Beijing South Station can be traced back to the Majiapu Station, which was built in 1897. After much reconstruction and expansion, the station was named Beijing South in 1988 and primarily served 'low speed trains and trains operated at medium-short distances.'<sup>21</sup>

As one of the key infrastructures of the 2008 Beijing Olympic Games, the old station was vastly expanded in 2006 from an insignificant station into 'one of the largest railway terminal buildings in Asia'<sup>22</sup> (Figure 5/12).

The station has 13 platforms and 24 track lines, with a total floor area of around 250,000 square meters.<sup>23</sup> According to Arup, the station is predicted to serve 105 million passengers annually in 2030, or about 286,500 daily, peaking at 33,300 per hour.<sup>24</sup> Compared to the Xi'an Station, Beijing South's much larger station size accommodates a significantly increased number of passengers.

**Figure 12.** *Beijing South Station from Air*



Source: [http://slide.news.sina.com.cn/c/slide\\_1\\_19411\\_17992.html#p=1](http://slide.news.sina.com.cn/c/slide_1_19411_17992.html#p=1).

The design of the station's flow further distinguishes Beijing South from Xi'an. Conventional two-dimensional station connections, which heavily rely on plazas, were re-structured into three dimensions, following a 'zero distance

<sup>21</sup>. The original text in Chinese is: “以慢车和短途运输列车为主” Zhi-qi Li (李志启), “新北京南站六大特色,” *Chinese Consulting Engineers* 104, no. 4 (2009): 8; see also Song-tao Li (李松涛), *Research for Space Pattern in Area of High-speed Railway Station*. Doctoral Thesis (Tianjin University, 2010), 196-197.

<sup>22</sup>. The original text in Chinese is: “亚洲最大的铁路枢纽站房之一” Mu Wang et al., “Great Landmark and Municipal Railway Pivot: Design and Creation for New Beijing South Railway Station,” *World Architecture* 8 (2008): 38.

<sup>23</sup>. Mu Wang (王穆) et al., “以火车站为中心的综合交通枢纽——新建北京南站的设计与创作” *Architectural Journal* 4 (2009): 24.

<sup>24</sup>. Arup, “Beijing South Railway Station, China,” *Urbanism and Architecture* 4 (2010), 60.

connection' principle. The available range of station transports, such as HSR, normal rail, metro, taxi, bus and vehicles, are housed under one roof with vertical connections to maximize the station's operational efficiency.

According to Mu Wang et al., Beijing South Station has five stories, two of which are above ground. The elevated departure lounge is served by a roadway in front of its entrances. Departing passengers descend from gates inside the lounge to the platforms, which are on ground level. The next level down serves arriving passengers and has a double-deck parking garage. There are two metro services on the next two levels<sup>25</sup> (Figure 13).

**Figure 13.** Section of Beijing South Station



Source: Mu Wang et al., "Great Landmark and Municipal Railway Pivot": 44-45.

Beyond the complicated departure/arrival flows, Beijing South shares a design philosophy with the Xi'an Station. First, rail passengers are guided according to a 'one-way' principle with many controls for both departing and arriving passengers. This means that the station does not accommodate people who are not train passengers. Second, the main spaces, such as the waiting lounge, are mostly mono-functional. There may be a few grocery stalls in the lounge, but they are mostly on the edge and in the corners, and they only serve passengers. Unfortunately, the much-improved connections of Beijing South do not bring more urban users into the station life.

#### *SIDA TYPE II: Developments of Station Node Areas*

Again, we start from 'flows' to investigate the urban areas around Beijing South Station. According to Mu Wang et al., the station's internal road system<sup>26</sup> 'is connected with the metropolitan skeleton road network on multi directions at multi levels.'<sup>27</sup> There are two metro lines, number 4 and 14, which further transform the station into an urban transport network.

In terms of the usage percentage of the above transports, Chun-xia Gao et al. discovered that 46% of station visitors travel by metro, 13% are bus riders, 26% use taxi services, 14% travel by other vehicles and 1% use an unknown method.<sup>28</sup> Yuanjun Zhou presents another study that claims that the metro

<sup>25</sup>. Mu Wang (王穆) et al., "以火车站为中心的综合交通枢纽" 24-25.

<sup>26</sup>. Includes roadways on elevated, ground and underground levels for all vehicles serving the station.

<sup>27</sup>. The original text in Chinese is: "多层面、多方向上与市区骨干路网顺畅衔接" Mu Wang et al., "Great Landmark and Municipal Railway Pivot," 41.

<sup>28</sup>. Chun-xia Gao et al., "Analysis of Passenger Flow of Beijing South Station," *Logistics Technology* 230-231 (2010): 19.

serves 67% of station visitors, buses serve 14%, taxis serve 13% and other vehicles serve 6%.<sup>29</sup> Despite the variations between the researches, both conclude that few passengers walk between the city and the station. This indicates that the Beijing South Station operates on a much-expanded regional scale, heavily relies on urban transport and considers pedestrians to be of little importance.

In addition to decreasing the number of pedestrians, the station is physically isolated from its urban context. For instance, as the plaza is no longer needed to accommodate station connections, two empty but well-landscaped open squares were built on either side of Beijing South Station. Also, the large-scale artery roads that travel around the station building form a barrier to pedestrians.

This isolation strongly negatively influences urban developments around the station node. In 2006, along with the station's expansion proposal, the local government planned the ambitious 'Beijing South Station Economical Circle.'<sup>30</sup> Taking advantage of station passengers, this plan aimed to develop a new commercial environment that 'highlights the business identity, such as offices and logistics.'<sup>31</sup> However, this proposal, as can be observed, was hardly implemented.

Song-tao Li studied the impact of the Beijing South Station on nearby areas, finding that 'the area development...is generally very slow...the station is physically detached from nearby areas.'<sup>32</sup> Xue Hou et al. performed a more in-depth review of the station node's development. They found that within a 500-metre radius from the station building, there are nearly no facilities that serve station passengers, and the walkability of the area is poor<sup>33</sup> (Figure 14).

<sup>29</sup>. Yuanjun Zhou, *Large Railway Passenger Station Plaza Space Post Occupancy Evaluation (POE)*. Master Thesis (South West Jiaotong University, 2013), 63.

<sup>30</sup>. The original text in Chinese is: “北京南站经济圈”, Yue-jia Fu (付昱佳), “北京南站孕育新商圈” (New Business Precinct Proposed for Beijing South Station), In *Beijing Business Today*. B4, 10 March 2008.

<sup>31</sup>. The original text in Chinese is: “突出商务概念, 如商务办公、物流商业,” interview of Chao-gang Li (李超纲), District Chief, Fengtai District, Beijing, reported by Yue-jia Fu (付昱佳), 10 March 2008.

<sup>32</sup>. The original text in Chinese is: “从整体上看南站周边区域发展较为缓慢……南站整体上与周边区域还呈现出一种形态上的脱离状态” Song-tao Li, *Research for Space Pattern*, 208.

<sup>33</sup>. Xue Hou et al., “Study on the Influence of Regional Development around Station of HST-Taking Beijing South Station as an Example,” *Urban Studies* 19, no. 1 (2012): 43.

**Figure 14.** *Urban Pattern and Function Analysis of Areas around Beijing South Station*



Source: Google Earth/Baidu Map.

#### *Summary of SIDA Types I/II*

In terms of the station/plaza design, *SIDA* Types I and II present substantially different configurations for a station's flow and connections. However, this does not convert a station from a rail infrastructure into a destination of daily urban lives. The poor permeability of urban life into the stations means that passengers are the only clients invited into a station's precinct.

On the other hand, *SIDA* Types I and II perform differently regarding the influence of the station on the city. Influences of the station on the urban area are found around the *SIDA* Type I, although the quality of these influences varies along different directions. For the *SIDA* Type II, the station is closed off despite the increased physical size and operational capacity.

#### **Conclusions**

This research determined that a high permeability of urban lives between a railway station and its immediate urban area is important for achieving the integration of both precincts. This integration helps stations transform from neutral transport nodes into diverse urban destinations while allowing the development of a close relationship between the station and the city's identity.

This paper also reveals that pedestrian 'flows' are fundamental for establishing sufficient permeability, which means that the physical scope of a *SIDA* is based on the distance passengers that are willing to walk. However,



this distance varies in different contexts, as observed in the case of the Xi'an Station.

The increased capacity of Chinese HSR infrastructure means that the population of an expanded geographical area may become rail clients in the future. Stations must rely more on motorized urban transports to support their operations.

However, this does not mean that the walking 'flows' in and around a HSR station should be of little importance. Beyond the *SIDA* scenarios of the inner-city stations, HSR infrastructure looks at powering developments of a whole new town, which is built on full integration between station and city. This integration, as learned from above, is shaped by permeability through the pedestrians. It is therefore important to challenge the current templates of the station and its node area planning and design, and reinvent new relationship between station and city (Figure 15).

**Figure 15.** *New Town Development around Hangzhou HSR Station*



Source: Hangzhou Urban and Rural Planning and Design Institute.

## Bibliography

- Arup. "Beijing South Railway Station, China." *Urbanism and Architecture* 4 (2010).
- Cao, Xiao-shu, K. Zhang, L. Ma and X. Yan. "Research on function combination and spatial structure of construction land in Guangzhou railway station and railway eastern station area." *Geographical Research* 26, no. 6 (2007).
- Feng, Jian. "Spatial-Temporal Evolution of Urban Morphology and Land Use Structure in Hangzhou." *Acta Geographica Sinica* 58, no. 3 (2003): 343-353.
- Ferrarini, Alessia. *Railway stations: from the Gare de l'est to Penn Station*. Milan: Electaarchitecture, 2005.
- Fu, Yue-jia. "北京南站经济圈," [New Business Precinct Proposed for Beijing South Station.] In *Beijing Business Today* B4, 10 March (2008).
- Gao, Chun-xia, B. Dong and Q. Li. 2010. "Analysis of Passenger Flow of Beijing South Station." *Logistics Technology* 230-231 (2010).
- Gehl, Jan. *Cities for People*. Washington DC: Island Press, 2010.

- Guo, Fu-shou, “郑州火车站广场将修建10座人行天桥,” [Ten Pedestrian Flyovers to be Built for Zhengzhou Railway Station Plaza.] In *Henan Business Daily* A20, 13 October (2011). <http://bit.ly/1HPXNR6> [accessed November 24, 2015.]
- Hou, Xue, W. Zhang, G. Lv and Z. Hu. “Study on the Influence of Regional Development around Station of HST-Taking Beijing South Station as an Example.” *Urban Studies* 19, no. 1 (2012).
- Huang, Lei. *Study on Planning for Xi'an JieFangmen Passenger Transport Hub*. Master Thesis. Xi'an University of Architecture and Technology, 2008.
- Li, Hui-min. *The Study of the Development of History and Design of Hangzhou Station*. Master Thesis. Zhejiang University, 2012.
- Li, Song-tao. (李松涛) *Research for Space Pattern in Area of High-speed Railway Station*. Doctoral Thesis. Tianjin University, 2010.
- Li, Zhi-qi. “李志启) “新北京南站的六大特色” [Six Features of New Beijing South Station.] *Chinese Consulting Engineers* 104, no. 4 (2009).
- Lin, Chen-hui, L. Ma and S. Yang. (林辰辉,马林,杨少辉) “高铁及枢纽建设对城市发展影响的研究综述” [Review of Research on Urban Development Impacts from High-Speed Rail and Terminal Developments.] In *中国大城市交通规划研讨会论文集* [Proceedings of the China Metropolitan Transport Planning Conference.] Suzhou, China, 2010. DOI= <http://bit.ly/1NAK11H>. [Accessed November 24 2015.]
- Min, Lei and Huan Huang. “Urban Design Of Comprehensive Transport Hub: A Case Study Of Hankou Railway Station.” *City Planning Review* 33, no. 8 (2009).
- Pan, Weiyi. “From Separating City to Creating Communication: A Case Study on Progression of Railway Station Renewal in the View of Urban Design.” *Huazhong Architecture* 4 (2010).
- Peng, Yue. “Study on Traffic Connection in Xi'an Railway Station Area.” *Value Engineering* 5 (2013).
- Wang, Guo-hui and Shu-xian Li. (王国辉,李贤淑). “西安铁路客运站与城市交通的衔接研究” [Research of Connections between Xi'an Railway Station and Urban Transport.] *Railway Operation Technology* 14, no. 2 (2008).
- Wang, Jiao-e and Jin-xue Ding. (王姣娥,丁金学) “High-Speed Rail and Its impacts on the Urban Spatial Structure of China.” *Urban Planning International* 26, no. 6 (2011).
- Wang, Mu, C. Wu and L. Wang. “Great Landmark and Municipal Railway Pivot: Design and Creation for New Beijing South Railway Station.” *World Architecture* 8 (2008).
- Wang, Mu, C. Wu, T. Z. Zhou and L. Wang (王睦,吴晨,周铁征,王莉) “以火车站为中心的综合交通枢纽——新建北京南站的设计与创作” [Integrated Transport Complex Centered by Railway Station - Design and Creation of New Beijing South Station.] *Architectural Journal* 4 (2009).
- Wu, X. and L. Jiang 2005. “Making the Disused Railway Lines as the City Fast Traffic Track - Taking the Relocation of Yiwu Section of Zhegan Railway in its Electrification as an Example.” *Planners* 21 (2005).
- Yang, Tao, C. Han, S. Lu and A. Li (杨涛,韩超,芦守义,李阿萌) “既有铁路站房改扩建形成综合交通枢纽的设计对策” [Design Tactics of Reconstruction and Enlargement of Existing Railway Station into Integrated Transport Hub.] *Railway Economic Research* 6 (2013).
- Ying, Chun-sheng and D. Pu (应春生,濮东璐) “杭州城站地区城市设计” [Hangzhou Railway Station Area Urban Design.] *New Architecture* 1 (1999).

- Yu, Tao, Z. Chen and P. Zhu “Characteristics and Mechanism of High Speed Rail-driven Suburbanization in China: A Case Study of Beijing-Shanghai High-speed Rail.” *Scientia Geographica Sinica* 32, no. 9 (2012).
- Zhang, Xiao-xing. “Development of the Urban Form in the Guangzhou Railway Station Area under the Transformation by Rail Transit Methods.” *Journal of South China University of Technology (Natural Science Edition)* 30, no. 10 (2002).
- Zhou, Jian-hong. (周建宏) “论近期我国特大综合型铁路旅客站建筑创作” [Architectural Design Review of Large Railway Station Complexes of Recent Years in China.] *Architectural Journal* 4 (1990).
- Zhou, Yuanjun. *Large Railway Passenger Station Plaza Space Post Occupancy Evaluation (POE)*. Master Thesis. South West Jiaotong University, 2013.