The regeneration of public building space in an urbanised centre
The future planning of Jinan Railway Station and its surrounding space

By
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Master Thesis Explanatory Document

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Abstract

Presently, with the continuous growth of the economy in China, urbanisation has developed rapidly. The increasing urban population has put significant pressure on many of the original public building spaces in the city centres. The pressure of high levels of urbanisation in China not only has severely damaged the original relationship between architecture and the city, but also reduces the quality of life for urban residents. Public buildings and spaces are the places where the population gather together and are vital landmarks of a city. Therefore, there needs to be a harmonious relationship between public building space and the urban fabric, as they manifest the economics and vitality of the city. This project concentrates on how to regenerate the public building spaces in the city centre. It focuses specifically on redesigning Jinan Railway Station (Jinan, Shandong) and its surrounding context.

This project is based on the exploration of urbanisation, urban design and public building space theories. Furthermore, it combines the advanced design concepts, some important precedent studies of contemporary railway stations from around the world and the city’s unique cultures to create the appropriate design approaches for the new Jinan Railway Station. The future design intention for the Jinan Railway Station is to entirely remove the original building and replace it with a multi-functional building complex. Traffic system services within the new design include not only trains but also extend to a subway line and space for buses, taxis and private cars. New technology such as E-ticketing and security lights will be used in a variety of public places within the design to make the architectural form and space of the complex more open, also to ensure maximum safety of passengers and commuters.

Ultimately, the outcome of this project is a railway station and surrounding transit squares design that responds to the demand for rapid urbanism and promotes effective transportation of people through Jinan city centre. This design will transfer Jinan Railway Station and its surrounding space as an urban landmark station public space that supports a harmonious relationship between Jinan city’s people and the station.
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1.0 Introduction
1.1 Background of project

With the rapid urbanisation in China, city areas are continually extending outward due to large numbers of people migrating from rural communities to the city. The original public buildings and facilities in the city cannot meet the existing population and economic needs. As Dr Yan Song, who is a director of the programme on Chinese cities at the University of North Carolina, said “existing infrastructure has restricted the development of modern, market-led cities, which require financial centres, commuting routes and residential areas”\(^1\). Thus, many new public buildings, such as those designed for transportation, culture, education and medicine, are built on the city edge.

In the rapidly growing City of Jinan, China, “policy sprawl”\(^2\) is particularly evident. As the urban area continues to expand, the public transport facilities in Jinan are also gradually improving to meet the needs of social development and passenger service. For example, the Jinan West Station and the upcoming East Railway Station (see Fig-1) on the edge of the city, which combined with the subway are to be built in 2018, have huge capacity and extensive facilities. It will not only properly alleviate the pressure of urban centres, but also promote the economic development of the urban periphery.

The original Jinan Railway Station is one of the earliest historic Gothic traffic buildings (see Fig-2), which could no longer accommodate the transportation development. Xie Yutang, the deputy mayor, ordered the dismantling of the original Jinan Railway Station and commented: “it reminds me of the suppression Chinese people have suffered in history. The lofty green

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dome looks like the helmets of Hitler’s army”. However, the reconstruction of the Jinan Railway Station and its transit plaza built in 1995 could not meet the current demand of scale and functions, nor at the same time, those affected by the traffic and economic development as well as the original order of the city.

Over the past 20 years, and continuing up to the present time, the Jinan Municipal Government has been determined to adjust and rebuild the city centre in order to strengthen the central district of the city by shaping parts of the urban environment. They have emphasised, too, that the planning for, and construction of, landmarks such as railway stations should reflect the urban image and local characteristics by maintaining the features and the overall pattern of the city’s highlights. In the future, with the development of Jinan City Centre to the north, Jinan Railway Station will become the centre of the city and have an important role to play in both transportation and the economy. How to redevelop Jinan Railway Station and the plazas surrounding this area to solve traffic problems in the downtown area while meeting future city needs becomes the focus of this project.
Figure 1 - Railway stations in Jinan city.  
(Image by Yanan Li, 2018)
1.2 Project outline

Based on urban and architectural design theories, this project explores the future development of public buildings and spaces in urban centres in urbanised China. The project takes Jinan Railway Station as the object of exploration. Through examining the history of railway station development and the historical background of Jinan Railway Station, insights are offered as to the ways in which railway station design has been transformed around the world. These insights also provide a basis for the design work in this study and are utilised in combination with important contemporary architectural precedents and knowledge. Following the premise of meeting Jinan’s future urban development needs, the station and its surrounding areas will be regenerated so as to become one of the essential multi-functional urban complexes in the city. The redesign of the railway station is strongly focused on meeting the needs of both contemporary Jinan city inhabitants as well as Jinan city dwellers into the future.
1.3 Aims/ Objectives of the project

This project aims to reconcile the Jinan Railway Station and its surrounding transit squares in Jinan’s city centre to conform to the urban texture and retain the characteristics of the city. At the same time, it can promote the economic development of the whole region under the premise of satisfying the larger passenger flow and can bring more vitality.

The redevelopment of Jinan Railway Station and its surrounding areas also has a broader aim: to better understand the relationship between public building space and cities in urbanised China. The examination of crucial precedents can help to forecast the future development trends of public buildings in the city centres through research.

The new train station and transit squares will be re-planned as a city complex in the city centre. In the form and space design of the railway station and the plazas, it will be combined with typical cultural features of Jinan, such as courtyards and water. The orientation of the building development should conform to the direction of the railways and the pedestrians. The volume of the building needs to take the surrounding buildings and street scales into consideration. The new Jinan Railway Station and its transit squares will combine different means of transportation and a variety of functions to meet the current and future needs (including those of transportation, shopping and leisure) of passengers and nearby residents.
1.4 Research question

How can city-centre public buildings be regenerated in urbanised China?

1.5 Scope and limitations

The purpose of this project is to explore the relationship between public building space and urban planning through research and analysis of Jinan Railway Station and its surrounding areas. The final design focuses on understanding the relationship between the Jinan Railway Station area and urban planning in Jinan’s urbanisation process. Based on the history and geography of the city, the project will concentrate on people’s feelings about, and activities associated with, open areas, the economy, traffic, facilities, and the overall environment in order to stimulate the economic development and meet the urbanisation demands of this area. Because the design of the project is based on the status quo of Jinan’s urban development and needs to combine local urban texture and urban characteristics, it has certain geographical and cultural limitations. Therefore, the results of the project may apply to the development of public buildings and spaces in other cities in China, but not necessarily beyond China.
1.6 State of knowledge in the field

This section firstly explores the problems of urbanisation development in China and identifies some solutions based on urban design theories. Secondly, it examines the relationship between buildings and cities to understand the importance of, and measures required, for developing urban public building space under urbanisation. Thirdly, the introduction of high technologies that could influence or change the space and form of railway stations and other public buildings in the future is highlighted. Finally, through the analysis of the design concepts and traffic flow of some advanced railway stations around the world, the future development trend of the Jinan Railway Station area will be planned.

The development of urbanisation in China has caused severe environmental problems; in particular, the dense population distribution in urban centres has resulted in more vehicles on the road and, thus, increased traffic congestion and air pollution. One of the design theory solutions is the “urban organic renewal” proposed by Professor Liang, which is based on an analysis of the current situation in China. The theory intends to maintain the overall harmonious relationship between architecture and cities, which is the key to improving the quality of cities thereby reducing the impact of urbanisation.

Because public buildings and spaces are the gathering places of the population, the relationship between good public building spaces and cities is the basis for ensuring high-quality development of the cities. However, China’s rapid development has made the city’s public building space lack local culture and heritage. In particular, lots of railway stations located in the centre of Chinese cities, such as Jinan Railway Station, stand apart from individuals and have no connections with the city textures or functions. This situation brings a lot of inconvenience to train passengers. If these railway stations are developed as multi-functional urban complexes, in line with the principle of “urban catalyst” proposed by Aldo Rossi, not only will cramped urban spaces be avoided, but also the economic development of the areas will be improved. Moreover, such urban complexes can promote the harmonious relationship between people, cities and architecture. In addition, high technologies are continually improving the quality of public buildings. For instance, the use of “Ticketless technology” and “Virtual Ticketing Agents” has simplified the process of ticket checking, as well as changing the space and form of public buildings, which will make future public building spaces more open.

Many new railway stations around the world have implemented multi-functional development strategy projects. They are not only transportation hubs, but also parts of the urban fabric. For example, the designs for the Kyoto Railway Station in Japan and the Berlin Railway Station in Germany integrated transportation, shopping, leisure facilities, offices and other functions, which is conducive to integration into the urban fabric and becoming part of the city’s function. Other examples are the Beijing South Railway Station and the Shanghai South Railway Station. Both of these draw on the form of the ‘viaduct’ at the entrance of the airport terminals; thus the three-dimensional transit design can meet the requirements of urbanised China.

All in all, the advanced design characteristics of new railway station areas worldwide can be considered in the redevelopment of the Jinan Railway Station area. They suggest a trend that could be followed into the future. By taking new technologies and China’s national conditions into consideration, this project’s railway station complex is designed to be the catalyst that sees Jinan City shift from having a single transportation function to hosting a multi-functional comprehensive development.
1.7 Methods -- Research Methodology

• Topology
The primary driver of this research project is the site information. The location selected is the railway station area of Jinan City Centre. First of all, the study comprehensively analyses the distribution of the railway station area. This includes the geographic location of the train station, the context of the surrounding zone, and the distribution and value in the use of public space and green space. Jinan Railway Station, as a large public transportation building, has become the hub of the city centre; therefore investigating the traffic flow is particularly important. Secondly, an analysis for the purpose of understanding the structural systems, planning, and materials of the Jinan Railway Station is carried out in preparation for the later stage of designing. Thirdly, points of urban planning are highlighted in order to understand Jinan’s city planning and, in particular, to clearly define the impact of Jinan Railway Station on the structure of the town. It is essential to take the large public building design principles and the original city texture into consideration so as to find and express the best relationship between the space, public buildings and the city by using graphical analysis.

Moreover, this research project will collect information about China’s urbanisation to understand its impact on particular contexts on Jinan city, which will be helpful in predicting the future use of the railway station in the centre of Jinan.

• Precedents
It is also necessary for future design to collect and analyse considerable precedents of the public building or the renewal of cities from both Eastern and Western countries. The precedents will inform the focus on re-use of public building space to make a harmonious relationship between public building and human activities.
• Design
The design of this project is based upon the collection of previous research information on urbanisation in China, Jinan City Centre city planning, and Jinan Railway Station and its surrounding areas in order to find out the most suitable approach to recreating the railway station. The priority is to adopt the most economical means and sustainable technologies so as to solve the contradictions between urbanisation and public building space and to stimulate the city economy.

This research project focuses on solving the contradiction between increasing urbanisation and the abandonment of public buildings and the consequent problems thereof. Under the principles of design specifications, people’s wishes should be put before economic benefits.

Because this study does not involve interactions or interviews with subjects, and is primarily based on research, an application for ethical consideration was not necessary.

1.8 Ethics and Considerations
2.0 Context Research

With the rapid development of urban rail transit in China, railway stations have become an indispensable part of a city’s function. Railway stations provide the important links between transportation systems, human activities and urban areas. From small wayside facilities to integrated transportation hubs to urban complexes, train stations in different historical periods have played different roles in urban design.

This section of the thesis briefly summarises the history of the development of railway stations around the world so as to understand the structures, materials and functions of railway stations in different periods. Following this, an introduction to the historical background of Jinan Railway Station is offered. In addition, an analysis of the Jinan Railway Station and the surrounding areas from different aspects, such as the geographic location, traffic, passenger flow, culture, climate and environment, is undertaken. This analysis is provided to understand the advantages and disadvantages of the station and the surrounding areas.
2.1 A history of railway stations

Since the first steam engine train was used in early nineteenth century England, railways have become a major means of transportation, especially in Europe and the United States. With the development of building technology, including advances in structures and materials, the construction of railway stations has become more diverse. They have also been designed to meet new functions and often have become more culturally significant.

The Bristol Temple Meads Station (see Fig-3) in London, which had a roof that spans 22 meters, was one of the earliest railway stations built in the nineteenth century. This station was designed by Isambard Kingdom Brunel, who was one of most famous engineers at that time. He created a semi-enclosed, large, wide space by opting for a hammer beam timber construction. A decade,
the London Paddington Station (see Fig-4) was built. It was designed by Matthew Digby Wyatt and Isambard Kingdom Brunel. The iron spans and glazed roof made the shed space additionally spacious and bright. Furthermore, the service target of the railway station was also transformed to incorporate cargo freight alongside passenger transportation.

Julian Ross thought the grandest stations seemed to “rival the great cathedrals and palaces”\(^8\). For example, Gare de l’Est (see Fig-5) in Paris was based on the similar materials and technology to the English stations, though the structure and facades of this station were bolder and more forthright. The generous concourse of Gare de l’Est provides ticket offices, shops and more waiting space for passengers; the magnificent architectural volume and distinctive half rose

Figure 4 - Paddington Station in the Victorian era
(Period Post Card)
window ensured that the station became one of the iconic landmarks in Paris.

In 1863, with the rapidly increasing population of London’s city centre, the first underground Metropolitan Railway system (see Fig-6) was built. This development addressed the problems of traffic congestion, and also allowed for the maintenance of original street style.

In Germany, designers were the first to combine a viaduct (a bridge composed of several small spans for forming an overpass or flyover) with the design of the railway and railway architecture to solve the traffic problems caused by population growth and industrialisation. This approach is seen in Berlin’s Alexanderplatz Station and the Dresden Railway Station (see Fig-7), which opened in 1882 and 1897 respectively. The former exploited the viaduct sitting of the station; the ground floor was used for ancillary spaces, offices, and a crossway connected by staircase to the platform. The Dresden station took full advantage of the viaduct, with its bottom layer providing easy access to electric trolleys and horse-drawn taxis. There was also a larger central terminal hall with six platform tracks and two flanking through hall with six through high-level tracks and other terminal tracks. Following its destruction during WW2 the station underwent a slow reconstruction and has subsequently been renovated. By the beginning of the twenty first century, the Dresden station was reconstructed with the addition of a translucent hall roof with Teflon-coated glass fiber membranes allowing more daylight into the interior of the concourses.

By the 1900s, influenced by the Modernist

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Figure 5 - Gare de l’Est façade
(Picture : Gilbert Bochenek)
Movement, many railway stations had created unique architectural styles. At the same time, reinforced concrete had become the hallmark of the modern architectural style. The Helsinki Central Station (see Fig-8), designed by Eliel Saarinen, was chosen as one of the world’s most beautiful railway stations by the BBC in 2013\textsuperscript{10}. The clear outline and grand shape, which utilised Finnish granite materials and reinforced concrete interior barrel-vaults roofs, reflect the “Cubist-inspired forms” of the station.

Nowadays, new stations are in fact beginning to merge into the urban fabric\textsuperscript{11}. Railway transportation is considered to be a necessity for the commercial life of a city and they are regarded as a significant means of urban development. Moreover, many stations such as Waterloo International railway station, combine new modern technology with original brick arch structures to create rich commercial spaces.


\textsuperscript{11} Julian Ross, Railway Stations (Oxford [etc.]: Architectural Press, 2000), p.21
Figure 8: The entrance of Helsinki Central Station
(Picture: Alfred Molon)
2.2 A history of Jinan Railway Station situation

The original Jinan Railway Station named ‘TisNan Railway Station’ (see Fig-9), which was designed and built between 1905 and 1912 by German architect, Herman Firscher. It was the only typical Gothic community railway station in the world and the largest railway station in Asia at that time. It witnessed the years of vicissitudes in the early modern history of the world’s most famous spring city in China.

In 1992, the old train station (see Fig-10) was dismantled despite strong opposition from citizens and scholars. The major reason for this demolition was that it was hard to adapt the station to manage the pressure from rapidly increasing passenger flow volume. Another reason related to the history of the station. Xie Yutang, the deputy mayor commented that: “this train station is a symbol of colonialism, it will remind you
of the oppressed days of the Chinese people.”

In 1995, the Jinan Railway Station Expansion and Reconstruction Project was completed and open for use. The total area of the station was approximately 160,000 square meters. Through years of renovation and transformation, and continuing up until the present day, the functions and facilities of the station have been improved; nevertheless, the station has lost some of its historical and cultural value.

There are some key differences between the old railway station and the current railway station, as follows:

1. The old railway station was built as a group of buildings, while the current one is a single large public building.
2. There was an average of 10,000 passengers per day using the old railway station. In 2014,

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the passengers flow volume reached 46,700 passengers per day. It is forecast to rise to over 88,000 passengers per day in 2030.

3. The old railway station had “unique Baroque style and beautiful lines” with a 13-meter-high dome structure built with stone and timber materials. However, the current station, with its column network structures, was made with concrete and glass.

4. The building area of the current railway station is around 20,000 square meters, which is four times bigger than the old one.

5. In the nineteenth century, the location of the railway station was on the edge of Jinan city. With the development of the urban area, the station area is located in the city centre now.

### 2.3 Passenger statistics and analysis

Table 1 - Comparison of Passenger Flows between Jinan Railway Station and Similar Domestic Stations
(10,000 Persons, 10,000 m2)

<table>
<thead>
<tr>
<th>Name</th>
<th>2020 Dispatch</th>
<th>2030 Dispatch</th>
<th>Original Station Scale</th>
<th>Station Scale</th>
<th>Station Area</th>
<th>Average Daily Traffic</th>
<th>Peak Daily Traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jinan Railway Station</td>
<td>2000</td>
<td>2500</td>
<td>4 platform 7 railway</td>
<td>platform (5-people,2-goods) 10 railways</td>
<td>2</td>
<td>6.8</td>
<td>22.2</td>
</tr>
<tr>
<td>Changchun Railway Station</td>
<td>1914</td>
<td>2500</td>
<td>4 platform 7 railway</td>
<td>9 platforms 16 railways</td>
<td>3.4</td>
<td>6.8</td>
<td>25</td>
</tr>
<tr>
<td>Hefei Railway Station</td>
<td>1700</td>
<td></td>
<td>4 platform 7 railway</td>
<td>5 platforms 12 railways</td>
<td>3.3</td>
<td>4.66</td>
<td>22.1</td>
</tr>
<tr>
<td>Shanghai Railway Station</td>
<td>5272</td>
<td>7838</td>
<td>16 platforms 30 railways</td>
<td></td>
<td>9</td>
<td>21</td>
<td>87.3</td>
</tr>
</tbody>
</table>
Obviously, the original limited station space cannot meet the increasing passenger flow volume in Jinan. It can be seen from the data in Table 1 and Table 2 that the existing Jinan Railway Station has a similar scale and the expected number of passengers in 2020 to 2030 to Changchun and Hefei Railway Stations, but the Jinan Railway Station space is around 0.58 times smaller than the other railway stations. Furthermore, it is estimated that in 2020, the total passenger flow of Jinan Railway Station will reach 25 million people per year, which is approximately three times more than passenger flow in 2000.

Table 2 - 1996-2017 Passenger flow volume in Jinan Railway Station

<table>
<thead>
<tr>
<th>YEAR</th>
<th>TOTAL PASSENGER FLOW VOLUME (UNIT: 10,000 PASSENGER)</th>
<th>DAILY PASSENGER FLOW VOLUME (UNIT: 10,000 PASSENGER)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>549</td>
<td>1.5</td>
</tr>
<tr>
<td>1997</td>
<td>597</td>
<td>1.64</td>
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<td>1998</td>
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<td>1999</td>
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<td>1.90</td>
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<td>2001</td>
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<tr>
<td>2011</td>
<td>1267</td>
<td>3.53</td>
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<td>2099</td>
<td>5.50</td>
</tr>
<tr>
<td>PREDICTION</td>
<td></td>
<td>8.8</td>
</tr>
</tbody>
</table>
2.4 Context

In response to rapid urbanisation, the Jinan Government implemented the urban space development strategy. This involved the following: exploiting Jinan’s eastern and western suburb, developing the urban area to the northern region and across the Yellow River; optimising urban functions in the city centre; and improving urban quality. The *Shandong Province Urban System Planning (2011-2030)* mentions that “in 2020, the urban population in the city centre will be 4.3 million. In 2020, the city’s total population will be about 8.4 million, of which the total urban population will be around 6.7 million people, and the level of urbanisation will be over 75%.” Therefore, the geographical position of original Jinan Railway Station has gradually changed from urban boundary to urban centre, becoming one of the important transportation hubs in Jinan’s city centre. The Jinan East Railway Station (secondary station) is also located in the city centre, where next to Daming Lake tourist attraction. However, it faces the fate of being demolished because the new East Railway Station is about to be built in the edge of eastern part of the city. In general, Jinan Railway Station, Jinan East Railway Station, Jinan West Railway Station and the upcoming Jinan New East Railway Station constitute the entire railway system of Jinan City.


2.5 Culture and climate

The site is located in Jinan city, China. Due to the large numbers of springs in the territory, Jinan is known as ‘the city of springs’ (see Figs-11 and 12). People in Jinan enjoy the “spring water life”, they like walking in the spring park, playing with water, fetching water at springs and swimming in the spring pond. What is more, the city is also renowned for its willow trees and lotus. There is a famous lotus fountain (see Fig-13) located in Quancheng Square, which is the largest public square in Jinan for entertainment for both residents and tourists; it has become the symbol of Jinan city.

The development of Jinan City has also produced distinctive architectural forms, such as courtyards and Hu Tong (see Fig-14), but most of the cultural buildings only exist in the city centre. Pleasant scales of streets, semi-private courtyards, enclosed architectural forms and constantly flowing spring water shape the activities of tourists and residents.

In general, the new development of Jinan Railway Station area should be combined with urban features, such as these springs water, siheyuan (a historical type of residence that was commonly found throughout China) and Hutongs (hutongs are alleys formed by lines of siheyuan, traditional courtyard residences).

Through analysing functional divisions, greening areas and transportation of Jinan Railway Station and its surrounding areas, there are a few negative aspects associated with the station and surrounding area as outlined below:

- The rail passenger traffic keeps increasing, but the current status of that traffic is mainly based


Figure 11 (top) - Hei Hu Spring in Jinan City (Picture: CFP)
Figure 13 (bottom) - People view musical fountain (Picture: Xinhua/Guo Xulei)
Figure 12: Da Ming Lake - Aerial view
(Picture: Xinhua/Guo Xulei)
Figure 14 - River, Courtyard or Hutong - a place where lots of activities and events occur.
(Picture: aking503)
on horizontal development. Different modes of passenger lines, railway lines and vehicle lines interfere with each other, which causes problems for passengers transferring to other modes of transportation; this also can easily cause traffic jams.

- In consideration of national conditions, China’s railway stations have extremely strict safety inspections, which not only delay the speed of people entering and exiting stations, but also limit the freedom of passengers.

- The size of the existing Jinan Railway Station cannot meet the requirements of the current passenger traffic.

- The traditional ticket checking systems cause passengers to be inconvenienced: passengers need to enter train stations around one hour before trains depart so need to spend a long time in waiting rooms. According to the China Consumers’ Association investigation, after entering the waiting room, passengers need to wait an average of about one hour before checking in. However, Jinan Railway Station’s waiting spaces have very limited functions, only rows of seats and a few small convenience supermarkets around.

- The Jinan Railway Station has limited high-speed rail services; there is only one high-speed train waiting room on the ground level. The total waiting area in the station is only 11,265 square meters. However, according to the calculation of the peak passenger flow of 117,000 people, the minimum waiting area should be around 110,000 square meters.

- There is an imbalance in the proportion of functions in the South Plaza near the Jinan Railway Station. Here, there are only a few functions — a place for evacuation and an oversized above-ground parking lot, which means that it is difficult for passengers to find a suitable place for talking with family or resting.

- The overall environment of the railway station is poor (no green space), and the noise from trains has a certain influence on the surrounding residents.

According to the urban planning of Jinan City’s Tianqiao District, the limitations of the South Square of Jinan Railway Station (traffic jams and the lack of functions) will be solved by developing the north area into the North Square of the station (see Fig-15). Its size will become
the second largest open plaza after Quancheng Square in Jinan City.

The design of the North Square will be based on the “people and car diversion” as the main traffic design point\(^{19}\). The ground part of plaza is designed as landscape; some parts of the underground level one will be used for long-distance buses hubs, others will be used for restaurants and commercial areas. The underground level two will be mainly divided into two parts — private cars and temporary taxi parking; and pick-up and drop-off service areas. However, in the existing planning scheme, due to the large size of the North Square, the designing of functional division is ambiguous, which is lack of human scale and will be hard to achieve walkability.

Moreover, the designer tried to re-establish the old train station with its clock tower and the baggage rooms on the north plaza; the facade will absorb the characteristics of the old Jinan Railway Station station. But there is no conditions and foundation for reconstructing the old railway station. Experts judged that “it is not just a form, a real reconstruction means using the original process, structure, materials.”

\(^{19}\) Mingge Luan, “On Relationship between Urban Planning and Construction Design with Jinan Railway Station as an Example”, *Shanxi Architecture* 43, no. 1 (2017): 21


Figure 15 - Planning of North Plaza next to the Jinan Railway Station.
With the expansion of cities, public buildings and spaces are playing essential roles in urban development. Well-designed public buildings and spaces can not only become unique landmarks in a city, but also promote regional economic growth, enhance the attractiveness of a city and inspire the vitality of an area. This literature review explores public buildings and spaces, and development trends in Chinese cities. The first part of the section seeks to explore the relationship between urbanisation and urban design based on the premise of urbanisation in China, combined with Western urbanisation theories. In addition, this review draws on discussions about the role of public buildings and spaces in cities. Railway stations are used as examples to discuss the development trend of public transportation buildings and the high-tech that can be used in the future to improve urban publicness. Finally, this review puts forward the feasible suggestions for the development of railway stations and surrounding areas in China.
3.1 Urbanisation and Urban planning

Urban developments have always meant urban expansions, conversions and maintenance. Since the 1990s, due to China’s rapid economic growth and urban construction policies, rapid urbanisation processes have made unwelcome urban expansions (also called “policy sprawl”\(^{21}\)) a more serious problem. They not only reduce land use and public service facilities, but also exacerbate the suburbanisation of urban centres. From the point at which urbanisation advanced, there has been no comprehensive public building and space rehabilitation programme for Chinese urbanisation. Therefore, the rapid growth of urbanisation has brought many problems which have not been systematically resolved. These problems include traffic congestion, land shortage, energy shortage, environmental pollution and an imbalance of public resources.

Charles Correa argued in his book *Housing and Urbanisation* that solving the population distribution problems can optimise the urbanisation process. Taking European cities (see Fig-16) as examples, Correa commented that “most of the cities of Holland are all form of the urban system—they all preserve their human scale”\(^{22}\). Considering urban structures and development modes in China, especially in the cities with a long history, it can be seen that they are expanded by a single centre, and the population distribution is decreasing from a city centre with high population density to the rural areas, which caused serious overloading of urban infrastructure in the city centre. As shown in Figure 17, due to the lack of comprehensive transportation hubs in the city centre of Jinan, traffic jams during holiday periods are a real problem.


\(^{22}\) Charles Correa, *Housing and Urbanisation* (London: Thames & Hudson, 2000), 110

Figure 16 - The plan for Randstad in the Netherlands
Figure 17 - In Jinan city, the traffic jams are common, especially during holiday periods. The red color area represents a traffic jam area. (Image by Yanan Li, 2018)
Rob Krier proposed that any city innovations should respect the logic of the whole. “Every urban building must obey the overall structural logic and provide a formal answer in its design to pre-existing spatial conditions.” Through a series of urban planning principles, Western countries gradually formed their urban planning systems, such as the British “Town and Country Planning” and “City and Regional Planning” in America.

Peter Newman puts forward the concept of a city structure in his book — “Poly-centric city.” In essence, he advocated a decentralised urban spatial layout. He declared it is an effective urban form to solve the balance between population and land. At present, some of the Chinese cities, such as Beijing and Shanghai, have adopted multi-centre and network-structure urban development strategies.

Ebenezer Howard’s “garden city” theory can be seen as the primary form of the ‘poly-centric city’. He described the relationships between people, town and country through the theory of “the three magnets”. To avoid urban sprawl, he thought of strengthening the natural space and greenbelt can limit the size of cities (see Fig-18). The theory of “organic decentralisation” proposed by Saarinen is also based on that theoretical foundation.

In principle, the realisation of multi-centre urban developments represents a long journey. It is a difficult challenge to improve the existing urban environment and meet the needs of contemporary urbanisation in China. Liangyong Wu, a professor of Architecture and Urban Planning, referring to the current situation of Chinese cities development, proposed the theory of “urban organic renewal”. He declared urban planning


should be He declared urban planning should be viewed in the same way as an organism; that is, an organic connection and in harmonious coexistence from the city to the building, from the whole to the local. The method is to redevelop and ensure the prosperity of cities by renovating those areas not adapted to integrated social life, including the reconstructions of buildings, the transformations and continuation of the ecological, spatial, cultural, visual and other environments. Liangyong Wu also asserted urban planning should follow the city’s internal order and law and conform to the city’s texture and scale. According to the transformation of the content and requirements, the planning should properly handle the current and future relations of urban space. Furthermore, on the basis of sustainable development, it is imperative to explore the city’s growth and upgrading, and continuously improve the quality of urban planning, ensuring the environment of the urban transformation area is consistent with the overall urban environment.

“Always design a thing by considering it in its next larger context – a chair in a room, a room in a house, a house in an environment, an environment in a city plan.”

- Eliel Saarinen.

Almanac of Architecture & Design, 2005


3.2 Urban public buildings and public spaces

Dr. Chloë Voisin-Bormuth mentions it in the book chapter *How to Build the Public Spaces of Democracy* that the development of a place of urbanity can be understood as “social interaction”\(^\text{29}\). The premise of social interaction is the gathering of people, which also is the essence of the urban renewal and one of the main reasons for the vitality of the cities. Therefore, where people go and where they meet is the core of getting a city to work. Public buildings and spaces offer places for public events, providing people with recreation, visits, exchanges, and learning, which are important carriers for improving city quality and humanity. Public buildings and spaces play an important role in the growth of cities and the experience of people living within city spaces. When Rudolf Stichweh wrote about the space associated with social processes, he was analysing this situation as a “moment of not easily influenceable exteriority”, both of social and personal life is affected by this “exteriority”\(^\text{30}\).

The development of public spaces can be roughly divided into three historical stages, from the public area ruled by politics and powers before the nineteenth century (first stage) to the public space dominated by leisure and social interaction between the nineteen century and the twentieth century (second stage), at which time, the “public sphere”\(^\text{31}\) and public spirit were considered major factors in society, and civic awareness had become a part of rational urban planning. The third stage started in the 1970s when the public sphere was gradually declining, and public life was slowly becoming privatised. Some scholars have commented that “public space becomes the stage for a symbolic reenactment of social values and preferences, and when some prevalent values

\[\text{“The public sphere and the private sphere develop in a close relationship without losing their polarisation……The more strongly the polarisation is exerted and the closer the interchange between the public and private spheres, the more ‘urban’ the life of an urban aggregate”}\]

\[\text{– Aldo Rossi}\]

*The Architecture of the City, 1982*

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\(^{30}\) Lixin Song and Chunshan Zhou, “Progress Of The Value Of Urban Public Space In The Western Countries”, *Modern Urban Research*, no. 12 (2010): 91


\(^{32}\) Helmut Holzapfel, *Urbanism And Transport: 62*
or patterns of lifestyle are taken for granted, other forms of values and living models may suffer as a result.\footnote{Aldo Rossi, The Architecture of the City, American edn. (Cambridge, MA: MIT Press, 1982): 86–87.}

In China, in the context of economic globalisation and ‘opening up’ policy, the traditional culture of urban public buildings and spaces have also been strongly impacted by an homogeneous consumer culture. Cities have gradually lost their cultural personality and humanistic spiritual value. Many squares, markets and other public areas are missing their local characteristics.

The idea of “urban catalyst” was proposed in the book The Architecture of the City by Aldo Rossi. He regarded urban catalyst as capturing the “primary elements of a city\footnote{Aldo Rossi, The Architecture of the City, American edn. (Cambridge, MA: MIT Press, 1982): 59}, which include various activities and spatial characters relating to urban life, etc. Aldo Rossi discussed how “constructed primary elements often constitute relative permanence in a city, they can simultaneously be capable of accelerating the processes of urbanisation”.\footnote{Juliet Davis, “Urban Catalysts In Theory And Practice”, Architectural Research Quarterly 13, no. 3-4 (2009): 296} He also revealed the connections between the city, architecture and human memories. He explained that the collective memory or history of a city could be continued through space, type or monument. Therefore, the types of spaces that should be used most as an urban catalyst are public buildings and public areas. In places where people often gather or move, there are many possibilities between people, space and architecture at different times.

Aldo Rossi argued “the past is partly being experienced… the most meaning fun permanences are those provided by the street and the plan”.\footnote{Jia ming, Zhang, On the Relationship between General Public Building and Urban Design (China Academic Journal Electronic Publishing House. June 2017): 43} He emphasised how architecture should be considered from the perspective of urban integrity. However, many large public buildings are built in the centre of of those city centres, and so destroy the urban texture and fabric. Moreover, the public spaces in cities where large public buildings are erected usually exceed human scale; this has meant that urban public spaces are gradually dying because people are reluctant to stay there. An architect who has been engaged in the Chinese construction industry for a long time, claimed that the design of public building space in China at present is more focused on targets, such as building density and floor area ratio than design at a spiritual level. He suggested that the continuity of the “city interface, organic, uniform and spiritual level”\footnote{Meike Schalk, “The Architecture Of Metabolism. Inventing A Culture Of Resilience”, Arts 3, no. 2 (2014): 284} in the repair of public space in the city is necessary.

Kisho Kurokawa is one of the representatives of the notion of “metabolism”, which holds that the
relationship between cities and buildings are not static, rather it is a dynamic process like biological metabolism. He also insists “intermediate space is a tentative common, shared element, a working agreement. Since Intermediate space is always a tentative zone, it is a state of dynamic accommodation with symbiosis.” As with the idea of ‘metabolism’, the cities-buildings relationship of interdependency and mutual integration can form a space full of interesting and multiple meanings. Kurokawa put forward the idea of “grey space”, which was used in the urban spaces in China, promoted the integration of public buildings space and urban space and made the network of urban public space more complete.

Generally speaking, the harmonious development of the city is inseparable from an excellent urban public space relationship. Creating a good public space requires people participation, such that human communications and activities naturally become the centre of the vitality of the entire city. Humanisation and quality are the core demands of urban public space planning, respecting culture and inheriting culture are the principles of urban public open planning.


3.3 Public transport building space - railway stations and plazas

As the city’s extensive public buildings and public spaces, railway stations and the station squares always represent the economic strength and vitality of a city. As time goes on, people’s attention to those public transport buildings has gradually shifted from the physical forms to the spiritual level. Dr Ye-Kyeong and Jung Hye-Jin insisted that railway stations do not only have the single function of transportation but also can become “a recyclable industrial heritage and a possibility as an urban space with an enjoyment of the city scenery”\textsuperscript{40}. Since the nineteenth century, railway stations not only have been used for transportation, but also have played the role of “the accelerator in regenerating the old city with its historical background”\textsuperscript{41}. The experiences of railway development in Western countries show that the transformation of a single function railway station into a traffic complex

\textsuperscript{40} Shin Ye-Kyeong and Jung Hye-Jin, “New Spatial Possibilities of Railway Station: Everyday Heritage, Enjoyable Landscape”, \textit{Procedia Engineering} 118 (2015), 377

\textsuperscript{41} Shin and Jung, “New Spatial Possibilities of Railway Station”, 378.
with multiple modes of transportations not only is conducive to increasing the land utilisation rate of urban centres but also significantly improve the ability of coordinated regional development. At the same time, a nice municipal transport complex can reconnect areas that have historically been separated by railroads from urban forms and spaces. Therefore, many old railway stations in city centres have been transformed as entry points for the revitalisation of the city centres, importing new elements to promote the regions, and enhancing the vitality of the urban core area through the integration of stations with commercial, office and leisure spaces. Thus, train stations have developed from architectures into a key part of the city.

Railway stations and the station squares were once summed up by Luca Bertolini and Tejo Spit as “the contradiction between nodes and places”. From the point of function, they are ‘nodes’ of cities, which are the hubs of various transportation modes. Those areas need efficient evacuation to ensure safety and smooth traffic. At the same time, railway stations and surrounding areas are also the ‘place’ where people carry out most of their daily activities. The more people gathered, the more vibrant the city is. High-density human activities guarantee economic and cultural development in the surrounding area.

42. Yandong Zhu et al., “Influence to Area Re-Development by Reconstruction of Railway Station at Urban Core Areas: Case of Zhengzhou Railway Station”, Modern Urban Research, no. 10 (2007): 47

43. Teng Wang and Jiwei Lu, “Railway Station Complex and Urban Catalyst -- Example of Shanghai South Railway Station”, Urban Planning Forum, no. 4 (2006), 82

44. Luca Bertolini and Tejo Spit, Cities on Rails (London: E. & F.N. Spon, 1998), 9
To some extent, the concept of “vertical city”, which means urban complex development in a vertical direction could help to balance the relationship between the ‘nodes’ and ‘places’. This is so especially for the railway stations that they are in the city centres; vertical transport systems not only save limited land resources, but also make it easier for passengers to transfer to different transportation modes. Furthermore, the various mixed functions turn a station area into a “miniature city”, which can meet the various needs of passengers and residents. This represents the process of railway stations are “beginning to merge into the urban fabric”. For example, the Kowloon Railway Station in Hong Kong has been developed into a city complex integrating residential, shopping and transportation modes (see Fig-19). The multi-functional superposition and high-intensity developments create a lot of positive public spaces, which is also conducive to improving the efficiency of urban operations.

At present, many train stations in China have not considered connecting with other modes of transportation; rail transit has become an independent system, separated from the urban network structure in space, function and transportation systems. This causes passengers having to “walk by themselves through the systemic gaps which shouldn’t have existed and waste the consumers’ precious time”.47

Railway station plazas are also playing increasingly important roles in the study of urban spaces. Some scholars commented on this at the international rail transit symposium: “the rail transit square is an important conversion and exchange place for the urban system and huge URT Development”. In: The 2nd International Symposium on Rail Transit Comprehensive Development (ISRTCD) Proceedings, ed. Xia Haishan, Zhang Yunan (Berlin, Heidelberg, 2014), 12


46. Ross, Railway Stations, 21

(the urban rail transit) system underground. Rational design of the public squares can not only enhance the evacuation capacity of stations, but also enhance the overall sense of the urban public spaces. However, most of the traditional rail transit squares are designed as “end points of the urban space”. Take Jinan Railway Station and South Plaza as an example: the square and the railway station are seen as two separate spaces since they are divided by the station’s facade so the urban public space seems to have ended here (see Fig-20). The division of space not only limits people’s civic activities, but also affects the extension and development of urban public space. In a word, the design of station squares should proceed from the publicity of cities, strengthening the evacuation procedures, carrying forward a city’s characteristics and attaching importance to the continuity of the space.

Overall, whether it is a matter of considering urban planning, size, interface or public building space, all should be combined with Chinese political, economic and social values and policies, starting from social equality and sustainable development. The construction of urban railways integrated with an appropriate urban plan is a pressing necessity in China.


With the continuous development of building structures and technologies, railway stations have evolved from small sheds to large-scale transportation hubs (see Fig-21) to colossal mass urban complexes. Obviously, advances in technology have always affected the changes in the structures, spaces and forms of public buildings. Wang and Wang explained that diversified intelligent technology not only makes public buildings sustainable, but also produces a comfortable and efficient smart environment. The core goal of intelligent technologies is to realise the harmonious development of architecture, people and nature.\textsuperscript{51}

Here are a few key points of the future development of railway stations under the influence of new technologies:

\textsuperscript{51} Baohua Wang and Jingjing Wang, “Impact of Digital Age on Architectural Design”, \textit{Chinese and Overseas Architecture}, no. 6 (2009), 139-142.
• E-ticketing

The Arup company predicts that railway stations in 2050 will remove gate-lines (see Fig-22) due to “ticketless technology”\(^\text{52}\). Passengers can be automatically identified while travelling, getting on and off trains. Transportation companies can automatically process payments based on the identification system. In the very near future, paper train tickets may no longer be used, and people will be able to get into train stations by scanning a mobile phone or ID card, or even through face recognition technology. The use of this technology will turn the enclosed hall of stations into more open areas, and people will be able to freely shuttle through public building spaces without being disturbed by any limited entrances. At most of China’s railway stations, passengers are no longer waiting in a long line to enter the train station.

\(^{52}\) Future of Rail 2050, 41

Figure 22 - Ticketless systems
(Picture : ARUP)
• Virtual Ticketing Agents

Virtual Agents are station computers offering combinations of ticket systems, vending machines and call centres. Passengers can talk to a ‘real person’ in ‘real time’ via the Virtual Agent which provides a similar experience to being at the ticket window. Those agents have been trialled already by Deutsche Bahn and it is expected that they will be used at major stations soon.

The use of the Virtual Ticketing Agents will change the internal layout of railway stations. The original ticketing hall and ticket offices will disappear or be transferred to the staff office. That means the railway station areas will become spacious.

• Future security

Safety facilities are quite crucial for public transport buildings and squares. At most of the railway stations in China, passengers need to pass the security check before entering the indoor space. At present, technology companies are coming up with some solutions to security problems. For instance, Bosch Security developed its Aegis UFLED white light illuminator which integrated diverse cameras, lighting and communications technologies. The light illuminator can issue voice warnings to intruders, capture images and automatically send alerts to staff via text message and e-mail. Therefore, public safety issues are no longer one of the reasons for restricting the development of public buildings space in the future.

• Virtual supermarkets

Shopping online in public spaces such as subway and railway stations is not a dream. In South Korea, the Tesco company came up with the idea of “let the store come to people” which means that people can use smartphones for shopping online while waiting for the trains (see Fig-23). The company uses the layout of a typical shop but only with images of products and QR codes on station walls. Passengers can purchase items by taking a picture of the corresponding barcode. This technology is not only changing passenger’s waiting time and experience, but also improving the existing station space. The walls replace the three-dimensional convenience stores, and other functions in public spaces can better utilise the remaining space.

53. Upton, “9 Innovations”.
Figure 23 - Virtual world: The shopping walls are already in operation in South Korea and China.
3.5 Conclusion

Based on the above new technologies, in the design and construction of public transportation buildings in the future, the public building space will be more open and free. It will be helpful for passengers because it will save a lot of time and simplify the entire travel process.

Excellent public transport buildings are not only urban transport hubs, but they may also become monumental urban landmarks or urban complexes. They are breaking through the enclosed state of the buildings themselves, and evolve into a multi-level and multi-function comprehensive opening system, which is “the integrated development trend of urban and architecture.”

4.0 Precedent Review

This section selects different modern train stations in different countries as cases. Through the analysis of their building sizes, functional divisions, spatial layouts, and people flow organisation, the purpose is to understand the advantages and disadvantages of each building. The section will conclude with a summary of the design concept of the railway station area.
4.1 Beijing South Railway Station

The Beijing South Railway Station is one of the largest stations in Asia. The building’s covered area is 499,200 square meters, and the total the surface area is 309,400 square meters. It is not only a transportation link for China’s new high-speed intercity network, but also a landmark in Beijing.

As the city’s comprehensive transportation hub, Beijing South Railway Station combines various modes of transportation. The station has five levels: the third and second floors of the underground are the subway levels; the underground level one is a transfer hall, including 50 bus stops, taxi driveways and 909 social car parking spaces; the ground floor has 24 railways and 13 platforms; and the top level is the waiting area.

The railway station uses ‘passenger and vehicle diversion’ and ‘entrance and exit isolation’ to evacuate passengers (see Fig-24). Inspired by the design of the current airport terminals, the passengers who take a taxi can get to the drop-off areas from the viaduct. After entering the waiting area and the first security check, the passengers can access the transfer hall by elevator and get onto the platform after the second security and ticket check. Due to the strict safety and ticket checking system of the Beijing South Railway Station, passengers still need to wait before reaching the platforms.

The oval-shaped main building is inspired by Temple of Heaven (see Fig-25) - the long axis of the elevated floor is 350 meters and the short axis is 195 meters. Beijing South Railway Station has a huge spatial volume which makes the hall more visually oriented. Moreover, the Beijing South
Railway Station is an eco-friendly train station; the natural ventilation and solar panels are primary features of this building. In addition, the canopy roofs can provide daylight which reduces the CO2 output in the daytime.

Figure 25 - The aerial view of the Beijing South Railway Station
(Picture: Zhou Ruogu)
Shanghai South Railway Station is a principal railway station with six platforms and thirteen railways. The overall design concept adheres to the concept of “big traffic, big space, big greening”\(^\text{56}\).

The second floor of the train station is surrounded by a motorway viaduct (see Fig-26), just like most of airport terminal designs, cars can get to the entrance area of the train station directly from the highway access to the elevated level. As one of the vital transportation hubs in Shanghai, there is “seamless connection” between different transportations, passengers can easily transfer from trains to taxis, buses or subway, achieving the standard of “zero-distance transfer”\(^\text{57}\) standard. What is more, there is no wall in the waiting hall, and the roof is transparent and light roof (see Fig-27), sunshine can go through lobby directly to the


57. Gang Zheng, Lei Chen and Xuan Hua, “Image Originated From Concept, 128

Figure 26 - A motorway viaduct curves around the station, which serves as a gateway to Shanghai (Picture: AREP)
platform and underground area, which makes the whole interior space of Shanghai Railway Station more bright and spacious.

The shape of the landscape plaza radiates in the form of a concentric circle with the roof while ring light belt roads and radioactive paths act as the main skeletons. However, the transit square of Shanghai South Railway Station lacks human activities and communications with passengers or residents, which made space look and feel more vacant.

Figure 27 - Interior of the Shanghai Railway Station
(Picture: AREP)
4.3 Kyoto Station

Kyoto Railway Station, designed by Hara Hiroshi, is a large-scale integrated building with multi-functions. He combined the futurist architecture style with an Eastern atrium, creating a new urban complex with a traditional Western public space and distinctive traffic centre.

There are nearly 270,000 passengers per day at the Kyoto Railway Station. The distance from east to west is about 470 meters, the atrium of the main building is 60 meters high and the height of the whole complex structure is around 70 meters (see Fig-28). The site area is 38,000 square meters, and the total floor area is 32,000 square meters.

The Kyoto Railway Station has three underground levels and 16 ground levels (see Figs-29 and 30) in which there are retail stores, a shopping mall, a small museum, three theatres (including a 925-seat theatre), multi-storey carpark garages (1,250 carparks), a hotel (539 rooms, total area is around 1,800 square metres) and government facilities. The area used for the railway and subway only accounts for 1/20 of the whole building area. The Kyoto Railway Station has become a truly comprehensive public building space, and transportation has become one of the functions of open space.

Kyoto Railway Station is not only a transportation hub, but also a part of the urban contexts. Passengers can observe every corner from different heights in the train station. The station connects different functions through the atriums and squares, forming a modern “village texture” as well as maintaining the continuity of the place in time and space (see Fig-31). Hara Hiroshi commented in his book that “using atriums to


Figure 28 - The atrium of the Kyoto Station (Picture: u/Paganator)
absorb the inconsistency in the plane, the atrium is the beginning of the world and the end of the world.”

Figure 29 - Circulation in the Kyoto Station  
(Drawing : Yanan Li, 2018)

59. Hiroshi Hara et al., Shi Jie Ju Luo De Jiao Shi 100 (Beijing Shi: China Architecture & Building Press, 2003), 204

Fig 30 - Different functions in the Kyoto Station

Fig 31 - Squares in the Kyoto Station help to form a modern “village” in urban context
4.4 Berlin Central Station

The Berlin’s Central Station is located in the Berlin city centre, adjacent to the Bundeskanzleramt and Reichstag. The station is a well-known landmark in Berlin and also an excellent example of integration into existing and new urban fabrics. It was designed by GMP and completed in 2006 (see Fig-32).

The floor area of the Berlin Central Station is around 70,000 square meters, and the total construction area is about 175,000 square meters. Like a miniature city, the Berlin Central Station accommodates numerous functions in the vast building volume, which meets all the needs of passengers. There are 860 underground car parking spaces and 15,000 square meters of retail and office space in the station. Normally, there are around 350,000 passengers arriving at and departing from the station per day. According to the “EuropaCity” development, in the north of the station, there will be approximately 600,000 square meters used for residential, office, retails and cultural buildings. Obiously, the success of the Berlin Railway Station significantly increases employment probability and promote economic growth.

The railway station has about 870 square meters of solar panels installed on a fibreglass roof with a length of 450 meters, which is conducive to building energy conservation (see Fig-33). At the same time, natural lighting at daytime can reach the underground platform space through the transparent roof and transfer hall. Compared with the Chinese railway stations, the station’s interior space is more free and functional, making it easy for passengers to carry out various activities (see Fig-34, 35 and 36). However, the current management system and ticket checking system in Berlin Central Station is not suitable for the situation in China. The opening of public places also has some risks to security. There are strict security checks in Chinese railway stations.

Figure 32 - East facade of Berlin Central Station as seen at early dawn from Alexanderufer. The building is reflecting in the water of Humboldt Harbour.

(Picture: Ansgar Koreng)

Figure 33 - Interior of the Berlin Central Station

(Posted by Paganator)
Figure 34 - Horizontal passengers’ movements in the Berlin Central Station
(Drawing : Yanan Li, 2018)
Figure 35 - Vertical circulation
(Drawing: Yanan Li, 2018)

Figure 36 - Function distribution
(Drawing: Yanan Li, 2018)
The "Stuttgart 21" Project aims to restructure the Stuttgart rail node plus construct a new line between Wendlingen and Ulm. It includes moving the current train station and railway underground to create more commercial, residential, working and green spaces. In a Railway Technology analysis, the project is heralded as beneficial in that it will "provide Stuttgart with a new city centre". However, due to policy and funding issues, this project has not been completed so far. The station will have eight tracks, four platforms and four gridded glass domes outside. The expected passenger numbers at New Stuttgart Train Station will reach 302,000 every day. The unique railway station structure will consist of a 1,400 feet length concrete shell, of which some parts are eight centimeters thick and are supported by 28 bell-shaped "light eyes" (see Fig-37). These skylights and curved structures allow natural lighting to be dispersed throughout the underground space. It is also possible for people to walk on the station’s roof, which is a wonderful link between urban space, architecture and people (see Figs - 38 and 39).

Furthermore, in the design concept of New Stuttgart Train Station, more attention was paid to “barrier-free accessibility”. Passengers can enter or leave this place from all directions, which made the transport process more convenient (see Figs-40, 41 and 42).


Figure 37 - The interior rendering to show the structure of the New Stuttgart Train Station
(Picture : Deutsche Bahn/ Aldinger & Wolf)

Figure 38 - The model of the station
(Picture : Holger Knauf)
Figure 39 - A section of the New Stuttgart Train Station (Drawing: Bahnprojekt Stuttgart–Ulm)

Figure 40 - Ground level entrances to the main access level additional entrances
(soure : Bahnprojekt Stuttgart–Ulm)

Figure 41 - Barrier-free accessibility
(soure : Bahnprojekt Stuttgart–Ulm)

Figure 42 - Entrances to platforms
(soure : Bahnprojekt Stuttgart–Ulm)
4.6 Conclusion

Through the analysis of the above railway station cases, it is clear to see that in terms of public building space design, especially the design of railway stations and surrounding areas, the urban perspective should be the driving force, one which actively integrates the urban environment and texture. Strengthening the humanisation and public-ness of city spaces should also involve a consideration of the local cultural characteristics.
5.0 Site Analysis and Criteria

5.1 Site analysis

As cities continue to expand, railway stations which were initially on the edge of the cities have become a part of the city’s central areas (see Fig-43). From urban scales, the location of urban spaces, or the spatial form of city, many stations have become the new focus of the city centres. As for the specific case of Jinan Railway Station, its area will become the Central Business District in the future. Figure 45 shows the changing Jinan urban area from 1880 to 2017 and the Railway stations in Jinan city.
Figure 43: Jinan urban development
(Drawing: Yanan Li, 2018)
Figure 44:
Top -- Site Location
Bottom -- Highways
(Drawing: Yanan Li, 2018)

Figure 45:
First line -- Traffic jam in South Plaza (Image: Yanan Li, 2018)
Second line -- Platforms and footbridge in the station (Image: Yanan Li, 2018)
The third line -- Heritage building around the station (Image: Yanan Li, 2018)
Fourth line -- Passengers need to wait in line to check in (Image: Qi Lu Wang)
From the perspective of transportation, there are two viaducts around the station area, one on the east main road and the other on the west main road, and both of which run north and south. From the point of view of functions, the surrounding area is dominated by residential communities, and some government offices are also present. Moreover, there are few green spaces and only a small square around the station so there is not enough public leisure place for residents (see Fig-47).
Figure 47: The analysis of function distribution
5.2 Jinan Railway Station and its surrounding area

**Jinan Railway Station Information**

The Original Railway Station Area : 20,000 m²

Scale of The Original Railway Station : 4 Platforms 10 railroads

High-speed Waiting Area : 70m * 15m = 1,050 m²

Normal Waiting Area (including commercial spaces) : 120m * 85m = 10,200 m²

Passenger Flow Volume : 25,000,000 p

Max Passenger Flow per day : 1,170,000 p

Compared with the railway stations analysed in the previous section, the building area of Jinan Railway Station is much smaller (see Fig-49). Compared with Beijing South Railway Station, Jinan Railway Station does not have a comprehensive transportation system due to the limited urban area and existing traffic. It also lacks the comprehensive functions evident at both the Berlin Railway Station and the Kyoto Station.

Figure 48: The Jinan Railway Station has 4 platforms, 10 railroads
Figure 49: Comparison of Jinan Railway Station and other railway stations
5.3 Criteria

- Passenger flow line system

According to the architectural design data set, the primary flow lines of railway stations in China are normally divided into three types: the passenger flow line, the baggage flow line and the vehicle flow line in the station transit square. The streamline design should distinguish the order of entry and exit, at the same time, the streamline should be simple and avoid mutual interference.

There is the analysis of the passenger flow line system of railway stations.


(Drawing: Yanan Li, 2018. Based on Jian Zhu She Ji Zi Liao Ji 4)
Fig 51 - The relationship of the height between railways and elevation of buildings
(Drawing : Yanan Li, 2018. Based on Jian Zhu She Ji Zi Liao Ji 4)

Fig 52 - Positional relationship between railways and buildings
(Drawing : Yanan Li, 2018. Based on Jian Zhu She Ji Zi Liao Ji 4)
5.4 Program

The New Jinan Railway Station size:
68,000 square meters.
(North-South) 340 meters, (East-West) 200 meters

Northern Plaza:
99,000 square meters
(North-South) 300 meters, (East-West) 330 meters

Southern Plaza:
16,500 square meters
(North-South) 50 meters, (East-West) 330 meters

Figure 53: draft diagram to show the connections between different functions
• Estimated Result (based on precedents)

<table>
<thead>
<tr>
<th>Facility</th>
<th>Area (m²)</th>
<th>Floors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Hall</td>
<td>1,500-1,800</td>
<td></td>
</tr>
<tr>
<td>High-speed Waiting Area</td>
<td>8,700</td>
<td></td>
</tr>
<tr>
<td>Baggage Rooms</td>
<td>3,000</td>
<td></td>
</tr>
<tr>
<td>Museum and exhibition: 500-1,000 m²</td>
<td>2 floors</td>
<td></td>
</tr>
<tr>
<td>Shopping Mall in Station: 30,000 m²</td>
<td>4 floors</td>
<td></td>
</tr>
<tr>
<td>Shops</td>
<td>2 floors</td>
<td></td>
</tr>
<tr>
<td>Restaurants</td>
<td>2 floors</td>
<td></td>
</tr>
<tr>
<td>Theatre</td>
<td>(7-8 movie halls, 150 m²/hall)</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>Indoor playground</td>
<td>500-800</td>
<td></td>
</tr>
<tr>
<td>Traditional small business</td>
<td>100-500</td>
<td></td>
</tr>
<tr>
<td>Standard market</td>
<td>500-1,500</td>
<td></td>
</tr>
<tr>
<td>Large markets</td>
<td>2,500-5,000</td>
<td></td>
</tr>
<tr>
<td>Super large market</td>
<td>6,000-10,000</td>
<td></td>
</tr>
<tr>
<td>Hotel</td>
<td>(25,000 m²)</td>
<td></td>
</tr>
<tr>
<td>Total rooms</td>
<td>300-350 rooms</td>
<td>around 15-20 floors</td>
</tr>
<tr>
<td>Cosy rooms</td>
<td>(35-40 m²)</td>
<td>200 rooms</td>
</tr>
<tr>
<td>Superior rooms</td>
<td>(40-50 m²)</td>
<td>100 rooms</td>
</tr>
<tr>
<td>Deluxe rooms</td>
<td>(50-70 m²)</td>
<td>30 rooms</td>
</tr>
<tr>
<td>Family rooms</td>
<td>(70-80 m²)</td>
<td>20 rooms</td>
</tr>
<tr>
<td>Bar and restaurants</td>
<td>(around 5,000 m²)</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>(1,000 m²)</td>
<td></td>
</tr>
<tr>
<td>Office Space</td>
<td>(15,000 m²)</td>
<td></td>
</tr>
<tr>
<td>Total rooms</td>
<td>150-200 rooms</td>
<td>around 5-8 floors</td>
</tr>
<tr>
<td>Small size</td>
<td>(30-50 m²)</td>
<td>100-120 rooms</td>
</tr>
<tr>
<td>Middle size</td>
<td>(50-80 m²)</td>
<td>60-80 rooms</td>
</tr>
<tr>
<td>Big size</td>
<td>(80-100 m²)</td>
<td>50 rooms</td>
</tr>
<tr>
<td>Conference / Activities</td>
<td>(1200–1,500 m²)</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>(1,500 m²)</td>
<td></td>
</tr>
</tbody>
</table>
6.0 Design Process

Informed by existing knowledge surveyed in the literature review and the analysis of precedents, the main objectives and design drivers for this investigation are to redevelop Jinan Railway Station and its surrounding area into an urban complex, to create a central commercial and transport district, transform the traditional public buildings area into open urban public spaces. Based on the premise of ensuring the security of the train station area, the station’s service target must not be limited to passengers, rather, it also needs to be open to citizens and the public at large. The following are the concepts for the future Jinan Railway Station:

- Circulation: vertical transportation system and horizontal traffic routes
- Multi-functional integrated business district
- Atrium openness: courtyard, the greenhouse in the station
- Urban square: provide more functions for people’s activities
6.1 Design problem

Building location determination (see Fig-51)

The building complex on the north side of the tracks — one access side, relating to the North Plaza;
The building complex above the tracks — two access sides, relating to the North and South Squares;
The building complex on the south side of the tracks — one access side, connecting with South Plaza.

In most of the old Chinese train station designs, such as the original Jinan Railway Station, the waiting areas are on the line side of railways and platforms. This structure is suitable only for small two-storey stations with low passenger flow. The two-storey waiting room is connected to the platform only through the bridges. What is more, most of the railway stations with that same structure have only one side entrance so it is inconvenient for the passengers to enter and exit the station. With the developments in construction and technology, some of the waiting areas in railway stations are built above railways. The waiting areas are divided into different small waiting rooms corresponding to different platforms; however, the waiting spaces are narrow and cannot meet the growing passenger flow.

In modern Chinese railway station buildings, more waiting spaces are designed in the form of halls. The popular large-span structure can not only increase the utilisation of space, but also improve the indoor environment through increasing natural lighting and volume of space.

Therefore, the redevelopment complex of Jinan
Railway Station should be built above the railways and platforms. Although the construction cost is higher than the other two options, the building is a ‘bridge’ that connects the areas on both sides of the track; this can not only save land resources in the city centre and reduce traffic congestion, but also be better at controlling passenger traffic, thus making the passengers’ travel more comfortable and convenient.
6.2 Initial concept exploration

• Threshold

Above ground — Underground
Private side — Public side
City transports — Intercity transports

• Comparison — “Node” (see Fig- 55)

New and old — new high residential buildings, old historical buildings
Organic and mechanical — human activities, natural and verticals, such as subway, trains.
Movement velocity — high speed, fast (trains, cars) and slow (bicycles, walking)
Move direction — “South-North” human movement and “West-East” railway, subway movement
About feeling — soft, warm, intimate and tough, cold, passivity
Figure 55 - “Node” concept
- Mass

The main body of the building complex adapts to the direction of the railway. Different materials express the varying contrast points in the previous analysis.

Figure 56: Three building blocks by modeling
Figure 57: The mass of the building complex is divided by the direction of people flow and the direction of traffic flow.
6.3 Development exploration

- Circulation

Vertical -- transportation system
The distribution and transfer of multiple transport passenger flows are changed from flat layout to three-dimensional layout with multi-layered structures. The building space develops from horizontally to vertically, and underground and ground are combined. This design not only saves the station's floor space but also provides passengers with a convenient transfer system and reduces the impact of the station on the surrounding traffic.

Horizontal -- visual orientation
The transit hall of the building not only works as the entrance from the mall to the trains, but also has the function of a semi-indoor pedestrian street, which connects office, hotel, shopping, transportation and other services together. Therefore, the width of the roads and the form of the hall must be based on commercial street design standards as well as on passenger flow considerations.

In the design, the visual orientation of the transit hall is one of the focuses in design. A significant corridor not only guides passengers and shoppers to their final destination, but also enhances the evacuation capabilities of the complex building.

- Viaduct design concept

An elevated layer can be built between them, passing through the north side of the building. There are also entrances and exits on both sides of the site. The establishment of the viaduct not only allows passengers to enter the train station more quickly but also reduces the problem of traffic congestion. (see Fig-58)
Figure 58: Viaduct design concept
Figure 59: Horizontal connection concept
• Atrium openness

Atriums in a station complex can both increase natural daylight in the building and contribute to temperature regulation and ventilation. In the design of the atrium, the visual orientation should take into consideration the organisation of the people flow.

Secondly, in the design of the station hall, the latter should be integrated into the courtyard form of old Jinan city, including green plants and water features, so that passengers or tourists can experience both culture and nature in the building complex.

Figure 60 : Experiment with two different corridors
Figure 61: Exploration of plazas function
• Urban square

Transit squares have not only a strong evacuation capacity, but also a place to integrate different modes of transportation. The squares are an essential part of the city’s textures and functions. In this project, both the North Plaza and the South Plaza would provide more functions for people’s activities.

• High-technology in station complex design

The entrances, exits and safety design of the New Jinan Railway Station complex should be based on new technology, which can automatically check the ID. When the passenger enters the transit level, the automatic identification system can deduct the ticket fee straight away. Therefore, the station building will develop into a borderless public place, and the passengers’ movements in the station will be unrestricted.

• Materials

In the design of the railway station complex, the main body of the complex uses curtain walls and fibreglass roof to increase the lighting of the interior space. Some public spaces also use red tiles and other materials to reflect the spatial characteristics of the city.

Figure 62: Entrances become “borderless”
• Concept diagram

Functions elevation (East - West)
Functions elevation (North - South)
Public space and private space (North - South)
Public space and private space (East - West)
• Platform to subway

- Circulation
- Underground Driveway
- Exit/Subway
• Transit level to platform
- Ground level to Transit level

- Circulation
  - Entrances from plazas
  - Entrances from transit hall
• Courtyard forms
• Circulation above the ground
• Circulation perspective
• Functions

- Offices
- Hotels
- Commercial
- Theatre
- Museum and exhibition
• Masterplan
• Perspective (1)
• Perspective (2)
• Perspective (3)
• Perspective (4)
• Exploration of section (1)
• Exploration of section (2)
• Exploration of section (3)
7.0 Design Outcomes

1. Masterplan
2. Floor plans
3. Detailed drawings
4. Sections
5. Perspectives
1. Masterplan
3. Detailed drawings

1. Water, Green -- Multipurpose stairs
2. Borderless, Ticketless -- Railway area
3. Cultural, Courtyard -- Waiting area
4. Flexible, Bridge -- Shopping area
5. Scenery, Landmark -- Roof top
5. Perspectives
8.0 Conclusion

With the rapid urbanisation of China, the quality of urban public buildings and spaces has in many cases suffered and lost its vitality due to the massive population growth in cities. This thesis demonstrates how public building spaces in city centres can be regenerated to enhance the vitality of cities and improve the quality of urban life. The final design has transformed New Jinan Railway Station and its surrounding areas in the city with a major shift from an enclosed form to an open public space. Semi-indoor commercial pedestrian streets and squares have replaced the closed hall in the current Jinan Railway Station. The new train station is designed as a multi-purpose urban complex that combines shopping, dining, hotels, and Jinan History Museum. The semi-public space (transit hall and shopping levels) becomes more lively and free through the form of courtyards and corridors. The South Square and the North Square reflect the unique culture of Jinan through the use of water, green vegetation and bridges.

The main design issue in this project was the circulation in the Jinan railway building complex and its surrounding transit plazas. The existing traffic flows at the site are very complicated: the flow of people and the flow of vehicles currently interfere with each other, and all modes of transportation are at the same level which makes the design of the future Jinan railway station complex face many challenges. An initial concept design was explored to use the spatial separation of building and plazas to avoid intersection between passenger flows and vehicles flows; however, this method did not fundamentally solve the problem of traffic congestion in this area. The design approach then was considering the traffic flows of the public building space from a city perspective and led to the design of traffic routes development in the vertical direction. An elevated road leading to the transit hall of the railway station complex with the surrounding viaducts was established within the design. Moreover, the bus stops, taxis and private car parks have been placed in the underground parking lot, which liberated the traffic pressure on the ground.

The design philosophies and approaches explored in this project including urban complexes, vertical traffic design and public openness of railway stations. They could be applied to the future development of other public building spaces in city areas. However, the results of this project are limited by the site conditions, so the design methods should be adjusted according to different situations.
9.0 Bibliography


10.0 List of Illustrations

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Figure 3 https://www.telegraph.co.uk/travel/picturergalleries/5925618/Top-10-Ismamb-Kingdom-Brunels-great-surviving-structures.html?image=2

Figure 4 https://en.wikipedia.org/wiki/London_Paddington_station#media/File:Paddingtonstation.jpg

Figure 5 https://en.wikipedia.org/wiki/Gare_de_l%27Est#/media/File:Paris-Gare_de_l%27Est-2009.jpg

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Figure 7 https://en.wikipedia.org/wiki/Dresden_Hauptbahnhof#/media/File:Dresden_Hauptbahnhof_1900.jpg

Figure 8 https://www.molon.de/galleries/Finland/Helsinki/RailwayStation/img.php?pic=8

Figure 9 http://blog.sina.com.cn/s/blog_605e4aa90100yi0r.html

Figure 10 http://blog.sina.com.cn/s/blog_605e4aa90100yi0r.html

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Figure 16 Evert Meijers, “Polycentric Urban Regions And The Quest For Synergy: Is A Network Of Cities More Than The Sum Of The Parts?”, Urban Studies 42, no. 4 (2005): 771

Figure 17 The data from AutoNavi.

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Figure 26 https://www.archdaily.com/885878/shanghai-south-station-arep/5a3afc29b22e384b3a0000f1-shanghai-south-station-arep-image

Figure 27 https://www.snecf.com/sncv1/en/businesses/flagship-station-shangai

Figure 28 https://www.reddit.com/r/japanpics/comments/7k07rd/kyoto_station_with_its_12_floors_of_escalators/?utm_source=ifttt

Figure 31 https://www.kyoto-station-building.co.jp/floorguide/

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Figure 39  http://www.bahnprojekt-stuttgart-ulm.de/en/details/new-stations/stuttgart-main-station/connected-to-the-city/


Figure 45  http://jn.house.ifeng.com detail/2018_02_15/51384741_0.shtml
The timeline organised through the development of the railway stations around the world, which includes the construction time, locations and characteristics of the railway stations. By comparing the functions, spaces, structures and materials of these railway station buildings, it is easy to understand that the reasons and processes of public transport architectures transformed from a single functional building to multi-functional complexes; it is also helpful to the development direction and possibility of new transport public architectures in the future.
Full name of author: Yanan Li

ORCID number (Optional): .................................................................

Full title of thesis/dissertation/research project ('the work'):
...The regeneration of public building space in an urbanised centre...The future planning of Jinan Railway Station and its surrounding space...

Practice Pathway: ..........................................................................................

Degree: Master of Architecture (Professional)

Year of presentation: 2018

Principal Supervisor: Bin Su
Associate Supervisor: Min Hall

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Principal Supervisor: Bin Su

Associate Supervisor/s: Min Hall

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