Integration design of transportation infrastructure in urban environment

An integrated regeneration of Shanghai Station Surrounding place

Qing, Yong Sheng
Thesis / Prof. Arquim González
Integration design of transportation infrastructure in urban environment
An integrated regeneration of Shanghai Station surrounding place

Gong, Yuncheng/ MBArch. ETSAB. UPC / 2016-2017
Thesis / Prof. Aquiles González Raventós
Contents

ABSTRACT ................................................................................................................................... 1

摘要 ....................................................................................................................................... II

Contents .................................................................................................................................... III

1 Introduction ............................................................................................................................... 1

1.1 Research background ......................................................................................................... 2
   Urban world .......................................................................................................................... 2
   Infrastructure ...................................................................................................................... 2
   Chinese Transportation ...................................................................................................... 3

1.2 Definition of the core conception ...................................................................................... 4

1.3 Research Problem, question and aim ................................................................................ 6

1.4 Research methodology ....................................................................................................... 9

2 Transportation infrastructure in city ...................................................................................... 12

2.1 History of the relationship between infrastructure and urban space ............................... 14
   Urbanism to engineering and come back ............................................................................. 14
   Recent years’ events ............................................................................................................. 19

2.2 Today’s transportation infrastructure in urban environment ............................................ 20
   2.2.1 How transportation infrastructure influences urban environment ................................ 20
   2.2.2 The trend of the development of transportation infrastructure ...................................... 21
   2.2.3 Contradiction and symbiosis ....................................................................................... 22

2.3 Four aspects of the symbiosis relationship ........................................................................ 26
   2.3.1 Infrastructure as urbanism .......................................................................................... 26
   2.3.2 Transportation infrastructure, nature and landscape .................................................. 28
   2.3.3 Integrated scale of transportation infrastructure and urban fabric ............................. 30
   2.3.4 Benefits of the symbiosis relationship ....................................................................... 32

2.4 Theory model for symbiosis relationship as an example ................................................... 34
   2.4.1 Transit oriented development ..................................................................................... 34
   2.4.2 The space mode of integrated transportation infrastructure in TOD ......................... 36
   2.4.3 Risk and problem of TOD ......................................................................................... 39

2.5 Chinese situation of transportation infrastructure ............................................................. 40

3 Cases of the integration design of transportation infrastructure ............................................ 42

3.1 A tape in the city, raised garden of Sants in Barcelona ....................................................... 44
   3.1.1 Relationship with the urban environment .................................................................. 46
   3.1.2 Skill of hiding .......................................................................................................... 48
ABSTRACT

Recent years, we could see a trend that the infrastructures are coming back to the topic of today’s architects. With the development of science and technology, and the progress of globalization and urbanization, we could see that infrastructure is playing a more important role in urban environment, not only the functional influence but also in urban form and citizens’ feeling of the city, especially the transportation infrastructure in city like railways and metros. In most case, infrastructures become visible and tactile as effective means of urban development. This is not only due to increasing requirements concerning the efficiency of modern high capacity infrastructures. Conventional infrastructure projects have also significantly transformed the urban fabric and topology as well as that of the surrounding landscape.

A single-purpose and high-standard engineering managed transportation infrastructure system is becoming more and more difficult to meet the needs of nowadays urban life. In architecture, landscape architecture, and even economic and politics fields, we have seen recently the emergence of the infrastructure as an important concept that appears in a larger thinking about urbanism.

This thesis will aim at this contemporary problem about the integration design of transportation infrastructure in urban environment. The whole research will use literature study, case study, comparative study and induction as the methodology, chase two lines of the development of the relationship between transportation infrastructure and urban environment. One is theory, from the first development of urban planning of Hausman in Paris, to the period that infrastructure was not a space but an engineering structure in urban planning, and to today’s theory research like the infrastructural urbanism first invented by Stan Allen and Transit oriented development from new urbanism. Another is the cases, finding the contemporary example in reality, to see how nowadays transportation especially railway infrastructure integrated different functions and space together.

From these two lines of development, I raise a conception called “symbiosis relationship” between transportation infrastructure and urban environment. It means the integration design of transportation infrastructure in urban environment is to solve the contradiction and shape a closely combined relationship. And also it is a balance between these two items. This relationship could be divided into public space, greening system and landscape, scale and the social benefits. And that shows two most important things, one is the ability and potential that transportation infrastructure could push the development of city and become a new regeneration point, another is the possibility and diversity that in symbiosis relationship transportation infrastructure could integrated in city and serve people. Finally, I will apply these theories and proposal into the project in the surrounding place of Shanghai Station in China.

On one hand, China is still under the fast development of infrastructure in whole country to meet the development of finance and the huge amount needs from the population, on the other hand, this fast development make the efficiency as the first consideration, so very often, it is not good to be used in urban environment, and damage the urban fabric, become an obstacle for the further development of the city. The practice here is try to solve these problems using the experience from the theory study and European development. It will talk about “skill of hiding”, “building connection” and “creating public space” as the experience and cases that could be learnt in Barcelona and other European Countries. So this project of trying to make some regeneration in Shanghai Station is to check whether the trend and theory of transportation infrastructure could really be useful to a developing country like China. And through this kind of trying and rethinking, hope this thesis could more or less become a help and reference to today’s situation of transportation infrastructure in urban environment.
摘要

最近这些年，我们可以看到关于基础设施的讨论正在逐步回到建筑师的职业视野内。随着科学和技术的进步以及全球化和城市化的进程，我们可以看到如今在城市中基础设施正在扮演一个愈加重要的角色，基础设施并不单单影响城市的基础设施功能和布局，同时也对城市的形态和人们对于城市的认知产生着很大的影响。在这其中，尤其是每日都能接触到的交通基础设施如铁路、地铁、火车站等交通设施。在大多数情况下，基础设施对于城市的发展来说正在变得更加能被感知和可视。这同样不仅是因为人们对于现代高质量基础设施效率的追求，同时我们也可以看见综合的基础设施开发可能会对城市结构和地形以及周围的城市景观造成怎样的影响。

一个高度标准化、工程化以及单一目的的交通基础设施工程项目已经很难满足如今中城市以及居民随着社会发展而日趋升高的需求。 在建筑、景观、甚至政治和经济领域，基础设施如今正在成为一个更加广泛的有关于城市主义思考的一部分。

这篇论文的题目是交通基础设施在城市环境中的整合设计，是一个在当代语境下的思考。整个研究过程中使用了以下方法，文献查找，即理论性研究，案例分析，对比和归纳。由交通基础设施最开始以一种重要元素出现在城市整体规划中开始，本文遵循了两条路线对于交通基础设施在城市中的地位进行了研究，一条是理论路线，即从历史开始到归纳趋势，交通基础设施在城市中经历了从豪斯曼在巴黎的城市改造中的林荫大道这样的结合人行路权社交权以及车辆交通的基础设施建设，到由于技术的高度发展而导致的高度标准化和工业化的基础设施对城市和自然的肌理，到如今又逐步开始讨论交通基础设施该如何与城市结合的过程。如今，无论是斯坦艾伦在《基础设施都市主义》中对于基础设施都市主义的九项原则提出，还是来自于新都市主义的交通设施导向城市开发，我们都可以看见建筑师试图通过对于基础设施这一城市重要元素再介入城市建设中。另一条研究路线是案例分析，主要关注了近年的当代项目，（主要是巴塞罗那周边）是如何将城市的多种不同功能整合进交通基础设施尤其是铁路设施中去。

从这两条线索的脉络发展中，我提出了一个关于交通基础设施与城市空间的 “共生关系” 的定义。共生关系即是通过解决现如今交通基础设施在城市发展中遇到的矛盾和对于城市继续发展的阻碍来获得的一种平衡。一种整合交通基础和环境的紧密连接的关系。我将这种关系分为四个方面进行阐述，公共空间、景观、尺度、和社会价值。这种共生关系同样揭示了两项非常重要的事项，即交通基础设施作为城市更新和发展推动力的能力与潜力，以及交通基础设施在共生关系下整合城市功能服务人群的多样性和可能性。最终，我将这些理论与案例研究所得运用在了上海火车站周边地块的可能性改造设计中。

一方面，中国如今仍经历着基础设施急速发展的过程，一方面是经济发展，另一方面也是中国巨大人口所带来的巨大生活压力所致。比如中国可能正面临着世界上最大的铁路运输困难，春运。同时，由于这种巨大的发展压力，导致了过分追求效率，建设目的单一的问题，所以中国现在的交通基础设施常常是功能导向的工程设计，对城市环境和居民体验来说是不利的。在这里的设计正是希望通过以上的理论和案例研究，以及欧洲（尤其是巴塞罗那）在城市发展中的经验来解决这些问题。设计主要分成“隐藏的技巧”，“连接的建立”，以及“公共空间的创造”， 一如在案例分析中所遵循的理论框架。最后，这些从巴塞罗那以及欧洲的优秀案例中总结出的经验将会在上海站周边地区的实际项目中得到运用和验证。通过这种运用和反思，希望能够让我们反思国内如今过于高速发展重量不重质的交通基础设施，以及为未来的城市更新与发展提供有益的参考。
1 Introduction
Introduction

1.1 Research Background

"In most case, infrastructures become visible and tactile as effective means of urban development. This is not only due to increasing requirements concerning the efficiency of modern high-capacity infrastructures. Conventional infrastructure projects have also significantly transformed the urban fabric and topology as well as that of the surrounding landscape."

Urban world

Cities have powered the world economy for centuries. From 1800 till now, the population of the world increased 6 times, the population of the citizens increased 60 times. In 2008, the population of the city became more the population in countryside for the first time. And towards 2050, more than 70% population of the world may become citizens. Even though now the situation of urbanization is changing very fast, we start to discuss the phenomenon of counter-urbanization and also reurbanization, we could not neglect the huge influence that urban world carry to us. According to the McKinsey Global Institute’s research on the urban research “Urban world: Meeting the demographic challenge in cities”, we can see that “Large cities generate about 75 percent of global GDP today and will generate 86 percent of worldwide GDP growth between 2013 and 2030. Population growth has been the crucial driver of cities’ GDP growth, accounting for 58 percent of it amount large cities between 2000 and 2012. Rising per capita income contributed the other 42 percent.”

At the same time, though the process of urbanization slow the speed and seems to need many cautious decisions in some developed countries, it is still developing very fast in China and also other developing countries. The fiercely changing of the urban environment, and the fast development of society notice many problems in the urban world. No matter the regeneration of the urban environment or the fast developing urban environment, we should pay attention to the current situation and challenge today. And the infrastructure is one of the most important material problems in the urban world we faced today.

Infrastructure

The world today invests some $2.5 trillion a year on transportation, power, water, and telecommunications systems. Yet it’s not enough—and needs are only growing steeper.


In architecture, landscape architecture, and even economic and politics fields, we have seen recently the emergence of the infrastructure as an important concept that appears in a larger thinking about urbanism. With the development of the society and urbanization, interest in urbanism has been growing over the last few decades, in today’s process of globalization, even though we should consider different situation in different environment and culture, the problem and fast changing of infrastructure has become a common problem we have to face. The infrastructure itself, has become a potential area for the development of both the urban space, but also the economic environment.

The infrastructure of the city, though inevitably has a lot relationship with the civil engineering, but has come back to the discussion of urban environment and landscape. We not only want it to take responsible for the municipal function, but also want it to become a more friendly place and can grow with the urban environment, create the possible public activities and benefit from it.

With the urbanization and urban regeneration, the old and outdate transportation infrastructure like station and railway system have different situation in city than ever before. Some old stations are built in the margin of city, but with the development of the city it becomes the big void in the city environment. We could not ignore the obstruct made by the infrastructure. And the landscape, also cut by the infrastructure and could not shape a unity as a system (if not designed well and consider the context). On the other hand, we should see the value that the transportation infrastructure bring.

1. INFRASTRUCTURAL URBANISM: ADDRESSING THE IN-BETWEEN[M]. DOM PUBLISHERS, 2011
2. UNITED NATIONS POPULATION ISSUES. HTTP://WWW.UN.ORG/ZH/DEVELOPMENT/POPULATION/URBANIZATION.SHTML
to the city. Needless to say the mobility and public connection, but with the number of so many people give this kind of infrastructure more opportunity and benefit. And also in very density environment like New York, this kind of infrastructure regeneration may become the last chance to reshape the public system.

**Chinese transportation**

China is developing the transportation infrastructure very fast these years. However, that carried some problems, also the potential. Because of the policies and huge population, the problems and needs are even more urgent. To suit the fast development, the transportation infrastructures are built fast and efficiency is the first important problem the government concerned. That has absolutely did damage to urban environment, and because of the planning is not perfect, sometimes this kind of railway roads and even high way will influence a bigger area than normal ones. In Shanghai, there happened several times about changing the position of the high way and avoiding some danger. The same situations happened on the stations in Shanghai.

With the development of the economy and society and people’s need, the Chinese government also changed the strategy of designing the station. The old mode of building the stations in an urban environment meet so many problems today, and we are learning the European and American way of integrating the transportation infrastructure and urban environment. Here is a good opportunity to talk about it, as Barcelona is one of the best example about shaping the public space in the world. Not only the result, but also the process is worth to be studied.

![Figure 1.1 Multi-Level of the Transportation System](source: HTTP://PR2015.AASCHOOL.AC.UK/DIP-11/ROBERTO-BOETTGER)
According to the Merriam-Webster Dictionary, infrastructure is defined as a resource required for action. This definition is so comprehensive that it encompasses resources such as manpower, in addition to buildings and basic facilities. In other words, infrastructure refers to the basic services, facilities, and systems necessary to the growth and development of a community, such as transport, funding of public and private projects of various sorts, education, and research. This is in contrast to a narrow concept of infrastructure focusing on physical-spatial systems, which can be largely divided into transportation (road, rail, air, canal, etc.) and communication systems. Recently, the possibility of infrastructural space as a mobile and generative spatial system in relation to discussions on the urban landscape has been nearly the focus of attention in the Netherlands.

And the reason why to chose the transportation infrastructure is made by different kinds of consideration. On one hand, aiming at one certain area can help to narrow the range. The infrastructure is a very range concept nowadays, we can even call every functional buildings in the urban environment as an infrastructure. By narrow the range we can concentrate our work there. On the other hand, if we talk about infrastructure, it will be very easy to think connection with the civil engineering, something like dam, sewage system or power station, these kinds of infrastructure, also they act a very important in today's human life, but they are not the space which people will directly use, or be in use in such a strength like transportation infrastructure. Transportation infrastructure like railway or metro station, are which is very close to people's daily life, they will be inside the buildings and use it. It is because of this close relationship that we chose the transportation. In addition the huge volume and the position of the station make it more value to do the research for the public space and urban environment, both in the space aspect but also social benefit aspect.

The transportation infrastructure includes these kind of construction: Station, railway road, port, airport, road, etc. And this research will most concrete on the station, railway road and road, this kind of transportation which across the urban ground floor.

The integration design, as it is said, is trying to find a cooperate relationship between transportation infrastructure and other urban space. To use the value of land and find potential in the undeveloped space of city, solve the problem it created. It can be a single building, which use urban space and public activities as an intervene inside, and also it can be a big urban project which influence a bigger area or an urban design project which take root in the urban space and shape the transportation infrastructures. Finally, it is a sort of architectural issue, so it will based on space discussion, talk about space connection, urban fabric, and urban theories, try to shape a space design. Although it will consider some other aspect like civil engineering or political environment, but that's not the main issue to be discussed here.

---

Introduction
1.3 Research Problem, Question and Aim

Research Problem

About the research problem, here I divide it into two part, one is the outside part, the relationship between the public space in urban environment and transportation infrastructure. Another part will be the inside part. Talk about the inside relationship of the symbiosis of public space and that specific municipal function in the transportation infrastructure. The transportation infrastructure, as we know, is complicated because of the diversity and different need, so this part is actually to talk about the transportation function and other function.

In the outside aspect of the relationship between the public space and transportation infrastructure. Many transportation infrastructures have really become an obstacle in the whole city. The commercial, residence and public space system are cut by the huge volume of the buildings, the infrastructure of railways and railway itself. With the development of the whole city, this kind of obstacle influence a big area of the whole city. In today’s high density environment, we try continuing development of the city, and continue the process of urbanization. this kind of use of space is a big waste of the urban land, too simple and crude for today’s complicated urban environment.

And that is not only the problem of cutting the urban materiality world, but the transportation has influenced the people’s daily life, some facility, like the big train station and the long road bus stop, especially in a busy district, has cut the continuity of the sequence of public space. When you are walking in this kind of environment, you have to share and give place to the vehicle. This loss of the people’s human space is a problem in some place in China.

On the other hand, like train station nowadays, we do not see them as a kind of functional machine like before. We do not want it to be “like a projectile being shot through the landscape and it (the railway) transmutes a man from a traveler into a living parcel.” This is the origin status of the transportation system, chasing for the speed and efficiency, But today we want to see the diversity (and it really needs) in the urban environment, how can a train station or metro station provide different use for the huge amount of people travelling here.(Actually, if we can divide the function in different station, and disperse different function in the whole urban are, it can help decrease the crowd of the rush hours. Easy to understand, if all the function like residence and work and living are divided clearly, then people need to go different place (long distance) to finish one day’s work, but if we can provide some shop or small
restaurant in the station, it can help putting some people out of the rush hours, they can chose to do some activities in the station but not all the people go one direction. This kind of need is a limitation, but also opportunity to the transportation infrastructure.

**Research Question**

Since the 1990s, however, as the criticism emerged that public space had not contributed to the improvement of the quality of everyday life, there has been an increasing interest in the processes by which the composite system of infrastructure in contemporary urban space restructures urban publicness. This is seen for instance in communication and mobility infrastructure, which are the two major types of infrastructure. Infrastructure is related not simply to the intensity of physical mobility, but also to its density, that is, the degree of communication; hence, restructuring infrastructure in urban space also fosters a critique of urban space in modern society, in which mobility is widespread.

In nowadays’ urban regeneration in city, how will we treat the transportation infrastructure in city. Can it be in symbiosis with the public space? We should change our idea of the narrow infrastructure but look serious about the relationship between the infrastructure with the urban environment and landscape. It can be a totally new project or renewing in city or even an addition structure in the old building. Could we find a good or modify treatment to solve the gap made by the railway and give city a complete possibility to continue developing and mixed-use different function in today’s high density environment. In the future city renewing, what can we design (or do) to the city.

That’s my research question, just like things happened in 1999, Van Broeckhuijsen, at that time, the Dutch architects try to find a way of solving the the disconnection in the downtowns made by railroads. They design a big platform what they called “urban desk”, and try to organize different kind of functions on the urban desk and connect different part of the city.

**FIGURE 1.4 THE MULTI-LEVEL NETWORK IN SIO, JAPAN** [HTTP://WWW.SIE.SIK.OTJP/](http://WWW.SIE.SIK.OTJP/)

**FIGURE 1.5. OSAKA METRO STATION** [HTTP://WWW.SKYSKRAPERCITY.COM/SHOWTHREAD.PHP?T=1315795&PAGE=30](HTTP://WWW.SKYSKRAPERCITY.COM/SHOWTHREAD.PHP?T=1315795&PAGE=30)
Research Aim

This research aims at the transportation infrastructure and the public space. This thesis works toward the development of a method for infrastructure-centered publicness in the design of urban public space by looking into the relationship between transportation infrastructure and public space. The article will talk about infrastructure, shared space, publicness, accessibility, liminal space, functional use, mixed-scale, etc. The researches, both theory and case studies, will be summary and get several trends and possibilities for today’s transportation infrastructure. This kind of conclusion and possibilities will be used on the design of Shanghai Station to finally shape a real project about the integration design between transportation infrastructure and surrounding urban environment. From this design I will try to find some general principles and mode for today’s urban environment of China.
I will use two kinds of methods to do this research, the first is to chase the development of files about the urban infrastructure. Like some policies and reference about the topic, another will be the case study, based on Mies Award but also will add some other projects, maybe not detail analysis but to show the development of the consideration of nowadays urban infrastructures.

**Literature study**

At this part, I will study the linear development of the infrastructure in urbanism, analysis different aspect thinking and theory of the relationship between transportation infrastructure and public space. The public space means the urban environment and the publicness in the transportation infrastructure. Use this theory improvement to instruct the analysis of case study and learn some modes of the symbiosis.

**Case study**

According to the Mies award list, I will choose at least two cases to do deep analysis, from the background of the project to the relationship with the urban environment. The second part will be the analysis of the detail in architecture period. But the most important topic of the case study will be the relationship between the station and the public space, including but not limited to the technology, structure, connection, blending space.

**Comparative study**

The comparative study will be divided into two parts, the vertical comparison and horizontal comparison. The vertical comparison means in one case, I will analysis the difference before and after the construction, aiming to understand the change that the symbiosis of the transportation infrastructure and public space bring to the whole surrounding environment. The horizontal comparison will be the comparison between different case study in the same period. Situation in different places are different, so different strategy and different kind of methods will be used by different projects. Understand this kind of difference will help us to understand the essential part of the symbiosis of the transportation infrastructure and public space.

**Induction**

The induction will be used after the above three methodology. I will summarize the common and different characteristics in the case and give some general advise and method to keep the symbiosis of the transportation infrastructure and public space. Make a outlook of future role and importance that the transportation infrastructure played in the future development of urban environment and public space.
Figure 1.8: The connection in public space as infrastructure, source: Author.

Figure 1.9: The multi-level system in transportation infrastructure, source: Author.
2 Transportation infrastructure in city
Transportation infrastructure in city

2.1 History of the relationship between infrastructure and urban space

Urbanism to engineering and come back

“……Initially, infrastructure was part and parcel of regional and urban structuring. It obeyed conditions imposed by the environment - topography, flood, soil resistance - and gave way to building form around it. Infrastructural systems acted as ordering devices. They were conceived as integrated man-made landscapes. Up to the 19th century, morphological cohesion between infrastructure and urbanity was engraved in traditional and newly developed road typologies. Vehicular movement was intelligently married to pedestrian circulation and augmented by ancillary programs to act as an instrument that guided rapidly developing parts of the city……”

If we trace back to the beginning of the urban planning, it means to consider the city as a whole unity, but not to divide the city into different districts and change it in each district, it means to build the system contribute to the whole city, it will be the Baron Haussmann’s famous planning in Paris.

According to “The Cambridge Economic History of Europe”, “in the middle of 19th, the people in the country of France moved to the city and town, almost 45% of them moved to Paris. At that time, Paris has old house and bad transportation system. The chaos of the residential area and the narrow gravel road made the environment dirty and crowded.”

And with the extension of the railway network, the growing population, the Paris at that time is facing the problem of transportation (because the growing amount of carriage has paralyzed the transportation in Paris), sanitation, and the social stability.

Haussmann’s network of roads was, to some extent, brutally imposed on the old urban fabric, demolish the buildings and

---


FIGURE 2.4 THE ROAD AND MUNICIPAL INFRASTRUCTURE DESIGN IN HAUSSMANN'S PLAN. HTTP://BLOG.SINA.COM.CNS/BLOG_B044794A0582D07A.HTML
embedded in the urban structure. It carries out a lot of problems, like more or less do damage to the history culture, (at that, the residential buildings are not protected and seen as valuable as today), Cause the deficiency of the housing, and lead to, more or less, the imbalance of the society.

However, this network solve the most urgent needs in that day’s Paris. And because that the plan is made within a vision of urban integrity, the roads system is well located to take advantage of existing monuments and the public space, topography, urban environment, and other beneficial opportunities, Haussmann’s plan create an amazing environment for the people. At the same time, the roads system is combined with the landscape, street furniture, building edges and the utilities, sewer. These infrastructures formed a new system of transport, pedestrian, municipal function, power and public space. And the boulevards in Paris, which has later become a common method to shape the road’s landscape, become a great public space for people’s activities. “Although some Paris boulevard date from the seventeenth century, most were built in the mid-nineteenth century under the direction of Baron Georges Eugène Haussmann, Napoleon III’s prefect of the seine. Many of the latter, including some of the most impressive ones, were multiway boulevards. These streets established the basic form of the multiway boulevard used world wide.” And the sewer system Haussmann left to Paris benefit Paris for hundred of years. This kind of urban regeneration, combine the infrastructure to the public space, gain huge success, and make the infrastructure as one important key word in the urban planning.

The same situation also appears on Frederick Law Olmsted (April 26, 1822 – August 28, 1903), who is the designer of the New York Central park, and is known as the father of landscape design in the United States. Nowadays people pay more attention on his contribution to the urban public space. The “Parkways” he created, as a transportation infrastructure for automobile, which is also designed as a sort of landscape, connected different parks in the city and combined with the flood, and drainage engineering. The park system he created, combined with the infrastructure system,
become on kind of new type of urban form later. As evidenced by these projects of the 19th and early 20th, infrastructure was both an icon of technological modernization and the urban improvement in people’s daily life. And in the later case of Soria y Mata’s linear city, the new form of the road or transportation system also represented the consideration of urban structure. We can still see the infrastructure project in cities remained deeply rooted to urbanism.

However, with the development of the technology and society, the infrastructure between cities became more or less disconnected from its environs as it was turned into a transportation system of its own. The modern transportation infrastructure, like web of roads, highways, railroads, ports are becoming indifference to the land and environment because of its own logic of performance and technical requirements.

“By the mid-20th century, bureaucratic and technocratic production modes had moved infrastructure toward being a component of traffic management rather than of urbanism. Utilitarian terms, efficient circulation, and the technological panacea - asphalt - resulted in the specialization of road design. Highly standardized freeways and expressways with almost no relation to the immediate environment became commonplace.”

And if we consider historical background, the modern transportation infrastructure like high-speed railway road, and the train’s station are considered as one of the most important strategic source, so sometimes they are put into another system to be designed, the defense of the country and the efficiency of transporting the army and weapons. For instance, in Russia, the width of the railway road is different from in west Europe, because the government don’t want to give the opportunity to other country to transport the army in their country. At that time, the transportation infrastructure focus more on itself and other aspect,

Figure 2.7 Soria y Mata’s Linear City, https://alchetron.com/Arturo-Soria-y-Mata-1177552-W

---

but not the public space, urban environment, and landscape.

Fortunately, the thinking of the relationship between the infrastructure and public space didn’t stop. In Reyner Banham’s “Los Angeles: The Architecture of Four Ecologies”, we can see he explained how Angelenos related to 4 “ecologies”, the beach, the freeways, the flatlands, and the foothills, in Los Angeles, a mobile city, he talk about the city, put the natural and artificial (infrastructure) ecologies to discuss together. This kind of combination appears more and more because of the development in the society and people’s need, people get rid of the difficult living situation and become the major in the urban space.

In the past decades, there has been growing discussion of the infrastructure, landscape and territory. Since the 1990s, concerted efforts have made to move away from an infrastructure that was predominantly determined by engineering requirements. We can see the excellent achievement in Barcelona, France’s various TGV and tramway projects, and the projects in Japan. We can see the new ring road in Barcelona and the underground infrastructure that combined with the urban public space. Like Rambla de Brasil and the railway road garden. And also in Japan, because the dense is even higher than Barcelona, the focus on the use of land become more important, we can see in Kyoto Station, how Japanese architects blend the public space and activities into the transportation infrastructure and keep the directly use of the station.

The discussion and thinking of the infrastructure come back to the context of the environment, infrastructures like transportation infrastructure play an important role in the urbanism. That’s the history of the relationship between the transportation infrastructure and urban environment.
Recent years’ events

Recently, the possibility of infrastructural space as a mobile and generative spatial system in relation to discussions on the urban landscape has been newly the focus of attention. \(^8\)

In the last several years, we have seen a lot of architectural events, publications and discussions focused on the infrastructure and exploring the role that infrastructure played in the development and regeneration of the city. \(^6\) Trying to find new solutions for today’s complicated, technical, and public infrastructure challenges. This kind of discussion and events, are a comprehensive issue, which include landscape, architecture, engineering, urbanism, and even social investment. Different source of attention made the infrastructure as one of the hottest word in today’s urban development.

For instance, the WPA 2.0 competition in 2009, organized by UCLA’s CityLAB which “recalls the Depression-era Works Projects Administration (1935-43), which built public buildings, parks, bridges, and roads across the nation as an investment in the future one that has, in turn, become a lasting legacy” and “encourage projects that explore the value of infrastructure not only as an engineering endeavor, but as a robust design opportunity to strengthen communities and revitalize cities. Unlike the previous era, the next generation of such projects will require surgical integration into the existing urban fabric, and will work by intentionally linking systems of points, lines and landscapes; hybridizing economies with ecologies; and overlapping architecture with planning.” \(^9\)

MoMA’s Rising Currents: Projects for the New York

Waterfront exhibition in 2010, invited several different teams to try to solve the problem of New York’s coast and sea-level problem, “Though the national debate on infrastructure is currently focused on “shovel-ready” projects that will stimulate the economy, we now have an important opportunity to foster new research and fresh thinking about the use of New York City’s harbor and coastline.” \(^10\)

The Landscape Infrastructure Symposium at the Harvard GSD in 2012, the sub title is Landscape Infrastructure Symposium: Systems & Strategies For Contemporary Urbanism the symposium invited a group of architects, landscape architects, historians, engineers, and ecologists to explore “the future of infrastructure and urbanization beyond the dogma of civil engineering and transportation planning” and “to propose responsive strategies that address the predominant challenges facing urban economies today.” \(^11\) Additionally, picking up on a growing public discourse on infrastructure and reacting, often directly, to recent infrastructure failures, climate-related catastrophes and to meet the growing population’s needs of new kind of lifestyle and infrastructure, many architecture and design college has studio and competition aiming at this problem.

Infrastructure is certainly a topic of the day; in his 2013 State of the Union address, former President Obama singled out infrastructure as a critical weakness and impediment to re-growing the US economy. Obama referenced 70,000 structurally deficient bridges across the US, and proposed an Infrastructure Bank that would seek private money to supplement public spending on ports, pipelines, roads, bridges, airports, high-speed rail, and self-healing power grids.

---

10. the WPA 2.0 competition in 2009 http://bustler.net/competitions/latest/1061/wpa-2-0-student-competition
Transportation infrastructure in city

2.2 today’s transportation infrastructure in urban environment

2.2.1 How transportation infrastructure influences urban environment

Transportation infrastructure is one of the most important infrastructures in the urban space. So here I will divide the influence into three parts: amount, shape and quality.

Amount

Capacity of the transportation network will directly influence the intensity of the land development, and also the density of the area and the amount of the constructions.12 The capacity of the transportation network include the public transportation, private motor vehicles and non-motorized traffic. one of the reasons that we do not want to depend on the private motor vehicles is that if the municipality want to increase the density of one area, it will need a higher capacity of the road. However, the wider the roads are, the smaller place the buildings could take. This kind of the development has limitation of development and difficulty, so the public transportation is better on the amount of development.

Shape

The railway roads, light rail, and the metro lines on the ground, which will cut the context of the city directly. Creating disconnected place and influencing both the arrangement of the buildings on the ground and beneath the ground. With the development of the urban margin, that problem will become more urgent. On the other hand, the entrance of the transportation network, like the bus stop, the entrance of the metro and the railway station will also appear on the ground of the city and shape as a part of the urban views.

Quality

How the transportation infrastructures step into the urban environment will influence the quality of the urban space to a large extent. The station, for bus, metro and railway are the node of people in the city. Itself is an important place as the urban environment, and if we could do a good integration design of the transportation infrastructure and surrounding space, it will be a good way to use the huge amount of people and develop the potential of the economic possibilities, providing a good feeling of space to people in the movement.

Scale

The transportation infrastructures always appear in cities as a huge volume in contrast to other buildings in urban environment. the changing state of the scale in this area, (the in-between place between different scale), influence the urban fabric and push to develop many different sorts of space than before.
2.2.2 The trend of the development of transportation infrastructure

From the history and the development, we can see the change of the relationship between the infrastructure and public space. At the same time, we can learn two trends in the design of infrastructure, one is multi-function and another is decentralized. These two trends, which accompanied with the background of higher density in city, the pressure of land, the growing needs of people’s public activities, and the chasing of the healthy city and facilities, become inevitable in today’s urban regeneration.

The decentralized, which should be divided into two part, first is that the infrastructure, such as the transportation infrastructure, is not a system with high degree of autonomy as before. It is with high standard and engineering technology, but also take root in the urban environment, has a strong relationship with people’s public activities, considering the influence it bring to the community. This enhance the publicness in the transportation infrastructure like train and metro station and their surrounding place. On the other hand, decentralized means, divide the transportation system, make it disperse into the urban environment. That will make different people and area more easily to get to the transportation system and enlarge the influence that the transportation infrastructure bring to the public.

Multi-function, means the diversity of the infrastructures. The transportation infrastructure, is not a single-purpose system today. In different condition, it should fit different environment. No matter the residence or the commercial area. The transportation infrastructure should serve not only the transportation, but also the public needs. Even itself can become a park or big plaza which connect different part of the city. So today’s form of transportation infrastructure is continue changing, to fit different needs, and different people can enjoy the public life here. That also shape the publicness of this sort of place. How to organize different relationship between station, railway road, community and landscape becomes a new topic today.
As we have talked about the trends of the development of transportation infrastructure in city, if we look into the property of the transportation infrastructure, we will find some interesting characteristics and contradictions made by this new trends. Originally, when we first build the transport system, we aim at transport things fast, no matter the goods or the people and connect the world more easily. From this initial aspect of transportation infrastructure, it is designed to transport as fast as they can. So the stations we saw today, are always designed as a direct and clear place. The direction and isovist are so important that if we look back into the old stations, the huge entrance and a big hall for the travelers are almost the standard element in a train station. To enhance the monumental atmosphere and clear direction.

However, at the same time, the influence, necessity and the role as important node that the station played in the whole city, carry the station a huge amount of people. And nowadays transport system itself is still chasing the efficiency as one of the most important factors, so as the node of the transport system, the station has a very strong property of publicness. The huge amount of people and the property of node in the system bring different needs to the station. The dense and population need not only the transportation function but also some other service in the place, to meet these kinds of needs means the mixed of the function and provide the option to the users. On the other hand, if we look this situation from the view of commercial development, the huge amount of people and needs means the big opportunity and potential to build some service and commercial space, and insert these different functions into the transportation function.

There are also some other contradiction in the relationship between the transportation infrastructure and public space. For instance, the railway road system, to the whole city, a strong transportation system can help improving the ability of the logistics, transiting the
goods and people, from the relationship between city and city, it is very important and convenient, the railway is the lifeline of some cities. But in the inner city environment, the width of the railway road may become a big problem. The noise and shake will influence the nearby neighbor, the width of the railway road will cut the connection of different parts of the city, and even damage the expansion of the city. More or less, this kind of void become an obstacle in the city, and with the development of the margin of the city, it will be more difficult. The municipality, citizens, and investor will stand in different view to judge this problem, which also bring many misunderstood and difficulty.

This problem, in Barcelona, has been fixed more or less in the last big change of the plan of infrastructure for the Olympic, but if you go to the railway roads in the place where is far away from the center, you will find the problem is still exist. When the author walked along the railway road in Barcelona, it gave me a totally different impression of this city, than before. The neighbor is cut and because of the height, very few place can be used, very few people and activities, I even felt not safe in that area.

These contradictions, which appear in the transportation infrastructure, do not only mean the problems and difficulties, but also carry the opportunity and possibilities, the solution and design to these kind of contradictions of transportation infrastructures is the symbiosis relationship.
The symbiosis relationship between transportation infrastructure and urban environment

The word Symbiosis, according to Merriam-webster Dictionary, is defined as 1. The living together in more or less intimate association or close union of two dissimilar organisms (as in parasitism or commensalism); especially the mutualism. The original definition is an ecology word, that explain more or less the intimate association between two items, another meaning is, a cooperative relationship (as between two persons or groups). That's what we talk here, the relationship, that helps each other as a cooperative association. This kind of relationship between the urban public space and infrastructure means not only to combine two things together by a way of “plus”, but to solve and reorganize this relationship, integrate the transportation infrastructure into the urban environment and create an interesting place provide different services for different people to use, and improve the quality of the urban public space.

If we go back to the influence of what transportation infrastructure do to the urban environment, talking from three aspects, amount, shape and quality, the symbiosis relationship also appears in these three aspects.

From the amount, the symbiosis is the relationship between the amount of transportation infrastructure and intensity of the land. Do the capacity of transit adapt the needs for the development of the land? Could they combine more to make the proportion more reasonable. And do we waste the exist transportation infrastructure, can we move the source to a more urgent place?

From the shape, the symbiosis is the question of do the transportation infrastructure damage the urban environment? Does it provide the connection to other places in the city or be an obstacle? And does the transportation infrastructure become an appropriate figure in the urban environment or it becomes a kind of isolated sculpture. In the urban context, what a huge or small volume of transportation infrastructure looks like.

From the quality, the symbiosis is the question that if we have created good place with different function for different people. The traffic but also other functions will both improve the quality of the transportation infrastructure but also contribute to the urban environment. Is the integration design we did make people’s life more convenient or more difficult? And how is the influence that the transportation infrastructure do the neighbor and community.

In the next chapter I will explain the symbiosis relationship deeper from three aspects.
Transportation infrastructure in city

2.3 Four aspects of the symbiosis relationship

2.3.1 Infrastructure as urbanism

Some transportation infrastructure like station, airport, port, themselves are public space, here I will discuss the relation between transport function and public function space.

In the recent several years, one sort of thinking about urbanism and infrastructure appears, called the infrastructural urbanism. That was first named by Stan Allan in his “Points+ lines: diagrams and projects for the city”, in the chapter “infrastructural urbanism” he point out seven propositions for infrastructural urbanism. The first one is under.

“infrastructure works not so much to propose specific buildings on given sites, but to construct the site itself. Infrastructure prepares the ground for future building and creates the conditions for future events. Its primary modes of operation are: the division, allocation, and construction of surfaces; the provision of services to support future programs; and the establishment of networks for movement, communication, and exchange. Infrastructure’s medium is geography.” 13

Here he point out the role that infrastructure played in the urban environment, the infrastructure do not need to become a form-completed building or it do not take it as a final aim. The aim of infrastructure is to create a container in the city and contain different public activities and space inside. Just as the last chapter we said two trends of infrastructure. The transportation infrastructure, do not only finish the municipal function, but it can also connect different part of the city. because of its special function, sometimes do damage to the urban environment and become an obstacle in the inside urban space, at the same time it is very difficult to find other use in one level (possible, but in special condition such as Sant Antoni Sunday Market / Ravetllat Ribas Architects ) so we need to find the possibility in multi-level system and the surrounding space. This kind of space should be connected well with the urban environment so that the activities will happen,
Infrastructures accommodate local contingency while maintaining overall continuity. In the design of highways, bridges, canals, or aqueducts, for example, an extensive catalog of strategies exist to accommodate irregularities in the terrain (doglegs, viaducts, cloverleaves, switchbacks, etc.) which are creatively employed to accommodate existing conditions while maintaining functional continuity. Nevertheless, infrastructure’s default condition is regularity— in the desert, the highway runs straight. Infrastructures are above all pragmatic. Because it operates instrumentally, infrastructural design is indifferent to formal debates. Invested neither in (ideal) regularity nor in (disjunctive) irregularity, the designer is free to employ whatever works given any particular condition.” 14

Infrastructures, have some general property. On one hand it comes from the tradition and needs from civil engineering, on the other hand, we can see it as common thinking or typology. Especially in today’s transportation infrastructure. It is very important to study different connections from transportation to the public space. In physical terms the city is the conjunction of its public spaces, public space is the city. 15 but how it creates the connection and public space for the urban environment, In the urban environment, how to be blended into the context, how they build their volume, what kind of diversity it has, and which function as an addition to be inserted. in different conditions, it changes. That’s another thing, except the common principle, interesting to be noticed. Just as Bohigas wrote in “Ten points for an urban methodology”, “The identity of a public space is tied up with the physical and social identity of its wider setting.” 16 However, this identification is bound by limits of scale that are normally smaller than those of the city as a whole.” Therefore, this research is aiming at finding the similarity of connection, and the different method of creating the space.

15. BOHIGAS O. TEN POINTS FOR AN URBAN METHODOLOGY[J]. MARSHALL, T. TRANSFORMING BARCELONA. LONDON AND NEW YORK, ROUTLEDGE, 2004: 91-96
Transportation infrastructure in city

2.3 Four aspects of the symbiosis relationship

2.3.2 Transportation infrastructure, nature and landscape

Natural and urban landscape

Buildings approaching the forms of mountains and caverns; structures that appear as rivers and clouds: the contemporary architects producing these conditions advance an agenda that we can provisionally term the “architectural reconstruction of nature.” In addition to representing relationships to nature, the processes or shapes of nature, this architecture also appears to bring nature back into the view and experience of the city.

In contemporary environment of designing transportation infrastructure, even though we are still facing some problems of that the transportation infrastructure will destroy the natural landscape, change the topography in nature world and become an unsuccessful intervene. In many cases, the huge transportation infrastructures themselves become a sort of urban landscape. A kind of artificial nature and bring back the experience of nature space in the urban environment and connected to other landscape in the cities. This idea of combining the landscape and infrastructures, are more or less influenced by the idea of landscape urbanism. In many ways, landscape infrastructure builds on the theoretical ground pioneered by landscape urbanism. Early theorists of landscape urbanism were interested in describing the city as a landscape, overcoming the binary between urban and rural (and urban and natural) that reigned at the time.

However, the method to combine transportation infrastructure and natural elements in urban environment is still not easy. And the symbiosis relationship is even more. We should both consider these two items, but also the surrounding space which be used by the neighborhood or the community. We use landscape to fulfill the void? Or to protect the community that influenced by the transportation infrastructure, or even create a landscape system by

FIGURE 2.18 THE VANCOUVER LAND BRIDGE, HTTPS://LAUSA.WORDPRESS.COM/2012/11/22/THE-VANCOUVER-LAND-BRIDGE/
transportation infrastructure. Just as we talk in the last chapter, or as typology, things will happen differently depending on different condition and context, but we will have some general similarity.

On the other hand, become a kind of landscape does not mean the relationship only with nature, the transportation infrastructure could become a kind of urban landscape, artificial one.

A seminal attribute of the megaform is it’s quintessential horizontality, which is integrated as much as possible with the site on which it sits. At times this topographic character may be so dominant as to become a virtual landscape in itself ……

In His “megaform as urban landscape”, Kenneth Frampton said that in the environment of contemporary period, we are not as confident to design the shape of city before as we did in the second half of nineteenth century. Because of different reasons, now we architects are using fragmentation measures to fixing or doing regeneration in city. Megaform, not the same as mega structure, emphasis on the diversity of the architecture, the inside form of buildings. Frampton used L’illa as an example. He introduced how L’illa combine different things together on the Diagonal street. The commercial street, office, underground transportation infrastructure , and in the back of the building there is the garden and community. Transportation infrastructure in the city, is a sort of megaform and at the same time mega structure. It should fix the city, a kind of exact intervene, and also blend into the culture and context, shape the urban landscape. That another importation relation in the symbiosis relationship. How the transportation cooperate with the

natural and urban landscape, deal with the topography, context and form.

Three kind of relationships with landscape

1. Greening system as element
   In Atocha Station, we can see how greening system be used as a sort of element in station. The combination and design is amazing and really smart, so itself create a green environment inside the station.

2. Transportation infrastructure combine the landscape
   In Logroño station, we can difficult to say which part of it is station and which part of it is a park. The park and the station combine very closely and you could not divide two function into separate. It is a station, but also a park. Both can transport people and help people to enjoy a sunshine afternoon here.

3. Landscape transportation infrastructure as a system
   What makes high-line great is not only the design of the vegetation (of course its good), but the system that high-line bring to the society. It is not only a park or overpass, but a system that connect different neighbor and community, in a high density environment. The diversity and public activities that create by the high-line is in a landscape system, avoiding the cars and the roads. Balance the benefits from different involvers of the big project. So it becomes great, live and go to people’s life, shape a symbiosis relationship with the urban space.
Transportation infrastructure in city

2.3 Four aspects of the symbiosis relationship

2.3.3 Integrated scale of transportation infrastructure and urban fabric

The transportation infrastructure, which appears in the city, is in a different scale to other buildings in the urban environment, and that situation is general because of the needs for the transportation. Or if we change a view to talk about the problem of the scale, at first, the transportation infrastructure is designed for machines, like trains, cars, or metro, planes, and the surrounding buildings are designed for people, for human beings but not machines, so we could forecast that sort of contradiction of scale in same urban environment.

So as one of the aspects of the symbiosis relationship, and as the requirement of the urban space design, the different scale should be integrated. This does not mean to change the scale, volume, or the characteristics, but try to blend two sort of scale and try to achieve a symbiosis relationship. The method to deal with the integrated scale could be hiding, blending or creating new kind of space that as an comprehensive space.

In (fig. 2.21), there are several different railway infrastructures, the plan and the calculation of Fär, shows different methods of solving the problems of scale and blend the infrastructure into urban environment as buildings. The transportation infrastructures could be combined with different urban functions, such as residence, commercial, public activities, park, or even in one transportation infrastructure, the function of transportation could attached to other ones but not the main function.

Hiding

Hiding means to decrease the bad influence created by the transportation infrastructure in the aspect of scale as much as possible. Make people neglect the difference of scale and space, hide the infrastructure under other functions and forms in urban fabric. In the case of europalée Zurich (fig 2.22), the designer used artificial landscape, or urban landscape to hide the scale of railway roads, protect the surrounding buildings. And the artificial landscape could shape a new area of developing to help the growing of city. In the case of Entwicklung der ehemaligen Bahnflächen im Inneren Westen (fig 2.23), they used natural landscape to shape the protective screen protecting the surrounding space, then the difference and contradiction of the scale will be decreased by this green belt.

Blending

Blending means to blend the transportation infrastructure's scale into urban fabric, it could be a combination of functions or the composition of form. Kyoto station is very big, but not towering. That's because the function of different public activities help it become a part of the city, and then the huge scale could be divided into different functions and it will become suitable for the urban fabric.

Comprehensive integration

As in Yokohama harbor (fig 2.24), the harbor is trully take the responsibility of transporting the people to ships, but it also has become a concourse for people, combined with these two scale, we could not easily to separate two different functions and activities caused by functions, and the same situation also appears in High speed train station of Logroño and New York Hudson Yard, other function may become the main power of designing and take the main role in the whole project, the huge scale is also decreased by this kind of recomposition.
FIGURE 2.21 Different transportation infrastructures in urban scale. [http://www.gooood.hk/zhabei-new-gateway/#fbclid=IwAR2Bd6ZzI4yXwGqWMgg60wO78m-XlWvKChF01F5Fh2DrO9QAI4u1T5I](http://www.gooood.hk/zhabei-new-gateway/#fbclid=IwAR2Bd6ZzI4yXwGqWMgg60wO78m-XlWvKChF01F5Fh2DrO9QAI4u1T5I)


Transportation infrastructure in city

2.3 Four aspects of the symbiosis relationship

2.3.3 Social benefits

As Marcel Smets\(^\text{17}\) said in the interview, “Contemporary Infrastructure: An Interview With Marcel Smets” “Today, the intrinsic difficulty of creating an infrastructure project is to attain collective agreement from everyone involved. (By those in proximity with the NIMBY attitude; by the tax payers who think the project too expensive, by the environmental bodies that think it unsustainable, etc…)”\(^\text{18}\)

If the transportation infrastructure in a city do not has a good relationship with the environment, it will cause a lot of problems and be defended by the community. The bad transit experiment, inconvenient transportation, cut of the continuity of the city and even the noise and ash that influence the surrounding space. But if we can treat the transportation infrastructure in the city as a right way, it will really help to get a better environment, and bring benefits to the city. Sometimes, if we do a thing for right or justify, it will not go very smoothly and fast, but if we do it for benefit, it will continue very fast. The investment of infrastructures these years is just because of this.

On one hand, the transportation infrastructure, in a high density environment of the city, is one place can be developed. And that kind of use is to create more place in the city, more commercial or landscape or even residence. The land is very precious, so it’s a good way to find place to take economic development. At the same time, this kind of development bring jobs and the development of the economic. In 2015, 7% GDP of Chinese come from the investment of infrastructure, but in the United States, this number is 1.5%, so many people think it will be the next stimulate of finance in America and another chance to reshape the urban space in the city. On the other hand, transportation will also benefit from that, the better quality and better environment for the transportation.

We can see the example of New York Hudson Yard, in that case, it use maybe the last big void area in Manhattan, and create urban park and jobs and landscape, combined with the high-line park. Both the citizens, government, and investor could benefit from it. So this project goes pretty well in the development.

Hudson Yards is the largest private real estate development in the history of the United States and the largest development in New York City since Rockefeller Center. The site will include more than 18 million square feet of commercial and residential space, state-of-the-art office towers, more than 100 shops including New York’s first Neiman Marcus, and a collection of restaurants curated by Chef Thomas Keller. The urban development will include approximately 4,000 residences, The Shed, a new center for artistic invention.\(^\text{19}\)

Thus, the symbiosis relationship also means the relationship on the social benefits. Here I try to give some possibilities that how transportation infrastructure and urban environment benefits each other in this symbiosis.

Transportation infrastructure to urban environment: Mobility, accessibility, more land to be used and higher value, diversity in the public space, create economic investment and give other economic benefits indirect, improve the quality of urban environment.

Urban environment to the transportation infrastructure: Reduce the maintenance cost, help reduce the pressure of transit, higher quality from the regeneration, more attractive and more possibilities, providing more services.
THE MAKING OF HUDSON YARDS
UNDERSTANDING THE "PLATFORM"

To complete Hudson Yards, two "platforms" must be constructed to bridge over 30 active Long Island Rail Road train tracks. Finished buildings will extend through the platform and rise above, with caissons drilled deep into bedrock between the rail lines to support the structures.

- **10 HUDSON YARDS**
  
  **FOUNDATION SYSTEM: DRILLED CAISSONS**
  
  This tower is the only building being constructed completely on land—no platforms.

- **UNDERGROUND INFRASTRUCTURE**

- **PODIUM**
  
  **BASE STRUCTURE**
  
  Location and construction of columns supporting this building—home to a collection of shops and restaurants on its lower floors—must be coordinated with tunnels, tracks and LIRR facilities, which will remain active through construction.

- **STRUCTURE OVER THE YARDS**

  Trusses must bridge over this narrow section of the rail yard.

- **BUILDABLE AREAS**

  Due to the location of tracks, underground tunnels and utilities, only 38% of the site can be used to support structures.

- **30 HUDSON YARDS**

  Columns and other support structures below the rail lines—and on platforms above—will have a collection of shops and restaurants on multiple levels.

- **20 HUDSON YARDS**

  Columns and other support structures below the rail lines—and on platforms above—will have a collection of shops and restaurants on multiple levels.

Glossary

10 Hudson Yards. Opened in 2016, the 895 ft. tall (1.8 million square foot) office tower on the corner of 10th Avenue and West 30th Street will house the headquarters of Goldman Sachs and SAP.

30 Hudson Yards. A 1296 ft. tall (2.6 million square feet) office tower on the corner of 10th Avenue and West 33rd Street that will house the headquarters for Time Warner, Inc. and KKR. It will be the second-tallest office building in New York City.

Caisson. A large-diameter pipe drilled into rock and filled with concrete. At Hudson Yards, more than 300 caissons will be installed to support buildings and the platform.

Empire Line. Amtrak rail line that runs along Manhattan's west side, linking Penn Station to Albany.

Gateway Project. The state's plan to build two new rail tunnels under the Hudson River to connect Penn Station and the Northeast Corridor. A concrete shell has been installed below Hudson Yards to secure a path for the tunnels.

Hudson Yards. The 28-acre rail yard—framed by West 30th Street to the south, West 33rd Street to the north, 10th Avenue to the east and 12th Avenue to the west—where LIRR trains are "parked" between runs. The yard also includes an indoor maintenance shop, a 12-car-long cleaning platform and various employee-support facilities.

LIRR. Long Island Rail Road commuter system, North America's busiest. It transports 350,000 riders daily.

No. 7 Subway Extension. A 1.5-mile extension to the Flushing (Queens) line, moving its final stop from Times Square to Hudson Yards. The project opened in September 2015 and will be able to accommodate more than 42,000 commuters during peak times.

North River Tunnels. A pair of tunnels that run under the Hudson River and serve as part of the original Pennsylvania Station project, opening between 1904 and 1908, and more than 500,000 riders daily.

Truss. A structural system of beams, bars or rods that support a roof or bridge.

FIGURE 2.27 The structure of the platform on the railway roads, http://www.hudsonyardsnewyork.com/

FIGURE 2.28 The plan of New York Hudson Yard , http://www.hudsonyardsnewyork.com/
Transportation infrastructure in city

2.4 Theory model for symbiosis relationship as an example

2.4.1 Transit oriented development

Transit oriented development, which is also sometimes shortened to “TOD”, first comes from the idea of New urbanism. The TOD is a type of urban development that maximizes the amount of residential, business and leisure space within walking distance of public transport. A TOD typically includes a central transit stop (such as a train station, or light rail or bus stop) surrounded by a high-density mixed-use area, with lower-density areas spreading out from this center. A TOD is also typically designed to be more walkable than other built-up areas, through using smaller block sizes and reducing the land area dedicated to automobiles. And from the picture we can see some typical and common characteristics that appear in a development of the TOD mod.

The TOD mode can be characterized by:

——the mixed-use of the space, combine different functions
——moderate to high density, density is one big power of this mode of development, and
——walkable and connectivity, to save the use of land and create the possibility for people to use the place
——transportation choices, shape the mobility in the city, convenient for people to move in the city
——high quality design, an integration of different function and people means a good method to combine different parts of buildings and urban space

The model of TOD could bring some benefits and also the risks for city. According to the research from the national league of cities, TOD improves air quality and reduces auto traffic congestion. Studies indicate that TOD can reduce traffic congestion and air pollution by up to 25 to 50 percent compared to typical suburban development.

At the same time, it can combine the transportation infrastructure with the urban space, with a high density mixed-used program. It will be more convenient for people to use the facilities in city by developing a TOD system. But also it will also bring some problems like the financial risk to developer, high initial public investment costs, unsupportive regulatory framework and community resistance. In addition, though TOD is said to solve the problem of transition, but it could not reduce the distance of commuting. Tokyo is a good example of TOD system, a big success of improving the quality of urban space, but the distance of commuting is still long. However, it is still an interesting model for many nowadays east Asia countries, to solve the problem like the high density environment, huge population and the lack of land, especially in China.

20. TRANSIT-ORIENTED DEVELOPMENT WIKIPEDIA, HTTPS://EN.WIKIPEDIA.ORG/WIKI/TRANSIT-ORIENTED_DEVELOPMENT
21. The principle of TRANSIT-ORIENTED DEVELOPMENT WIKIPEDIA, HTTPS://EN.WIKIPEDIA.ORG/WIKI/TRANSIT-ORIENTED_DEVELOPMENT
22. TRANSIT-ORIENTED DEVELOPMENT (TOD), HTTP://WWW.SUSTAINABLECITIESINSTITUTE.ORG/TOPICS/LAND-USE-AND-PLANNING/TRANSIT-ORIENTED-DEVELOPMENT-(TOD)
23. TRANSIT-ORIENTED DEVELOPMENT (TOD), HTTP://WWW.SUSTAINABLECITIESINSTITUTE.ORG/TOPICS/LAND-USE-AND-PLANNING/TRANSIT-ORIENTED-DEVELOPMENT-(TOD)
FIGURE 2.30 Properties of TOD. https://www.flickr.com/photos/12208406@N03/3958835287/
Transportation infrastructure in city

2.4 Theory model for symbiosis relationship as an example

2.4.2 The space mode of integrated transportation infrastructure in TOD

Since here we are discussing the integration design of the symbiosis relationship, here I try to talk about the specific strategy of designing the space. I draw a picture to illustrate the basic mode of TOD model. The main idea is to change the original condition of separating the transportation infrastructure as a single-purpose system. The station, as one of the typical transportation infrastructure, has a big volume in the urban environment, but sometimes use less space on the roof of the traffic function. At the same time, if you want to go somewhere to enjoy the life in city, the long distance of transportation, restaurant, housing and other facilities will cost a lot of time for moving. And the wall or the empty space to protect surrounding space from the railway roads will also cut the relationship between community and make it difficult to go another place. And the regeneration mode is to combine different function together inside the station space, arrange different programs in different level to keep the convenient for both sides. Let the urban space and feeling become continue and same that do not make it be cut by the transportation infrastructure, and finally link the space with good quality to people’s daily life, link to the activities of surround space.

The principal uses include:

- Assessing the walkability, cycle friendliness, and transit orientation of completed urban development projects,
- Evaluating projects at the planning or design phases to identify gaps and opportunities for improvement,
- Evaluating existing station areas or station area plans, to identify opportunities for improvement and investment, and
- Guiding policy and regulations relevant to urban planning, transportation planning, land use, urban design and parking

Based on the original mode of the transit oriented development, nowadays method of building the station connected with the urban space could be divided into three modes. Overlap type, connected type, and compound type.

The principal uses include:

- Assessing the walkability, cycle friendliness, and transit orientation of completed urban development projects,
- Evaluating projects at the planning or design phases to identify gaps and opportunities for improvement,
- Evaluating existing station areas or station area plans, to identify opportunities for improvement and investment, and
- Guiding policy and regulations relevant to urban planning, transportation planning, land use, urban design and parking

FIGURE 2.31 THE MODE OF TOD AS AN EXAMPLE, SOURCE: AUTHOR

25. 日建设计，《站城一体开发——新一代公共交通指向型城建设》(2015)
Overlap type

(Fig 2.32 2.33) This type is to arrange the metro hub station, urban public space, bus station and other transportation in the vertical direction, enhance the function of traffic node. On the upper or beneath space, there could be put other attachment facilities to improve the value of the space. This kind of mode is aiming at the center of the city, which is lack of land, difficult to find a big area to arrange public transport transfer junction. The overlap type is to combine the square (urban public space), and station (transportation infrastructure) together by constructing a vertical building, improve the convenience of transport transfer and the walking environment. At the same, the attachment facilities like commercial and other service could provide diversity and possibilities. The example is Japan’s yokohama station.

Connection type

(Fig 2.34 2.35) Connected type, this kind of integration model always appear when the transportation infrastructure is underground, or not in the same level with the ground. This type, which concentrete on the connection between transportation infrastructure and urban space, use the in-between space to shape a landmark. The in-between space is open to city, it could be commercial, public facilities or an underground square. It could not only give a clear direction from urban space to the transportation infrastructure, but also provide light, and air to the transportation infrastructure which is in different level. On the other hand, the surround space could get benefits from this connection as a sort of open square. The example is the Tokyo spring garden metro station.

Compound type

(Fig 2.36, 2.37) The compound type is not aiming at one singe building or station, but a larger area in the city. It could use the methods from the overlap type and connection type. Actually, It is a sort of regeneration of different function and space in the neighbors. At that time, the public space and private space, the infrastructure and other functional space will be combined together. The form could be different, but the final aim is to use the maximum value of the land and provide a convenient life for the people inside. At the same time, the compound type of TOD needs a deep cooperation between the government, investors and community, only by this could it become a successful project. However, this kind of extreme development need the appropriate environment, not all the cities are suitable for this type. The example could be the Shibuya Station in Tokyo.
FIGURE 2.36 THE COMPOUND TYPE. SOURCE: AUTHOR

FIGURE 2.37 SHIBUYA STATION IN TOKYO. HTTP://NEWS.HXSD.COM/CG-DYNAMIC/201303/674064.HTML
Transportation infrastructure in city

2.4 Theory model for symbiosis relationship as an example

2.4.3 Risk and problem of TOD

The national league of cities, sustainable cities institute give four possible risks of TOD, as “Financial risk to developer, High initial public investment costs, Unsupportive regulatory framework and Community resistance.” The transit oriented development, absolutely is not available and suitable for all different conditions. And it is also difficult to use TOD to do some small regeneration in cities in Europe. By the way, it is maybe a appropriate method to be used in some Asian countries like Japan and China, because of the huge population and high density in the city.

However, the initial idea of TOD is to chase the maximum value and efficiency, the roll of people ourselves, more or less will step into some mechanical and technical problems just like the situation of transportation infrastructure in middle 20th. So we can still see some neglect of people ourselves in the mode of TOD.

Since TOD has these problems, here I do not use TOD as a perfect model for the symbiosis relationship, but to use TOD as an introduction of some possible integration design between transportation infrastructure and urban environment to shape a symbiosis relationship.

26. TRANSIT-ORIENTED DEVELOPMENT (TOD), HTTP://WWW.SUSTAINABLECITIESINSTITUTE.ORG/TOPICS/LAND-USE-AND-PLANNING/TRANSIT-ORIENTED-DEVELOPMENT-(TOD)
Transportation infrastructure in city

2.5 Chinese situation of transportation infrastructure

In different place, the condition is different, and China is very different from today’s western countries.

Chinese transportation infrastructure has developed a lot, after the establishment of people’s republic of China. In 1949, the transportation infrastructure fall far behind other countries. The total length of railway roads is 20.18 thousand kilometers, half of the railway roads are not available to be used, the length of highway for cars is just 80.08 thousands kilometers, and the number of cars is just 50.1 thousands. There are only 12 airlines in China in 1949. After 1978, Chinese economic reform, Chinese transportation infrastructure step into a new fast development after the recovery of the whole country. Chinese government put the investment of transportation infrastructure as the first consideration. The construction of railway contract with the economy, and the design of highway and port started to use the public bidding and tendering system. Till the end of 2015, the total length of railway roads in China is 121 thousand kilometers, second in the world, high speed railway road, 19 thousand kilometers, longest in the world. And the highway for cars, 4577.3 thousand kilometers, the longest in the world.

On one hand, Chinese train’s system has solved one of the most difficult transportation problem in the world. Long distance and many people’s inevitable use of the system. In Chinese Spring festival, more than 300 million people are moving in China by train, more than one third of European’s population. Though now China has the world second longest railway roads, it is still not enough considering the population of China. U.S.A has 301 thousand kilometers railway road length serving 300 million people, and this number is actually decreasing a lot, in 1913, America has 436 thousand kilometers railway roads. According to Chinese government’s report to transportation infrastructure, today’s railway road could basically meet the needs of Chinese people’s use. The problem changed. The transportation infrastructure is still not totally enough for people’s daily use but at the same time the quality of the space and facilities is becoming more important. In addition, China is still continuing the process of urbanization, and the amount of transportation infrastructure to be built is still very huge.

FIGURE 2.38 (left), CHINESE RAILWAY ROADS IN 2010, HTTP://WWW.GDHSK.COM/0%20ZHONGGUO/JIAOTONG.ASP

27. 《中国交通运输发展》白皮书 2016.12, CHINESE GOVERNMENT’S FILE OF TRANSPORTATION DEVELOPMENT IN 2016, DECEMBER.
On the other hand, after solving the most basic function problem, while China is developing very fast these years, both physical and mental, the conception of designing the Station in China doesn't accompany with people's developing need and higher density urban land using. The stations in China are more like a tool of mobility but not a public space of citizens. The outside of the stations always emphasis on the monumental and symbolic property, and the inside space, as you can see in the picture (fig 26, 27) always has a very large waiting hall for passengers with only chairs. Other services and facilities are little, even it is in the center of Shanghai. That condition is based on the chasing of efficiency and the control of designing the station from the technical aspects. The design is always like a dance between the limit of civil engineering and data department. The outside space, because of the chase of efficiency, high standard of policy and civil engineering, is also closed to the community. For instance, as one the most distract security policy in the world, if you don't have a ticket, you could not even enter the Shanghai Station, that make the station even a more closed obstacle in the urban environment.

Fortunately, Chinese government has realized the limitation and the problem of the old standard and method of designing the stations and other transportation infrastructure. According to “Chinese government's report of transportation development”, the technology of transportation infrastructure has become one of the best in the world, the next step is to push the combination between government and public investment. enhance the influence of market in building the transportation infrastructure. Improve the quality of the transportation infrastructure, make Chinese transportation infrastructure from “could go” to “well go”. It's a good opportunity here that Chinese government has recognized that we should rethink the method we build the station. These years many reforming projects are in construction in China. In addition, after the period of fast development, it's time for us to sit down and rethink the problem and mistakes, the more important thing is, to think the possibility and potential parts. That's also the reason why I chose the integration design of transportation infrastructure in urban environment.
Cases of the integration design of transportation infrastructure
3 Cases of the integration design of transportation infrastructure
Cases of the integration design of transportation infrastructure

3.1 A tape in the city, Raised garden of Sants in Barcelona
The train and subway routes in Sants neighborhood, Barcelona, has opened a wound in the urban fabric during the last century. With an average width of 30m. and an 8-way platform, the infrastructure has divided the neighborhood into two separated parts along 800m, generating urban dysfunctions, in terms of noise pollution and degradation of its surroundings.1

The chance come to this part of railway road is the arrival of high speed rail (AVE) in Barcelona. The government first decided to lay the two AVE lines underground, and that left the width of two lines on the ground free. The free space, which is later decided to be given back to the public, shape the buffer space both in north and south of the railway. And gave the opportunity to design the public space, connection and landscape on both side. That finally made it possible to plan for urban redevelopment at a neighborhood level but not a single protection civil engineering construction.

In 2002, Barcelona Municipal infrastructure (BIMSA), a Barcelona city council agency, assigned responsibility for the Sants rail corridor urban redevelopment project, this started a complex process that has involved three administrative public bodies: the ministry of development, the government of Catalonia and Barcelona Municipal infrastructure, of course as well as neighborhood associations in Sants.2 Just as Marcel Smets said, “Today, the intrinsic difficulty of creating an infrastructure project is to attain collective agreement from everyone involved.”3

Because of the consideration of technical and financial reasons, the choice of laying the railway roads beneath the ground was discarded at the beginning of the project, another and the left choice is to keep the exist height of railway roads, and build a raised structure. So the designer used a concrete structure to cover the railway road. The supporting structure for the cover is based on criteria for absolute functionality in construction, which answers the crucial requirement for timely execution of the works, since it must be built while allowing for the continued maximum possible circulation of trains. The cover will take two functions, on one hand, it is a protect both for the neighborhood, and the railway roads, it could create physical defense for light, noise and even raise dust, also it could keep some people destroy the railway roads and avoid some potential risks. On the other hand, the roof of the cover will become a pedestrian space, provide extra public space to the neighborhood and community rather than only build a fence for the railway roads. This public pedestrian, which aims to improve communications in the Sants neighborhood, it includes a new road link running north-south along Calle Riera de Tena, which passed eneath the railway, and the continuation of Calle Antoni Capmany, running east-west, over the Badal slab. It also creates new north-south connection for pedestrians which will pass both above and below the railway covering.5 And alongside the structure, the designer put some public furniture and create some connection to the surrounding urban space, to a neighborhood level.

The detail analysis will be divided into four parts, the relationship with the urban environment, the skill of hiding, the connection it build and the space it create. From these four parts, I hope I could explain the integration design of transportation infrastructure and the symbiosis relationship it create.
Cases of the integration design of transportation infrastructure

3.1 A tape in the city, Raised garden of Sants in Barcelona

3.1.1 Relationship with the urban environment

This is the image (fig.3.3) of the aerial view in 2004 in this area. The dark part is the railway road in Sants. From the top view, the first impression is the high density in Barcelona, the fabric of the city is very compact. But the railway road cross the fabric cut the relationship of the community and urban fabric because of its width and narrow distance to the residence buildings. Shape a kind of valley in the city. The green part is the railway roads that have been laid underground and go to the Sants station, so this area is very close to the node of the railway roads in Barcelona. (fig.3.5,3.6)

From this image (fig.3.4) we could find two interesting things. One is in the end of the above ground part, there is a empty space towards the crossing of several roads. And this empty space is directly used as a parking lot. This entrance of the road, even the road is very narrow, is not friendly to the pedestrian. Another interesting is the distance between the residence and the railway road. In this case, the old railway road is really close to the residence buildings, and the space which left is difficult to be used, in a neighborhood level. On the different sides of the railway roads, the residence choose different method to face this transportation infrastructure. On the west side, the building try to fit the diagonal line in the regular urban fabric, the buildings’ edge is smooth and tidy. On the contrast, in the east side of the railway road, the edge of the existing buildings is not very tidy but seems to be resistant to the railway, it is like the shape of zigzag, so the left space could become some public space and the length which touched directly the railway road will be decrease.

In 2011’s overlook view of this area, we could see the main structure was almost finished. The whole structure was like a tap in the city to fix the gap in the urban fabric, both shape and color. And we could find some changes that the new structure carry to this area and the difference from 2004’s situation. (fig.3.7)

The first change is the width of the distance from the railway road to the residence buildings. Because the decrease of the railway roads (two AVE lines are laid underground), the distance from the buildings to the railway road enlarge. Which make it possible to walk easily and create some public sense in the city. That also lead to the appearance of some small public space after the enlarge of the distance. And some connections are created as we could see. This connection between the raised garden and neighborhood could influence surrounding urban environment and shape some new interesting space.

Finally the image of 2016 (fig.3.8), the whole project was almost finished and we could see the public space that connected to the entrance of the raised garden and how It influence the surrounding space step by step from a gap to today’s garden connected the neighborhood.
FIGURE 3.5.5 THE PARKING LOT IN THE ENTRANCE OF THE ROAD (LEFT), THE TWO KIND OF EDGE AS RESIDENCE (RIGHT).

FIGURE 3.7. SOME NEW PUBLIC SPACE THAT APPEARED AFTER THE ENLARGEMENT OF THE ROAD SOURCE: MAP.GOOGLE.COM.

FIGURE 3.8. 2016 OVERLOOK VIEW OF RAISED GARDEN, HTTP://MAP.GOOGLE.COM.
Cases of the integration design of transportation infrastructure

3.1 A tape in the city, Raised garden of Sants in Barcelona

3.1.2 Skill of hiding

Because of the huge scale and many different reasons, the transportation infrastructure which appears in the urban environment often acts as a bad role in the neighborhood. The noise, the shake of moving, the raised dusk or the sense of dangerous because of the close distance of the trains with fast speed that the transportation infrastructure bring to the nearby space, make the transportation infrastructure must be isolated from the outside environment. So in an integration design of transportation infrastructure, the first step is to decrease such bad influence it carries. That is the skill of hiding, to hide the bad side and provide the good aspects of the transportation infrastructure. The same as what has happened in this project.

The wall

(fig 3.9) The first step of designing this project is to build a protective screen on the railway road. The answer of these problems, which has been introduced before, is a concrete box which cover the railway roads. The architect designed this (fig 3.10) to protect the surrounding residence buildings, keep the noise and raised dusk away. In addition, in some part of the wall, the designer used plants to decorate the façade, on one hand it could more or less played a role like sound absorption material, on the other hand it could make the façade more acceptable for neighborhood. And the roof of this roof could become a connection to different places in this neighborhood.

The fence

Except the wall, there are also fence appear in this project. the reason to build this fence is because the consideration from vision, both for the user of the raised garden, but also the people who live in the nearby buildings. In this case, originally, the railway roads influence the nearby buildings, and the ground floor is the worst place, not only do they have the noise from the train and dust, but also do they influenced by the walkers(fig 3.11). After raise the level of the “ground floor”, now people have a park on nearly 4th floor, and now the people who lived in 4th floor in the nearby buildings will be influenced like the people in ground floor before (actually, almost all the ground floor are shops or other open space), and the people live under the raised level will be even worse.
FIGURE 3.10 THE WALL OF THE RAISED GARDEN. SOURCE: AUTHOR

FIGURE 3.11 THE CHANGED RELATIONSHIP BETWEEN RAISED GARDEN AND NEARBY BUILDING
That will be a big problem, so in some part of the margin of the raised garden, the designer put some fence with plants, on one hand it could protect the privacy and feeling of the neighborhood, on the other hand, the plants fence, would not make the edge as a solid edge or totally closed, but will leave some lights and wind both to the people on raised garden but also for the residence. Finally decrease the bad influence of the new project. However, there are some problems about the fence, I will discuss it in the later chapter “problems of the project”.

FIGURE 3.12, THE SECTION AND GREEN FENCE ON THE RAISED GARDEN, SOURCE: AUTHOR
The extensional of the project

Beside the wall and the fence, the designer also used the surrounding space to hide the noise and huge volume of the structure, alongside the margin of the raised garden, the designer put some public space and facilities, and also some trees to increase the feeling of distance, give it a series of levels from the residence buildings to the transportation infrastructure. And the constitute of these public spaces even influence the further urban environment, shape a series of node and connection to other place. From the figure 12, we could see how in this project, the surrounding space be organized. There are trees, benches, stairs and slopes, these four levels make up new public space. The gray space is the in-between space, and the dotted portion is the range of raised garden. The green point means the location of figure

Decoration

The transportation infrastructure also has some supporting equipment, these equipment and the equipment for the park are also be designed to hidden in the whole raised garden.
Cases of the integration design of transportation infrastructure

3.1 A tape in the city, Raised garden of Sants in Barcelona

3.1.3 Connection that built

Access and urban joints

Since the garden is raised, how to connect the ground floor and the raised level, shape a efficient multi-level system is very important in this case. At the same time, the raised garden also take the responsibility as has promised in the beginning, to enhance the connection between two sides' neighborhood. Along this naturalized route there are three spaces which represent the joints, as system of assess to the deck, which include: 5 lifts and 2 adapted ramps, 3 stairs, 4 escalators and 3 underground passageway.

(fig. 3.16) shows the four main accesses of the raised garden, which represents two ends of the raised platform, metro station, and the Rambla de Brasil and Market de Sants. the access, become a strong connection, that related the important urban joints to the raised platform, and build more convenient chance for people to arrive at another place. The black arrow means the passageway and the red buildings outside are some important public buildings as urban influence. And also the raised garden used the zigzag place, which I mentioned in chapter 2, to make itself blending into urban environment smoothly. And that also create some opportunity for public activities.

Topography

Barcelona is a city on the slope, so also the topography appears as one important influence in this project. Especially when there are also the entrance of metro station and underground passageway across the railway roads. By using the ramps along the edge of the structure, and the some important accessed, the project achieve a good sense of creating new topography. So when people go through the two side of ground level, there will not be a huge volume carried by the height from 4 to 12 meters of the raised platform, this feeling is decreased by the smooth transition of new topography. At the same time, it also divide different way of transportation like cars and pedestrian. However, in some part, because of the narrow distance, the raised platform still make people feel nervous.

figure3.18 explains how the project build the access as new topography, by using the topography, the raised platform goes down layer by layer, decrease the feeling of huge volume, and with the different height, it shape the underground passageway towards other side and the entrance to the metro station. In almost all the accesses of the raised garden, the topography is not dealing with only two levels, but more, that's also one property of today's transportation infrastructure in urban environment. (fig.3.19)
FIGURE 3.19. THE ACCESSES OF THE RAISED GARDEN. RESouce: AUTHOR.
Cases of the integration design of transportation infrastructure

3.1 A tape in the city, Raised garden of Sants in Barcelona

3.1.4 Things that have been created in integration

Landscape

As Kenneth Frampton’s idea of the megaform shaping new urban landscape, the raised garden shapes a garden inside the fabric of city, as a sort of tape, fixing the gap between disconnected. That’s from a larger scale, if we look the raised garden into a smaller scale, it also shapes some interesting landscape. In some entrance of the raised garden, the ramps are designed as a corridor on a small hill, the plants and the corridor form a small scale landscape. Both to the people who walk on the corridor, but also for the neighborhood, it is a good scene of green plants. The same situation happens on the raised platform, the grass ground are designed to have height and provide place for people to do different activities. Also the slope of the grass ground could become an excellent viewing deck towards the scene of city.

The possibilities for public activities

One of the success of this project is to integrate the possibilities for public activities. For example, the playground for children. Because the raised platform, children’s garden here totally avoid the danger from cars and give an open view for children, so the playground for children is always full of young kids.

The main roads of the garden are divided into east and west, in the west road, there is a straight and wide road, with no trees and obstacles, so people could run, ride bicycle, and take a quick walk on it. On contrast to the west one, the east road is full of plants and shadow, the road is zigzag have different height, so people could take a rest or even lay on the grass and enjoy one afternoon. It provide different space, but actually different choice for people’s life.

The light design is also very good, the bulb is hidden inside the handrail, and would not directly influence people’s eyes, residence people could come here at night, enjoy the view of night and don’t worry losing themselves.

The same as the wood stage and chair in the middle as one joint of the public activities, these kind of design link people life to the garden, so many people will use it, and just by this this integration design of transportation infrastructure is meaningful.
Cases of the integration design of transportation infrastructure

3.1 A tape in the city, Raised garden of Sants in Barcelona

3.1.6 Problems

Not logical fence, destroy residence's privacy

Even in the chapter 3.1.2 I have introduced the fence to protect the surrounding neighborhoods' privacy, but the set of the fence in some place is still not logical. We could in some place the raised garden is really close to the residence and influence them. But the effort made by the fence in other place is good. (fig 3.23)

Still some bad edge, you should walk with cars

Because of the exist urban fabric, some part of the residence buildings are very close to the structure, and the distance is narrow, the whole project more or less miss this kind of space and left some bad quality place, fortunately, this kind of space is little in the project. (fig 3.23)

Some place is not built as design

because of many reasons, the project wasn't finished as its original design and the plan we have seen before. The unfinished design, in some parts, looks a little bit stranger than other place. that notice us the integration design is an overall thinking for different groups of people, considering this is the most difficult and quintessence of design for transportation infrastructure. And the integration is to make the balance between different sources. (fig 3.24)

Fee of management, too depend on the help from government

Of course, totally depend on the government and community, like a normal square or park in the city is available for the project. However, the fee of the management and repairing the urban elements like benches and lights are eventually cost on people. As it is an integration design, could it be possible to combine not only transportation and park but also some other functions that could make the project operating by itself or just decrease the fee of management ? (fig 3.25)
Name of work in English
High Speed train station of Logroño

Name of work in original language
Estación de alta velocidad de Logroño

Location
Logroño, Spain

Year completed
2011 (Year began 2008)

Studios
Abalos & Herreros

Authors
Iñaki Ábalos (1956 Spain); Renata Sentkiewicz (1972 Poland)

PERI Area: 213 Ha. Train Station Area: 8,000 m². Platform area: 19,000 m². Parking Area: 18,000 m².

Bus Station Area: 10,800 m². Urbanization: 145,000 m².

Housing Area (Towers): 41,250 m². Housing Area (Other Housing): 83,750 m².
Cases of the integration design of transportation infrastructure

3.2 New urban landscape, Logroño Station

3.2.1 Relationship with the urban environment

From fig. 3-27, we could see the change of Logroño station. In 1991, there is an old station of low speed trains, and the station of the town is built at the margin of the city. The railway road, very clear in 1991’s map, shape the margin of the city and connect the city to other places. The white part is the residence part of the city. Then, to 2004, (fig. 3-27) the city was continuing growing, the station and railway roads, which were first as the edge of the town, become a sort of inside element of the town. There is still the old station, but we can imagine that it’s very difficult to connect the north and south part of the city. That was true, people here use south and north to divde two parts of the city that was cut by the transportation infrastructure.

And in 2017 (fig. 3-29), to build a new high speed station here, the government decided to demolish the old station and construct a new one. If you watch the map carefully, you may ask why the city stop at the same margin as in 2004 in the south side. That’s because there is another freeway for cars here, the high way cut the possibility for city to continue growing (also in the larger map you can see the high way). So if we put three map of the residence together, we can see the trend of city’s growing, and the different role the station will play from before. (fig. 3-30)

In the architect’s description of the architecture, he wrote: "The station serves as starting point for a new urban project that restores the connection between zones north and south in Logroño and at the same time serves to generate a great public park being the rooftop an integral part of this park, giving the geometric and topographic relevance to the volume."

The new station here now serve as a platform, to connect two parts of the city and give the city the energy to grow. (as a station and park in the centre of the city).

If we go back to see the landscape system (fig. 3-31), we can find another starting point of the design. The old town of the Logroño is very dense, and has not too much park for people’s activities (the river and margin is good), so inside the Logroño, the Station itself became a very important part as a park for the city: a big park for public activities.
FIGURE 3.29, 2017 MAP OF LOGROÑO, HTTP://MAP.GOOGLE.COM


FIGURE 31, THE PARK IN LOGROÑO SOURCE: AUTHOR
Cases of the integration design of transportation infrastructure

3.2 New urban landscape, Logroño Station

3.2.2 Multi-level system as combination

The raised garden in Barcelona used some skills of hiding to hide the huge transportation infrastructure in urban environment, here the Logroño station used the strategy of multi-level to hide the railway roads which destroy urban fabric. All Stations in surface usually mean an abrupt interruption of urban continuity. Precisely, the urban element that is destined to unite and bring together the city with the territory, leaves a void in the city involving urban and social segregation. The opportunity to rethink the typology of the station that the burial of the tracks means, should be a shift in the form of conceiving them. Intermodal Stations are an opportunity to transform the city, creating public spaces, developing green belts, promoting pedestrian and bicycle mobility; an opportunity to create a new topography to intensify the experience of the city as a collective process.

The station is created as a integration of different function and different source of people. At the same time, the designer shows a strong desire to fulfill the gap in the city which is made by the transportation infrastructure. How to solve this problem, create the diversity and attract different people to this area and have a good experience of taking the train? That’s also a question for today’s each city. With the development of the science and technology, we create different kinds of transports, different kind of new space, in the sky, underground and lay on the ground, how will we adapt to this urban environment? The answer from the architect is to create a multi-level system to contain different function. Just as Stan Allen said, to create a platform which contained different activities. The first thing they did was put the railway road from on the ground to underground. Left the space for station and other public space. then try to blend smoothly the station into the urban environment. They design a sort of new geography and keep the continuity of the public space. People can walk from another end of the park to the roof of the station. So here we could see from the fig.3-23, in this multi-level system, on the top is the park for everyone in the city, and the transportation function, direct and simple, not too much decoration of space, and what is close to transportation function is some shops both open to station and city, and in the lower place, there is some supporting equipment and parking lot. The Parking lot not only serve the station but also for surrounding and inside residence. In that case, the designer divide the function of transportation, public activities and other supporting functions, insert different functions into different part and combine them together by this multi-level system. This system, which give back the most area of public surface to the urban fabric, hide the bad influence of transportation infrastructure in urban space, and also enhance the function of transportation, give it a very strange direction of entrance and clear arrangement of space. that’s one of the successful points of this project.
Put the Railway underground

The Station no longer need so much space

very clear direction, and entrance
Cases of the integration design of transportation infrastructure

3.2 New urban landscape, Logroño Station

3.2.3 Connection to urban space

Inside station

The inside connection to the urban space is the entrance hall in the middle of the building. As we could see in the plan of basic floor plan, the space is clear and simple. Tourists and users could directly go to the ticket entrance and to the downstairs platform. There are also some connection in other two sides, serving for the working, shopping and supporting function. Around the main transportation space are some supporting area, for the staff of station and some small shops providing simple service for the users of the station.

Outside station

On the roof of the high speed station of Logroño, we can see it (fig.3-25) become a big public space as a park as in the same height of road, everyone could easily get there. And to make the continuity of the urban surface, in the end of the station, the roof goes up and shape the main entrance of the station. Actually, if we see the whole plan of this area, we can see it is not only a small hill, but also connect the opposite part of the street and the total volume of the architecture shape a new geography in the site. In the lower part of the hill, as the park part of the roof platform, it is free and open to every citizens, providing public space for both nearby and also people who want to go to another part of city, creating a rest place as a connection that links the north part and south part of the city.
Cases of the integration design of transportation infrastructure

3.2 New urban landscape, Logroño Station

3.2.4 Things that have been created in integration

Urban landscape

Fig. 3.38 shows the structure of the roof structure, more or less the same as some artificial topography. The architect used this new topography, on one hand, to shape a landscape of green system in the middle city, on the other hand, to arrange different functions and hide the transportation under “ground surface”. And also in this artificial landscape, the architects designed some urban furniture and elements to shape the sense of public space, like benches and activities tools for children. So different people can enjoy the sunlight afternoon with the landscape here. The public space's element and the accessibility of the roof (from surrounding space you can go to the roof, the roof is in the same height of pedestrian) the publicness appears in the Logroño station.

Metaphor of landscape and integration

The faceted form of the roof corresponds with the park's one in the top, so both surfaces compose beam and underside in a folded plan which in the external side generates in a hill or a lookout over the city and in the internal one, adopts a configuration near to the aspect of a cave or a grotto. So actually on both sides the designer want to notice people the feeling of landscape and topography, the sense is unity and integrated, the difference is, the surficial platform is clear, the inside is obscure. (fig. 3.39)
Multi-function

Actually the whole project is not only a high speed train station and its roof park. There are also residence buildings and commercials be designed in this block (fig.3.40). On one hand, for residence, the nearby station and the roof park could provide the mobility, convenient transportation and different shops and public facilities. For the station, the surrounding residence buildings and shops could support its function and improve the value of the park, because many people will use this. This multi-function method could integrate different source of people and improve the quality of different functions, the usage and benefits each other, shape a symbiosis relationship between different functions.

People’s daily life

The more important is, the station and its roof, being combined with the residence and commercial, become a place gathering the people. People could enjoy their daily in a transportation infrastructure but not be isolated by the obstacle created by it. The accessibility, public square furniture like benches, playground for children, fitness equipment, and the surround restaurants, shops construct a picture of life. At that time, a transportation infrastructure is no longer a single machine transporting people and goods, but a place for people’s daily life and enjoy the benefits from the mobility and gathering. This is very smart, on one hand, it is a new responsibility nowadays transportation node should take and other hand, that’s one of the best way of creating diversity in a station.
Cases of the integration design of transportation infrastructure

3.2 New urban landscape, Logroño Station

3.2.5 Problems

The decreasing population and increasing space of residence

From the data of population, we could learn that the population didn’t increase in the last 7 years. As I have said in last chapter, the most difficult thing in an integration design is to balance the interest from different sources. But could the increasing area of residence buildings apply to the decreasing users, I don’t know in this project.

Is it worth to build such a structure as in this area?

More or less, the same as last point. The new structure of new topography cost a lot, how could this cost create benefit, and since the residence is still not finished, will there be enough people to use this public space, keep the value of land but not create a nobody’s place. Time will give the answer. Actually, that’s also the problem of a lot of transportation infrastructure. As we all know that the infrastructure has a not long lifespan, the problem and use of it are very temporary, so it’s difficult to judge a project directly good or not, but to wait the people to use and to answer this question.

FIGURE 3.42, population of Logroño from 1942 to 2016, https://es.wikipedia.org/wiki/Logro%C3%B1o
Name of work in English: Kyoto Station

Name of work in original language: 京都駅

Location: Kyoto, Japan

Year completed: 1997

Architect: Hara Hiroshi

Area: 38076 m²

Construction Area: 237689 m²

FIGURE 3.42: Kyoto Station

https://www.flickr.com/photos/92832952@N00/4098388342/sizes/l/in/photostream/
Cases of the integration design of transportation infrastructure

3.3 Concourse in city, Kyoto station

“it is like in our home, full of life. And when I’m sitting on the steps of the station, I feel I’m with other people and could feel some dramatic sense.”\(^9\)

That’s Japanese famous writer Kenzaburo Oe\(^10\) told Hara Hiroshi, when he was talking about Kyoto Station. Today, when we go back to this sentence, we could feel the meaning of describing such a transportation infrastructure as a place that public activities will happen.

In 1990, the committee of Regeneration of Kyoto Station held an international competition of the new Kyoto Station. The requirement of the new building is: 1. Regenerate the public transportation system in this station, 2. Provide better service for the users, 3. Improve the vitality of the urban environment. And about the function, the committee ask for a hotel for the tourists, the comprehensive commercial center that represent the standard of Kyoto, the place for people’s communication of culture and performance, people’s square which could also be used to hold some exhibition, and supporting function such as parking lot and equipment.

Hara Hiroshi won the competition, the construction started from 1995, ended in 1997. The floor space of Kyoto station is 38076m\(^2\), the area of architecture is 237689m\(^2\). The whole project contain different buildings and functions. it is criticized by many people because of the difference of form with other Kyoto’s buildings, but at the same time it become the one of the master works of Hara Hiroshi, representing his idea of concourse in urban environment.

\(^9\) BU JINGHUA, HAN ZHONGQIANG, “VILLAGE CONSTRUCTION – PUBLIC SPACE DESIGN OF KYOTO BUILDING AND VILLAGE RESEARCH BY HARA HIROSHI, ARCHITECTURAL FURUM, TU-86, 2005

\(^10\) KENZABURO OE, FAMOUS JAPANESE WRITER, WON THE NOBEL PRIZE IN 1994

FIGURE 3.43, THE ATRIUM OF KYOTO STATION, HTTPS://SUGGESTIONOFMOTION.COM/MP-CONTENT/UPLOADS/JPN_KYOTO_TOWN_025_KYOTO-STATION.JPG
Cases of the integration design of transportation infrastructure

3.3 Concours in city, Kyoto station

3.3.1 Relationship with the urban environment

the railway road go across the center of the city. The Kyoto station is often criticized by its huge volume and strange shape that appeared in a city like Kyoto. To some extent, it is more or less broke the traditional impression of Kyoto from people, but the new structure and buildings is served for the new system of transportation, and the amount of people decide the difficulty of hiding the influence by the station. Fortunately, the station, because of the high density urban environment and the compact use of land in Kyoto, shape a long and thin figure in the urban context. The Kyoto station is benefited from the set of functions and the shape. It is blending well into urban context. And itself become a protective layer for the nearby buildings, the influence of the transportation like the noise and dust is decreased by the station building. And the urban continuity goes into the Kyoto station, the station is like a big urban complex before the railway roads.

FIGURE 45, THE KYOTO STATION IN URBAN ENVIRONMENT, SOURCE: MAP.GOOGLE.COM, ADDITION BY AUTHOR
Cases of the integration design of transportation infrastructure

3.3 Concourse in city, Kyoto station

3.3.2 Combination of different functions

“what we are always chasing for is the 'Kyoto Station', this design conception. Actually, the station is consist of restaurants, shopping mall, supermarket, culture facilities, parking lots and platforms. It is a combination of 5 different functions, inside, the area of transportation is just twentieth of the total architecture area.”

-Hara Hiroshi

The diversity of the Kyoto Station, and the reason why it could become an attractive urban public building is the combination of different functions. The transportation area and function is one part the whole complex. So when people step into the Kyoto station, they will not feel like going into a station, but stepping into a public building with plenty of service. The advantage of integrating those functions is obvious.

First, improve the quality of the transportation infrastructure. As you could do almost everything in that building as you could do in other urban public space, so it is very convenient and attractive for the tourists and citizens. As a result, the Kyoto station become a famous tourist attraction in Kyoto.

At the same time, because the integration of different functions, and the property of a important transportation junction, many people will go to this place to enjoy their daily life. The high-quality restaurant, theatre, cultural performance, commercial center and even some government department is here, citizen could easily get there and use it. These functions part and transportation function could benefit from each other. And the citizens get the convenience and better city life because of the short distance of moving.

Further more, based on the previous two points, in the process of the development of Kyoto station, it could decrease the cost. The decrease of cost is divided into two parts, the first is the cost of construction and management, the commercial and hotel, these parts could create the interest, on the other hand, an integration station means the high efficiency of using the land, so from a general view, the government save the land in developing this project.

In addition, the Kyoto Station, though has a lot of functions of daily life, but it doesn't have waiting hall in the station building. Not like the stations in China, the non-waiting hall design push the people into the commercial and urban space in the station, that's also an interesting creation, break the traditional mode of a train station and give more possibilities for other urban functions.

Finally, as the conception shaping a concourse in urban space from Hara Hiroshi, Kyoto station create the diversity, vitality and attract people from worldwide.

---


Cases of the integration design of transportation infrastructure

3.3 Concourse in city, Kyoto station

3.3.3 Things that have been created in integration

Clear and direct transportation

Actually, though the arrangement of the function is very excellent in Kyoto Station, but the aim of building a new century’s transportation system is also finished very well. From fig 3.48, fig 3.49, we could see even though the function around the transportation area is complicated, but the transportation circulation is very direct, clear and short. From the main entrance of the station, you step from an urban space into a building, and the distance is the short side of the building, you could directly go to the ticket check and go to the platform, the whole length of your trip from the entrance to the platform is just about 50 meters. By the way, the connection from the metro is even shorter than from the main entrance of the station. And it is in the most obvious location in atrium.

The clear and direct transportation circulation helps to build a good system of other connection to different functions, they are like branches in the trees and attached closely to the main circulation.

Connection for Complicated and abundant urban functions

The other abundant urban functions and functions are connected by different ways. There are three main corridors connect the

![Diagram 3.48: Transportation Circulation of Kyoto Station](image1)

![Diagram 3.49: Transportation Circulation of Kyoto Station](image2)
circulation from west to east. Great staircase, sky way, and backyard way. The great staircase (fig. 3.50) which in the atrium space in the Kyoto station, not connect two sides different functions, but also shape a huge public space with the atrium. In one end in left, the staircase connect to the garden on the roof and the surrounding buildings are office and hotel. On the right staircase, the road connect to different commercial centers, and in the end of right staircase, people could go outside the station, because it shape a large open air space there. At the same time, people could use it not only for the vertical transportation, but also as a relaxing place, As it has some platforms for viewing and sitting which shaped by steps. In addition, Japanese people also use the convenience of staircase to hold some interesting cultural and sports events.

the sky way (fig 3.53), most built as a symblic corridor, for viewing both the inside and outside the station. From the sky way you could see the view of Kyoto Tower and the vivid scene in the atrium of Kyoto Station. Here no more words about the great structure, which could also be discussed but not this topic.

The south footpath, is in the back side of station, as a supplement of the connection, and also on the footpath, it provides some relaxing place and viewing place for people.
Topography and new type

“It is a design of a sort of general collection of geography. Specifically, it is the route from the west to east, the thin and long space is like a valley, only by walk through the valley could you understand the whole appearance of Kyoto Station.”

--Hara Hiroshi

Not as the normal station to think the problem in a flat platform, the Kyoto Station create a new kind of topography in the urban space. As the station, especially the big station always needs to solve the problem of huge amount of transportation, so it is very meaningful to see such a result of designing the building in a vertical side. Contrast to the normal flat plan, this new topography gave the architecture more possibilities and place to arrange different functions and make more touch between the transportation function to the urban public space. At the same time the creation of “Valley” is a really interesting design to shape a public space that connect different parts of Kyoto station and gather them under a same roof. And up to the end of the valley, there are two bigger public space, as an urban square, serve for urban facilities.

Here Kyoto Station create a new type of the connection in a station architecture, considering the direct and clear connection to the transportation function and different functions, I call it “∞” type. That is in the middle of the building, it provide a most clear and direct method to solve the problem of transportation, and in two sides of the transportation function, you could add different functions as attachment as much as you want, and the other functions are like branches hang on the main transportation function and make service for it.

![Fig 3.57](image_url)

Youliang Zhou, Kyoto station and the design concept of Hara Hiroshi, [J], Architecture design, 2000(3): p74-75
Cases of the integration design of transportation infrastructure

3.3 Concourse in city, Kyoto station

3.3.4 Integrated space

The integrated space, as the atrium of Kyoto station, shape a convenient space for citizens, they could easily meet different needs in a short distance. Those functions are tied on an inevitable function, transportation, and then people could not only enjoy the speed and convenience that mobility carry to them, but also abundant services.

Further more, The atrium, as Hara Hiroshi’s concept of concourse, become an integration of different urban activities. People could take a rest on the steps, hold competitions, have dinner on the platform, make performance on the floating stage, and shopping, viewing, playing.

This atrium, at that time, is difficult to be seen as a single station space, but it is integrated into urban environment, connected to urban functions and activities. That is a sort of the symbiosis relationship between the transportation infrastructure and urban environment. And people and activities in different height and level shape a sense of community, benefits from the huge atrium space.

The construction and idea of transportation infrastructure are still developing very fast these years, and in different culture and area, the attitude and policy could make a big difference. However, from three case studies, I want to give some induction of the same properties in today’s design of transportation infrastructure in urban environment. These characteristics more or less reflect today’s fast changing needs, complicated urban environment and development of cities. And at the same time, the characteristics could become some method and strategy for future design’s example, and be applied into my design in the surrounding place of Shanghai Station.

Connectivity and accessibility

The connectivity and accessibility are the solution to the disconnected and difficult movement that created by the transportation infrastructure. How to keep the continuity of urban space, make it convenient for neighborhood to live but not disturb them. And how to build the connection, from a plan or from different level? The connection that built by the transportation infrastructure and the accessibility to go to different part is more or less the most basic problem in the design of transportation infrastructure.

Topography

Because of the existing railway roads or highway, it’s difficult to organize the connection or different functions and fix the gap between neighborhoods in only a flat plan. In a multi-level system could we organize the place for transportation and other activities. And other design such as build a protective screen for nearby people, build connection through infrastructure are also need a new topography in the existing context of urban environment. The access in Raised garden in Barcelona, and the Valley in Kyoto Station, even the architecture itself could become a new topography for people to use, like Logroño Station.

Mixed-use

With the development of economic and society, both city and people need transportation infrastructure like railway station and metro station have more services. And we could never neglect the opportunity that the transportation infrastructure carry to the development and commercial because of the big amount of people using it. Multi-function means mixed-use and diversity, which could also save the land in a high density urban environment, and create more lively space in city. Park (raised garden), residence (Logroño station) or urban complex (Kyoto station).

Design from section

Nowadays cities, are becoming more and more complicated, they develop in many levels and height. Today, if you get a plan map of Hongkong and want to understand the relationship of urban structure, it’s very difficult. The transportation infrastructure is same, the normal plan of the building help little to understand the real situation of it. So we need to use section as an important tool to design and understand the transportation infrastructure in city.

Integrate transportation infrastructure into daily life

From these case study, infrastructure is attempted to create new possibilities for public space by demolishing special boundaries that divided city and human activity. Such infrastructure includes station or highway itself had not become a public space nevertheless being used in daily life. These projects are steadily implementing the plan to integrate Infrastructure in Everydayness. We could see the valley in Kyoto station, Garden on the old railway road, and the park above the station in Logroño, this kind of integration finds a balance between transportation function and people’s life, which finally made the infrastructure like a normal building, connected with urban environment and have dynamic activities.

As a new start point for the development of city

All this methods and strategies are used to continue the development of the urban environment as a transportation infrastructure. From an engineering constructuion to an urban architecture, the change of the role give transportation a responsibility to push the development of not only space environment but also social and economic aspects.
<table>
<thead>
<tr>
<th>Case</th>
<th>Connectivity and accessibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raised garden in Sants, Barcelona</td>
<td>Connect both sides of the city together, and set entrances and accesses including elevators alongside the garden. As a bridge. In the accesses, building like small hills to lead people from the streets to the platform on the trains’ railway.</td>
</tr>
<tr>
<td>High speed train station of Logronon</td>
<td>Connect north and south part of the city, the roof is open to public, do not need to go to another height, so it’s more close to people, but for tourists from trains, they could not see the scene of city at first. Considering the automobiles, circulations, and function of stations, build a fluctuant topography on a flat place, both serve for human but also machines. Both up and down the roof, this topography.</td>
</tr>
<tr>
<td>Kyoto Station</td>
<td>The connection to the urban environment is not like above, like a normal station, but by using different level of city, you could enter this building very easily and directly. In contrast to a normal train station, Kyoto Station create an artificial topography like a valley, all the activities are connected by this urban valley and gather different people together. Not only a station, but more like a large urban complex and attached by a convenient transportation function.</td>
</tr>
</tbody>
</table>

FIGURE 3.59: Comparative study form [1]. Source: Author.
<table>
<thead>
<tr>
<th>Topography</th>
<th>Mixed-use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make small hills to lead people from the streets to the railway roads.</td>
<td>Reuse the space above the railway roads, double-functions. The purpose is more simple here. So the platform is also pure.</td>
</tr>
<tr>
<td></td>
<td>Parks, public square, station and combined with some residence, the functions a combined with the topography</td>
</tr>
<tr>
<td></td>
<td>Not only a station, but more like a large urban complex and attached by a convenient transportation function. Different people carry diversity to this building, more than above two transportation infrastructures.</td>
</tr>
<tr>
<td>Case</td>
<td>Design from section</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Raised garden in Sants, Barcelona</td>
<td><img src="image1" alt="Design Sketch 1" /></td>
</tr>
<tr>
<td></td>
<td>If only look the plan you could not get the point of the entrance of metro station under the raised garden and combined with railway.</td>
</tr>
<tr>
<td>High speed train station of Logronon</td>
<td><img src="image3" alt="Design Sketch 2" /></td>
</tr>
<tr>
<td></td>
<td>The same to solve the problem in a multi-level system, but here the station give the ground floor back to public space.</td>
</tr>
<tr>
<td>Kyoto Station</td>
<td><img src="image5" alt="Design Sketch 3" /></td>
</tr>
<tr>
<td></td>
<td>Underground, ground, and upper floors, different levels, different functions and combine them together.</td>
</tr>
</tbody>
</table>

*FIGURE 3.60, comparative study form2, source: author*
As a new start point for the development of city

Connect the north and south part of Logrono, help erase the margin left by railway, city could continue growing through this.

A new node, a new viewpoint in Kyoto, very good place for developing the whole city and attract many tourists here.

Reduce the bad influence of railway road, provide a public platform for activities and connect the neighbour, fulfill the gap in fabric.

FIGURE 3.60, comparative study form2, source: author
Cases of the integration design of transportation infrastructure
4 Practice in Shanghai Station’s north surrounding space
Practice in Shanghai Station's north surrounding space

4.1 Condition of Site

4.1.1 Development of Shanghai station

Shanghai Station, was first built in 1909, designed by a British engineer, it was the first several stations in China and learning from the western culture. also it is designed with the office for the railway department.

Nowadays Shanghai Station was not that building, but the station called East Shanghai Station before. the original architecture area is 20 thousands square meters, and had a 37 thousands square meters plaza. Planning to hold 10thousands travellers and make the surrounding environment convenient for people to use. Shanghai Station has 8 huge waiting hall for tourists, and 80 windows selling tickets, and because the train connected to Hong Kong, so there are also customs in Shanghai Station and the security check department.

In 2010, Shanghai Station was reconstructed for the EXPO, the architecture changed its facade and shaped what we could see now in the roof. After the reconsructing and some modifing, Shanghai Station is still the second biggest train station in Shanghai, and the biggest in the center of city. It is the node of transportation of the city. It has 14 railway roads, 13 platforms and 8 big waiting halls. In addition, 1,3,4 metro lines across this station and connect to it. It also connect 1,3,4 Metro Lines in Shanghai, and people could easily go to metro station through the special passage. The waiting halls are built above the plat form to hold more people and save space as a big station.

People could go to Shanghai Station more easily than other stations in Shanghai, because it is in the middle of the city and the convenient transportation of public transportation. The south plaza of Railway station has reorganized and shape one of the most busy commercial center of the city.

Today, Shanghai Station is one of the most important station in China, to north it could connect Beijing, and to South it could connect Hong Kong, and one of the busiest station in China.
4.1.2 Current situation of the site

When it was first built, Shanghai Station is in the margin of the city, after the fast development of city and urbanization, the station has become one center part inside the city as we can see in the picture. The main commercial area is described as red part in the picture, and we could see that the railway area has cut more or less the relationship between the further space and center of the city. And it has become an obstacle which stop the possibility of development and enhance the difference between north and south of the station. This influence, is also went to the east part of the city, become a negative area for economical development these years.

The reason why to chose this part of surrounding space (fig 4.4) is, on one hand, the south part of station has been regenerated several years ago, so it’s difficult to make another range in recent years, the south parts also developed very well because of the fluent connection to the center of Shanghai, and in north, the situation is totally different, the neighbor had the negative influence coming from the railway and also the development has almost stopped because of the same reason. This part is also influenced by the highway of Shanghai, shape a margin inside the city, be isolated to other neighbors. However, this area has possibilities to do an integration design considering this situation. It would become a new start point for the further development of the city and connection south and north part of Shanghai Station.
Practice in Shanghai Station's north surrounding space

4.1 Condition of Site

4.1.2 Current situation of the site
FIGURE 4.5. Map of the site, source: author

FIGURE 4.5. Photos of the site, source: author
Practice in Shanghai Station's north surrounding space

4.1 Condition of Site

4.1.3 The problems on site

From a general view, according to the Shanghai government’s report of working, the surrounding space of the station has such problems. Because of the obstacle made by the railway road, this area’s space output benefit is far lower than other parts in Shanghai with same situation. And the south and north part of station developed differently, the north part is not under good development and is far fall behind north part.

From microscopic view, this north east area is in the gap between residence and transportation infrastructure, the in-between place, is almost abandoned by government, and because of the influence by railway road and highway, this area is not convenient for moving to another area. Of course, this bring more problems, dangerous environment because nobody is there, no communication with other area, and waste of land. In some corner of street, the pedestrian even become garbage, full of rubbish and bad quality place.

And for the inside place of Shanghai Station, it has little relationship with urban space, like a machine with high efficiency. Because of some policies and standards, if you don’t have a ticket, you could even not walk inside the station, and in the gate there are strict security check. The inside functions, as has described before, little service function but has big waiting hall only for the tourists. That even enhance the gap between the railway road. The city is cut by the transportation infrastructure.

FIGURE 4.6 Site analysis, source: author
The bus stop near the station

The cars’ way cut the context and make the public space off and on

only one nearby public park in south part

railway cut the possibility for north part residence people go to the park

south part has shaped a good commercial space, while north part still need development

FIGURE 4.7. current situation of the site

FIGURE 4.8. Site analysis
Practice in Shanghai Station's north surrounding space

4.1 Condition of Site

4.1.4 Aims for the integration design

Fortunately, the government has realized the problem of this area, even from a economic view, it is a good chance to change the surrounding environment, and the problems both inside space and outside space. In 2014, the center government issue a file called “the suggestion of supporting comprehensive development on railway road construction” , in the suggestion, include the policy as encouraging the integration development of transportation infrastructure, use the railway road to develop above and underground space, under the policy, add multi-function into the railway infrastructure, that bring a good opportunity of integration design for Shanghai Station. In 2016, the Shanghai government hold a competition of the development of the space near Shanghai station, and continue using this competition to make the urban planning of this area.

So the aim of this regeneration project, is to rebuild the connection between the north and south side of the railway road, make it become a bridge in the in-between place. And provide some new functions that could meet the needs of both the tourists and the neighborhoods. Attract people to come here and use the facilities, so that the value of the land could be used maximum. And it could Integrate people's activities and daily needs in the project. In addition, the project should become a supplement of the train station because the lack of function inside the station.
Practice in Shanghai Station's north surrounding space

4.2 Relevant theory and principles

As I have introduced in the second chapter of the thesis, there are two main sources of the theory reference, one is the infrastructural urbanism which was put forward by Stan Allan in his “Points+ lines: diagrams and projects for the city”, in the chapter “infrastructural urbanism” he point out seven propositions for infrastructural urbanism. Another is the Transit oriented development coming from the New Urbanism. I will give some very simple reintroduction and give some principles for further designing.

Infrastructural urbanism

The first principle as announced by Stan Allan of infrastructural urbanism and the most important one is under.

“infrastructure works not so much to propose specific buildings on given sites, but to construct the site itself. Infrastructure prepares the ground for future building and creates the conditions for future events. Its primary modes of operation are: the division, allocation, and construction of surfaces; the provision of services to support future programs; and the establishment of networks for movement, communication, and exchange. Infrastructure’s medium is geography.”

Here he point out the role that infrastructure played in the urban environment, the infrastructure do not need to become a form-completed building or it do not take it as a final aim. The aim of infrastructure is to create a container in the city and contain different public activities and space inside. Just as the last chapter we said two trends of infrastructure. The transportation infrastructure, do not only finish the municipal function, but it can also connect different part of the city. because of its special function, sometimes do damage to the urban environment and become an obstacle in the inside urban space, at the same time it is very difficult to find other use in one level (possible, but in special condition such as Sant Antoni Sunday Market / Ravetllat Ribas Architects ) so we need to find the possibility in multi-level system and the surrounding space. This kind of space should be connected well with the urban environment so that the activities will happen, and need to be designed carefully.

“Infrastructures accommodate local contingency while maintaining overall continuity. In the design of highways, bridges, canals, or aqueducts, for example, an extensive catalog of strategies exist to accommodate irregularities in the terrain (doglegs, viaducts,

---

mode of development

——walkable and connectivity, to save the use of land and create the possibility for people to use the place

——transportation choices, shape the mobility in the city, convenient for people to move in the city

——high quality design, an integration of different function and people means a good method to combine different parts of buildings and urban space

Principle of design

The whole project, will mainly considering the activities of people in the urban environment combined with the transportation infrastructure, it will be the regeneration of the surrounding place of the Shanghai Station, and it will provide a platform for people to hold different kind of urban functions and activities in spite of transportation function. It will use the multi-level system and vertical thinking to create the diversity in city. And this space should be connected closely not only to transportation part, but also other parts of neighbor, build a bridge between the gap cut by the railway roads, give the possibility of walkable, mixed-use and also in the background of high density. That’s the basic principle of the integration design in this project.

So the whole progress of design will be divided into three parts, as the logic of the case studies, and come from the principle of design, and also it is the steps to regenerate the urban environment in the existing situation of Shanghai Station, and become a new start point for further development. the steps are, the skill of hiding, the build of connection and the creation of public space.

6. TRANSIT-ORIENTED DEVELOPMENT WIKIPEDIA. HTTPS://EN.WIKIPEDIA.ORG/WIKI/TRANSIT-ORIENTED_DEVELOPMENT
7. TRANSIT- ORIENTED DEVELOPMENT (TOD), HTTP://WWW.SUSTAINABLECITIESINSTITUTE.ORG/TOPICS/LAND-USE-AND-PLANNING/TRANSIT-ORIENTED-DEVELOPMENT-(TOD)
Practice in Shanghai Station's north surrounding space

4.3 Proposals on site

4.3.1 Hiding

The existing bus and the railway roads cut the relationship between the neighbor in this area of city, and also the highway, underground driveway, railway road, and bus stop (fig 4.19), this transportation infrastructure break the continuity of the public space and provide a bad experience for people to use this area, not only the travelers but also the local people. So the first step is try to hide this bad influence carried by the transportation infrastructure. (fig 4.12)

In the place of bus stop, i move the function of hotel which is under bad condition to the edge of this block, and build a double-level system to divide the function of bus stop and people's space of activities like open-air market and sports area. And also the same method on the nearby underground driveway, covered it with the pedestrian way like in Rambla de Brasil. Using this half-floor difference of height, i could both keep the transportation's clearity and also the feeling of public space.

In the several plans of solving the problems and bad influence carried by railway roads, i chose to build a platform linking different part of cities, use the left benefit of the railway and leave the possibility to continue the further development of this railway roads. On one hand, it directly hide the view of dust and industrial equipment in the surrounding space, and also the new structure of platform could protect the surrounding neighbor from the noise and dust like in the case of raised garden in sants of Barcelona. On the other hand, this arrangement also provide a more clear division of functional space in this area, improve the difficult situation to find the way and the bad view of the bad quality space. That is using the possibility of public activities to take place of the single-purpose transportation infrastructure's space in urban fabric.

FIGURE 4.9, the new style of urban space in a vertical changing, source: author

FIGURE 4.10, Three plans for the railway roads near Shanghai Station, source: author
There is a bus station around this block, which cut the pathway to other places and make the block become isolated, like an island. Demolish the old and in bad condition building, give the volume back in another place, and shape a new plaza in this place.

Build the bus way half-underground, so people can easily go there and also achieve a complete plaza on the ground. Shape a new plaza, connect the edge of railway and the entrance of the train station, give the access to people to get there.

The existing underground roadway is open to the air that is friendly to the cars and motors, but make the road on the ground cut. Make a roof to cover the hole, keep the continuity of the pedestrian.
FIGURE 4.12 Two parts of the hiding source: author

FIGURE 4.13 Diagram of the new bus stop+square source: author

- double level bus stop combined with the square
- Platform on the railway

bus stop+square source: author
Practice in Shanghai Station's north surrounding space

4.3 Proposals on site

4.3.2 Connection

Connection is used to create the relationship between the transportation infrastructure and urban environment, and also create the relationship or fix the relationship between different urban environment, here i will illustrate some different method to build this connection and help to build the symbiosis relationship. At the same time, it is also a key point to help push the development of the city.

Build a connection in a larger view in city

We have seen the stop of the development of the city and the difference of commercial in the north and south part of Shanghai Station, so the connection is, from a view of city, connect two different developed parts and balance the activities, help the low-developed part to go faster. And by this connection, people in both sides could share their resource and activities in the neighbors. For example, the city park in the south part, but in the north part there are little green ground and even some ground are still not used in the north part. Build this connection coule make people go to share the green system in city more easily, the same as other urban function.(fig 4.14)

Link surrounding neighbors, break obstacle

To break the obstacle made by the railway roads and fulfill the gap in the city, i build a platform on the railway roads. The platform build the connection between surrounding neighbors by servel different type of entrances and a strong direction from the north plaza. At the same time, the from the platform on the railway road, people could directly go to the ticket check and enter the platform (in this design, try to change some problems made by the policies). So it will be convenient for different source of people to use and become a gathering place to fulfill the gap left by the railway infrastructure. (fig 4.15)

Urban landscape as entrance and connection

The north side of the platform on the railway roads, i decide to build a rump for people to climb, just like a artificial small hill in the city. And that could also give the possibility to use the beneath space of the rump. I build a market here to provide the urban functions and the some functions that are lack inside the Shanghai Station. The rump could also be seen as the part of the greening system in the whole surrounding space of the platform. It could take responsibility of the connection, concourse for people to use, and also as a new view point that attract visitors come here and use, by the help of the node of transportation, that could be a success. (fig 4.16)

keep the continuity of public space

One of the problem of the transportation is cut the continuity urban fabric in the city. So here after these several steps, i decide to keep the whole float as a continuing route to view this area. And use the left space that after creating this connection. Bus stop, Parking, market, and even park and sports could be arranged in this route, shape a series of urban activities near Shanghai Station. (fig 4.17)

Connection as a tool but also destination

All the connection, including the connection to the platform of Station, is a tool to create the relationship between the transportation with the urban environment. But also at the same time, this functional items could become an interesting thing itself to serve the city, not only a attachment in this type of regeneration.
FIGURE 4.14 The link to the south park in the city. Source: Author

FIGURE 4.15 Breaking the obstacle and wall, create the connection. Source: Author

FIGURE 4.16 Using urban landscape to shape the entrance and also as a type of the connection. Source: Author
FIGURE 4.17 Diagram of how to keep the continuity of the pedestrian and shape the public space alongside the people float. Source: Author.
FIGURE 4.17 Diagram of how to keep the continuity of the pedestrian and shape the public space alongside the people float, source: author.
Practice in Shanghai Station's north surrounding space

4.3 Proposals on site

4.3.3 Integrated public space

Integrated public space also means to bring life and possibilities of activities to this transportation infrastructure area. The transportation infrastructure is the core of this area but also as a basic function to connect different activities and provide the convenience for people to use the facilities and buildings. Here I will give several proposals for this aim.

Mixed-use

Mixed-use means the diversity and multi-function in this area. Actually, different functions mean the different need from different kinds of people coming to this area. Mixed different functions, as has mentioned in the TOD, could help reduce the fee of maintaining the transportation infrastructure and help people to get convenient life in this area. At the same time, diversity means the connection from different people to help each other. Also the space will become safe and interesting because all the time there will be activities and users here.

Vertical combination of different functional space

Vertical combination of different functional space

Use the land as much as possible in an urban environment like Shanghai in a very high density environment is an inevitable responsibility for the manager and architects. It could not only provide more benefits for manager of the city but also provide a multi-layer system in the urban environment, and that's one of the way to solve the problem of too crowded city nowadays. At the same time, different functions in a vertical level will make the transportation infrastructure become a more interesting place for the visitors, not only for users.
FIGURE 4.18 The reorganization of the possibilities of activities, source: author

FIGURE 4.20 The life scene in project, source: author
FIGURE 4.21 The vertical combination of different functions, source: author
Practice in Shanghai Station's north surrounding space

4.4 Project in the surrounding space of Shanghai Station

The three parts of the design

Finally, the design will be divided into three parts, the plaza and stalls on the bus stops, and this underground space will be not only used as a bus stop, but also connected with the parking, metro station and the equipment and supporting room for the market. This underground space will also combined with the underground driveway under the market, but I’m not sure if there will be any problems if the driveway is very close to a foundation of an architecture.

And the regeneration of the surrounding space of Shanghai Station with bad quality for not only use but also environment. The design of the fancy market, it will provide the fancy market, playground for children because this area is too low to build a market, so I arrange some place for children here. On the above floors there are the open-air restaurant and markets, offices for stalls and a big canteen. The whole architecture is not only a functional space, but also as an entrance of the platform connection different parts of the design.

The platform on the railway roads, provide the possibilities for people to use and combined with the neighbor, and also this platform, as mentioned before, will help to fulfill the lack of the public service that the station itself do not have. On the railway, people, local people, visitors, tourists, and even other citizens will share a place of park, open-air markets, restaurants, and possibility for sports on it.

At the same time, this framework of the structure on the railway roads could be copied to the extensional place on the next railway roads in Shanghai, and it could become the platform for not only the park, sports and stalls restaurants as I did in the project, but also for the parking, urban framing, towers or other functions, as needed and as the situation of the neighbors.

Here, I will use plans and sections, deconstruction of axonometric drawings, and some scene to show the whole project. And I do some outlook for the further development in the city from this project as a start point.
FIGURE 4.22 Master plan of project, source: author
FIGURE 4.24 2nd Floor plan, source: author
FIGURE 4.25 - 1, 1.3 Floor plan. source: author
FIGURE 4.38: Deconstruction of Axonometric drawing, source: author

- Roof and rump of the market
- Glass Curtain wall system
- Concrete structure system
- 3rd floor, restaurant
- 2nd floor, open-air platform
- 1st floor, office for staff
- Ground floor, Market and stalls
Roof, as a view point in the market
give the possibility to climbing and viewing in this area.

3th floor, a whole restuран on the top floor in the market,
provide the sight and good environment.

2th Floor, the platform on the railway roads and market.
A park, outdoor market, square for people to relax and connect other parts.
Also a ticket towards the railway station.

1th Floor, inside the market, stuff room and some offices

Ground floor, a square built on the bus stop and combined with it, the main entrance of market, playground for children, and also we could see the railway roads here.

Underground floor, bus stop and parking for market,
asome store room and equipment, also a underground drive way to cross the railway road for cars.
The climbing route towards the top

Connection between the two sides of the railway roads, and also connected towards different direction and station

13 Railway roads from Shanghai Station inside the city, cross a long distance

Underground drive way, beneath the market.
FIGURE 4.37 Conception of master plan, source: author
FIGURE 4.38 Structure of the frame work on the railway roads. http://www.gooood.hk/zhabei-new-gateway%ef%bc%8ddefining-a-new-global-centrality-for-shanghai.htm

FIGURE 4.39 Scene in the project, source: Author
FIGURE 4.39 Possibility for further development on railway by different functions. [http://www.gooood.hk/zhabei-new-gateway%ef%bc%8ddefining-a-new-global-centrality-for-shanghai.htm]
FIGURE 4.39 Possibility for further development on railway, by different functions. 
FIGURE 4.40 Possibility for further development on railway, imagination. Source: Author
FIGURE 4.40 Possibility for further development on railway, imagination. Source: Author
Cases of the integration design of transportation infrastructure
5 Conclusion and outlook
Conclusion and outlook

This thesis work seeks two lines of the topic, the integration design of transportation infrastructure in urban environment. The theory study, after the understanding of history and some relevant theories, go to the symbiosis relationship between the transportation infrastructure and urban environment.

Then the problem of solving the problem and contradiction made by the transportation infrastructure becomes how to build and start this symbiosis relationship between transportation infrastructure and urban elements such as neighbors, urban public space, and people’s life. The case studies, go to the skill on how to really use these theories and build symbiosis relationship in detail. I divide the steps of designing as the skill of hiding, the connection that built the space and activities that been creates. These two line finally go to a real project in the surrounding place of Shanghai Station, it is not only to apply the theory and experience from Europe to Shanghai as a try, but also to check if these experiences and theories could be applied to Shanghai, China, a fast developing county.

Finally, I got some words to say after doing these steps, as a small summary of the thesis and the things I learnt in the fast changing contemporary transportation infrastructures.

Treat Transportation infrastructure as building

Transportation infrastructures like metro, and railway roads, stations have a lot of potential points to be developed in urban environment. The one-purpose and engineering-guided transportation infrastructure is becoming more and more difficult to go to a good balance between neighbors, city and infrastructure itself nowadays. We need to treat transportation infrastructure nowadays as we treat one building in the city. We should consider the façade, influence, and even public space, entrance, connections and the view of the transportation infrastructure. Not only the infrastructure like station (which is actually a building), but also like the railway roads, driveway that influence the people in city. Actually that’s the real trend of today’s practice, we could see many cases like I have analyzed in the case studies. And the transportation could create benefits more than only a one-purpose infrastructure. The integration design is, more or less, means the status of transportation infrastructure like that.

Integrate people’s life into transportation infrastructure

As we have seen many exciting successes of that in the case studies. The way to create a public space, a public building, as have been described before, is to arrange people’s life in it, not only transportation infrastructure, but also other buildings. What the special point for transportation infrastructure is, at the beginning, because of the mobility of the world today, transport is actually one inevitable thing that combined with people’s life. That bring the possibilities for the further development of transportation infrastructure but also create the original feeling of transportation infrastructure. How we create new type of transportation infrastructure combined with public space and attract people to use. The answer is to integrate people’s life into transportation infrastructure, that will be very successful as on type of public space. And many cases have proved that.

Use transportation infrastructure as a new possible start point for urban development

The cross of transportation and the big amount of land used by transportation infrastructure made the problems of its appearance in urban environment. Like the American new practice in Hudson Yard, there are many different possibilities to build on the regeneration of transportation infrastructure and could create huge benefits for the city. Not only for the investors and managers, but also that could help to improve the environment for neighbors and local people. The new land use and the benefits from integrating different functions in transportation infrastructure make the possibilities for the further development for city and also may
decrease the cost of regeneration and the cost of people's tax and life. What's more, to nowadays world economic, the investment of infrastructures could also help to create more jobs, development, and better life.

Outlook

Actually, the topic for infrastructure, is always a very contemporary topic, one reason is because of the life span of infrastructure, another is because of the fast development of society, economic, and technical changes. From the history, one of the most interesting things is the change of attitudes and solution to transportation infrastructure in urban environment. The next period of transportation, like the auto car, super railway, and underground individual transportation system in Los Angeles will totally change people's understanding and life style. And that are in our possible sight of the future. So here I want to give a small outlook for contemporary for today's transportation infrastructure. that the design of infrastructure will become a tool for architects to change the urban fabric, urban environment. And that tool, will aim at building a better environment for people, people will be the absolute leading actor in that case. And more and more transportation infrastructure will follow this trend to regenerate the city.
Acknowledgements

First I need the thank the chance of this double-degree projects to help two different countries students exchange their ideas and experience. And the great efforts made by the MBArch members including the professors, Aquiles Gonzalez, Eduard Bru, Josep Maria Fort, Xavi Lloret and also the help from my classmates.

Secondly i need to thanks the help from my Chinese professors, Wei Wei, Wang kai, and Tian Weijia, also special thanks to the amazing help from my Chinese classmates and friend, Yin ming, Peng shumian, Jiang Hanxiao, Liu han, Wu Yuhe

Finally, special thanks go to my supervisor Prof. Aquiles González Raventós for thought provoking and inspiring discussions as well as for fine words of support at the most critical times during the whole process of writing and completing this thesis.

Thanks to all of you again!
Index of figures

1. Introduction

FIGURE 1.2 OSAKA STATION CITY, HTTPS://WWW.PINTEREST.COM/PIN/40349447838955819/
FIGURE 1.3 SHANGHAI STATION HTTP://PR2015.AASCHOOL.AC.UK/DIP-11/ROBERTO-BOETTGER
FIGURE 1.4 THE MULTI-LEVEL NETWORK IN SIO, JAPAN, HTTP://WWW.SIE.SIK.OTJP/ (left)
FIGURE 1.5. OSAKA METRO STATION, HTTP://WWW.SKYSCRAPERCITY.COM/SHOWTHREAD.PHP?T=1315795&PAGE=30 (right)
FIGURE 1.6 THE URBAN DECK AND RESIDENTIAL BUILDING OF UCP (LEFT) / VOID DIAGRAM OF URBAN DECK (RIGHT) (SOURCE: HTTP://MAXWAN.NL)
FIGURE 1.8 THE CONNECTION IN PUBLIC SPACE AS INFRASTRUCTURE, SOURCE: AUTHOR
FIGURE 1.9 THE MULTI-LEVEL SYSTEM IN TRANSPORTATION INFRASTRUCTURE, SOURCE: AUTHOR

2. Transportation infrastructure in city

FIGURE 2.1 PARIS’S ROAD BEFORE HAUSSMANN’S REGENERATION HTTP://WWW.JIUPAICN.COM/2016/1010/204754.HTML
FIGURE 2.4 THE ROAD AND MUNICIPAL INFRASTRUCTURE DESIGN IN HAUSSMANN’S PLAN, HTTP://BLOG.SINA.COM.CN/S/BLOG_BC4470F40102V01A.HTML
FIGURE 2.5 THE BOULEVARDS OF PARIS, SHANNON K, SMETS M. THE LANDSCAPE OF CONTEMPORARY...
FIGURE 2.6 THE ROAD DESIGNED BY HAUSSMANN IN PARIS, HTTP://WWW.JIUPAICN.COM/2016/10/10/204754.HTML
FIGURE 2.7 SORIA Y MATA'S LINEAR CITY, HTTPS://ALCHETRON.COM/ARTURO-SORIA-Y-MATA-1177552-W
FIGURE 2.8 RAILWAY TRANSIT THE WEAPONS, HTTP://WWW.THINKDEFENCE.CO.UK/2015/03/THE-ANTIQUES-ROADSHOW-COMES-TO-SALISBURY/BRITISH-ARMY-EXERCISE-TRACTABLE-RAIL-06/
FIGURE 2.8 RAILWAY TRANSIT THE WEAPONS, HTTP://WWW.THINKDEFENCE.CO.UK/2015/03/THE-ANTIQUES-ROADSHOW-COMES-TO-SALISBURY/BRITISH-ARMY-EXERCISE-TRACTABLE-RAIL-06/
FIGURE 2.10 RAMBLA DE BRASIL, MAP.GOOGLE.COM
FIGURE 2.11 THE LANDSCAPE INFRASTRUCTURE SYMPOSIUM AT THE HARVARD GSD IN 2012, HTTP://SCENARIOJOURNAL.COM/LANDSCAPE-INFRASTRUCTURE-GSD/
FIGURE 2.13 Multi-function, https://www.pinterest.com/pin/39899146671141912/
FIGURE 2.13, The solution to the contradiction of direction and complicated functions, source: author
FIGURE 2.14, Milan Station, https://www.pinterest.com/pin/381117187191928059/
FIGURE 2.15 THE MARGIN OF RAILWAY ROADS IN LA SAGRERA (left), the huge void in urban fabric made by transportation infrastructure (right), SOURCE: AUTHOR
FIGURE 2.16 SYMBIOSIS RELATIONSHIP, HTTPS://LKOSTO.WORDPRESS.COM/TAG/MUTUALISM/
FIGURE 2.17 SANT ANTONI SUNDAY MARKET / RAVETLLAT RIBAS ARCHITECTS, HTTP://WWW.ARCHDAILY.COM/SEARCH/ALL?Q=MERCAT%20DE%20SANT%20ANTONI
FIGURE 2.19 Logroño Station, https://en.wikipedia.org/wiki/Logro%C3%B1o_railway_station
FIGURE 2.20 Atocha Station in Madrid, https://www.likealocalguide.com/madrid/atocha-trainstation
FIGURE 2.21 Different transportation infrastructures in urban scale, http://www.gooood.hk/zhabei-new-gateway%ef%bc%8ddefining-a-new-global-centrality-for-shanghai.htm
FIGURE 2.25 The social benefits that Hudson development carry to New York (left)
FIGURE 2.26 New York Hudson Yard urban complex (right)
http://www.hudsonyardsnewyork.com/
FIGURE 2.27 The structure of the platform on the railway roads, http://www.hudsonyardsnewyork.com/
FIGURE 2.28 The plan of New York Hudson Yard, http://www.hudsonyardsnewyork.com/
3. Cases of the integration design of transportation infrastructure

FIGURE 3.1, BIRD VIEW OF THE RAISED GARDEN, HTTP://STATIC.GOOOOD.HK/2016/12/002-RAISED-GARDENS-OF-SANTS-IN-BARCELONA-BY-SERGI-GODIA-ANA-MOLINO-ARCHITECTS.JPG
(left) FIGURE 3.3 2004 SITUATION OF THE RAILWAY ROAD, SOURCE: AUTHOR
(right) FIGURE 3.4 2011 SITUATION OF THE RAILWAY ROAD, SOURCE: map.google.com
FIGURE 3.5, THE PARKING LOT IN THE ENTRANCE OF THE ROAD (LEFT), THE TWO KIND OF EDGE AS RESIDENCE (RIGHT)
FIGURE 3.7, SOME NEW PUBLIC SPACE THAT APPEARED AFTER THE ENLARGE OF THE ROAD source: author
FIGURE 3.8, 2016 OVERLOOK VIEW OF RAISED GARDEN, HTTP://MAP.GOOGLE.COM
FIGURE 3.9 STEPS OF BUILDING THE WALL SOURCE: AUTHOR
FIGURE 3.10 THE WALL OF THE RAISED GARDEN , SOURCE: AUTHOR
FIGURE 3.11, THE CHANGED RELATIONSHIP BETWEEN RAISED GARDEN AND NEARBY BUILDING
FIGURE 3.12, THE SECTION AND GREEN FENCE ON THE RAISED GARDEN, SOURCE: AUTHOR
FIGURE 3.14, DIFFERENT LEVELS OF THE EXTENTONAL SPACE, SOURCE: AUTHOR
FIGURE 3.15 SOME EQUIPMENT HIDING IN THE PROJECT, SOURCE: AUTHOR
4. Practice in Shanghai Station’s north surrounding space
FIGURE 4.2, Shanghai Station, http://blog.sina.com.cn/s/blog_51d0d2c501009zfs.html

FIGURE 4.3, Location of Shanghai Station http://www.gooood.hk/zhabei-new-gateway%ef%bc%8ddefining-a-new-global-centrality-for-shanghai.htm

FIGURE 4.5, Photos of the site source: author

FIGURE 4.6, Site analysis, source: author

FIGURE 4.7, current situation of the site

FIGURE 4.8, Site analysis

FIGURE 4.9, the new style of urban space in a vertical changing, source: author

FIGURE 4.10, Three plans for the railway roads near Shanghai Station, source: author

FIGURE 4.11 The diagram of hiding the space source: author

FIGURE 4.12 Two parts of the hiding source: author

FIGURE 4.13 Diagram of the new bus stop+square source: author

FIGURE 4.14 The link to the south park in the city source: author

FIGURE 4.15 Breaking the obstacle and wall, create the connection source: author

FIGURE 4.16 Using urban landscape to shape the entrance and also as a type of the connection source: author

FIGURE 4.17 Diagram of how to keep the continuity of the pedestrian and shape the public space alongside the people float, source: author

FIGURE 4.18 The reorganization of the possibilities of activities, source: author

FIGURE 4.20 The Life scene in project, source: author

FIGURE 4.21 The vertical combination of different functions, source: author

FIGURE 4.22 Master plan of project, source: author

FIGURE 4.23 Ground floor plan, source: author

FIGURE 4.24 2nd Floor plan, source: author

FIGURE 4.25 -1, 1, 3 Floor plan, source: author

FIGURE 4.26 deconstruction of Axonometric drawing, source: author

FIGURE 4.27 North facade, source: author

FIGURE 4.28 D-D section, source: author

FIGURE 4.29 C-C Section, source: author

FIGURE 4.30 A-A Section, source: author

FIGURE 4.31 Analysis of the plans, source: author

FIGURE 4.32 D-D Section, source: author

FIGURE 4.33 C-C Section, source: author

FIGURE 4.34 A-A Section, source: author

FIGURE 4.35 B-B Section, source: author

FIGURE 4.36 Axonometric drawing, source: author
FIGURE 4.37 Conception of master plan, source: author

FIGURE 4.38 Structure of the frame work on the railway roads, http://www.gooood.hk/zhabei-new-gateway%ef%bc%8ddefining-a-new-global-centrality-for-shanghai.htm

FIGURE 4.39 Scene in the project, source: Author

FIGURE 4.40 Possibility for further development on railway, by different functions. http://www.gooood.hk/zhabei-new-gateway%ef%bc%8ddefining-a-new-global-centrality-for-shanghai.htm

FIGURE 4.41 Possibility for further development on railway, imagination. source: author
Bibliography

Introduction

2. UNITED NATIONS POPULATION ISSUES, HTTP://WWW.UN.ORG/ZH/DEVELOPMENT/POPULATION/URBANIZATION.SHTML

Transportation infrastructure in city

4. Frederick Law Olmsted (April 26, 1822 – August 28, 1903) was an American landscape architect, journalist, social critic, and public administrator. He is popularly considered to be the father of American landscape architecture. Olmsted
was famous for co-designing many well-known urban parks with his senior partner Calvert Vaux, including Central Park in New York City, Golden Gate Park in San Francisco[2] and Elm Park in Worcester, Massachusetts, considered by many to be the first municipal park in America., https://en.wikipedia.org/wiki/Frederick_Law_Olmsted


9. the WPA 2.0 competition in 2009 http://bustler.net/competitions/latest/1061/wpa-2-0-student-competition


INTEGRATION OF URBAN ENVIRONMENT BASED ON INFRASTRUCTURAL URBANISM

12. ALLEN S. POINTS+ LINES: DIAGRAMS AND PROJECTS FOR THE CITY[M]. PRINCETON ARCHITECTURAL PRESS, 1999


14. Marcel Smets wikipedia

15. CONTEMPORARY INFRASTRUCTURE: AN INTERVIEW WITH MARCEL SMETS’, HTTP://SCENARIOJOURNAL.COM/ARTICLE/CONTEMPORARY-INFRASTRUCTURE-AN-INTERVIEW-WITH-MARCEL-SMETS/

16 http://www.hudsonyardsnewyork.com/about/the-story/

17. TRANSIT-ORIENTED DEVELOPMENT WIKIPEDIA, HTTPS://EN.WIKIPEDIA.ORG/WIKI/TRANSIT-ORIENTED_-DEVELOPMENT

18. The principle of TRANSIT-ORIENTED DEVELOPMENT WIKIPEDIA, HTTPS://EN.WIKIPEDIA.ORG/WIKI/TRANSIT-
ORIENTED_DEVELOPMENT

19. TRANSIT- ORIENTED DEVELOPMENT (TOD), HTTP://WWW.SUSTAINABLECITIESINSTITUTE.ORG/TOPICS/LAND-USE-AND-PLANNING/TRANSIT-ORIENTED-DEVELOPMENT-(TOD)


21. 日建設計，《站城一体开发——新一代公共交通指向型城市建设》（2015）
NIKKEN-SEKKEI-LTD, THE COMPLEX OF STATION AND URBAN ENVIRONMENT, THE NEW GENERATION OF TRANSIT ORIENTED DEVELOPMENT OF CITY

22. 《中国交通运输发展》白皮书 2016.12, CHINESE GOVERNMENT’S FILE OF TRANSPORTATION DEVELOPMENT IN 2016,DECEMBER.

Cases of the integration design of transportation infrastructure

1. HTTP://WWW.GOOOOOD.HK/RAISED-GARDENS-OF-SANTS-IN-BARCELONA-BY-SERGI-GODIA-ANA-MOLINO-ARCHITECTS.HTM


3. CONTEMPORARY INFRASTRUCTURE: AN INTERVIEW WITH MARCEL SMETS, HTTP://SCENARIOJOURNAL.COM/ARTICLE/CONTEMPORARY-INFRASTRUCTURE-AN-INTERVIEW-WITH-MARCEL-SMETS/


6. MIES AWARD PAGE, HTTP://MIESARCH.COM/WORK/2704

7. THE DESCRIPTION FROM THE ARCHITECTS, HTTP://MIESARCH.COM/WORK/2704

8. BU JINGHUA, HAN ZHONGQIANG, “VILLAGE CONSTRUCTION – PUBLIC SPACE DESIGN OF KYOTO BUILDING AND VILLAGE RESEARCH BY HARU HIROSHI, ARCHITECTURAL FORUM, TU-86, 2005

9. KENZABURO OE, FAMOUS JAPANESE WRITER, WON THE NOBEL PRIZE IN 1994
   Youmang Zhou, Kyoto station and the design concept of Hara Hiroshi, [J]. Architecture design, 2000(3). p74-75
   The regeneration of public space by transportation infrastructure, 1980-2014
   Wan Juan, Wu Che. From the aspect of city combine with architecture, to see new urban stations' development
   Zhou Youmang, Kyoto station and Hiroshi Hara’s thoughts on architecture

Practice in Shanghai Station’s north surrounding space

1. Shang hai Station 百度百科,  http://baike.baidu.com/link?url=Y0BgDYBr16t_x6sCcCzkW2j-PjB7p66qmLX0SHDbkBjQwoGLsudbsSmKOEryx6L92QdH2NygsGJPjFhSSFLrhpEMZrkkgv34bOFcVBRv-zDaqSE1besmIPCEyC_EK8p
2. “关于支持铁路建设实施土地综合开发的意见”
   government’s advice on the comprehensive development of railway roads
5. TRANSIT-ORIENTED DEVELOPMENT WIKIPEDIA, HTTPS://EN.WIKIPEDIA.ORG/WIKI/TRANSIT-ORIENTED_ DEVELOPMENT
6. TRANSIT- ORIENTED DEVELOPMENT (TOD), HTTP://WWW.SUSTAINABLECITIESINSTITUTE.ORG/TOPICS/LAND-USE- AND-PLANNING TRANSIT-ORIENTED-DEVELOPMENT-(TOD)
Integration design of transportation infrastructure in urban environment

An integration design of Shanghai Station

Thesis/
Prof. Aquiles Gonzalez
Integration design of transportation infrastructure in urban environment

An integration design of Shanghai Station

Thesis / Prof. Aquiles Gonzalez