The Transformation on an Abandoned Railway area based on the concept of “Greenway”

– study of the Nanjing Western Railway Station in Xiaguan District
Abstract

It has been a pressing issue in the process of urban planning how to deal with abandoned railways that have been rendered useless or outdated by the process of rapid urbanization and the technological advancements in rail transportation. It is thus a relevant issue to try to bring forth into a planning proposal their potential values and possibilities be fully displayed.

This thesis mainly studied on the transformation of an abandoned railway area based on the greenway concept, aiming to give a new design proposal to the area around the abandoned Nanjing West Railway Station, making fully use of the local culture and history to create a comprehensive greenway and a lively district that connects back to the rest of the city. In order to achieve this goal, the greenway approach was used as the theoretical basis and to guide the design proposal. The literature on the greenway concept was first reviewed and then six principles were concluded from a comprehensive understanding of the concept to serve as guidelines to apply the greenway approach to the transformation of an abandoned railway. The literature review highlighted six principles that serve as a guideline: Linearity, Connectivity, Accessibility, Multi-function, Non-motorization and Sustainability.

A case study of the Nanjing West Railway Station in Xiaguan was then conducted. Xiaguan is a historical district in Nanjing, which once was the transportation hub both in waterway and railway. The West Railway Station closed to passengers in 2012 and most sections of the railways have been abandoned, creating social, aesthetic and environmental problems on the railway itself and in the surrounding areas. By taking the local conditions into account, a design proposal was made to improve the current situation. The design proposal was inspired by the Greenway approach principles and by the examples studied from other cases.

The thesis found from the case that the principles are the essential elements and simple guidelines, which can be used in different contexts when the intention is to create a greenway. But we cannot simply replicate an example because the local context is rather different. Instead, the local potential should be taken fully advantage of, such as the historical and cultural context. The transformation should not be isolated but to always connect with the surrounding areas. This is what the design proposal tried to achieve with the transformed abandoned railway, making it a small part of the greenway system in Xiaguan District and even in Nanjing in the future.

Key Words: Urban planning, greenway, abandoned railway, transformation, Xiaguan, Nanjing, green space
Acknowledgement

This thesis is written for a master’s degree of Science Program in Spatial Planning Urban Design in China and Europe, at Blekinge Institute of Technology. I would like to express my gratitude to all the classmates and teachers both in Sweden and in China, because without their support and assistance, it’s not possible for me to finish the thesis. Here are several persons I would like to show my highly appreciation to them.

First, I would like to thank my supervisor Ana Mafalda for her patience, careful comments and inspirational words. She always gave me direction and encouragement when I feel confusing and negative about my thesis. And many valuable suggestions from her also made my thesis make greater progress. I am also grateful to Professor Gunnar Nyström, who helped me with the design proposal. He gave me many useful advices and showed me some similar projects that inspired me a lot.

Besides, I would like to appreciate the Blekinge Institute of Technology and Nanjing Forestry University for providing me the precious opportunity to be here and study in such a good environment and atmosphere with the lovely classmates both from China and Sweden. I think it should be an unforgettable experience in all my life. At last, I would like thank my family and friends for giving me encouragement and support when I feel tired.
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Chapter 1. Introduction

1.1 Background

1.1.1 New problems of urbanization in China

Together with the fast-growing economy and concomitant rapid urbanization resulting from the introduction of market allocation processes in the post-Mao era, the urban planning in China has entered a stage never before reached. Planning is no longer completely monopolized by the governments, and has become increasingly decentralized and diversified due to the development of private planning and design firms and the participation of foreign-invested companies. Although there has been a shift in planning systems and planners as social actors, the continuing lack of public participation that excludes the critical voices from the public has not been solved internally, because the basic political and administrative system of urban planning little changed (Leaf and Hou, 2006). However, under the market-oriented economic policies and accelerating urbanization process since the 1980s, new problems of urban public space such as “window-dressing”, “privatization” and “gentrification” have occurred (Miao, 2011).

These new problems can be understood and expressed by the specific symptoms for each of them: “Window-dressing” often happens in projects scale-unfriendly or location-unfriendly that few residents are willing to use the space, aims at showing the administration’s accomplishment to short-term visitors instead of meeting the local residents’ needs and improving the entire city, even if they are big-budget projects; “Privatization”, refers to the private commercial development such as street-front architecture for shops and commercialization of public space, that damages the social life in adjacent public spaces due to the local government often cooperates with private developer and maximize their short-term profits by satisfying a minority’s demands, such as commercial tenants or real-estate buyers; “Gentrification” illustrates the phenomenon appears mainly in well-established commercial and public centers. The public facilities are uniform upgraded mainly serving high-income residents and other privileged minorities rather than average residents, therefore, the street markets are not allowed in core areas, many old buildings disappear and pedestrians are increasingly marginalized.

Judging from such circumstances, the most fundamental causes of Chinese urban renewal can be concluded as:

1) An ignorance of basic human functions, the demands of majority of residents and an evidence-based design approach: The projects with these above problems often aim to showcasing the governments’ power or making profits rather than meeting the needs of majority of residents. They implement the planning and design based on fashionable visual forms instead of doing some research or interviews before the plan.

2) Lack of respect for existing local urban forms which can support a rich civic life: The local urban forms such as the space layout or patterns, architectures and local culture that are quite...
significant for planners to integrate all the local elements to provide a livable neighborhood for local residents as well as the other visitors.

(3) An unfair political and administrative system that excludes critical voices from public. This can be treated as the most fundamental reason and without changes of the system such as legitimate guarantee for public participation and the expression of public interest, these problems can not be solved internally.

Therefore, it should be recognized by Chinese officials and planners that in order to create a socially stable community, a fair legal or political system plus the necessary modern infrastructures are far more attractive to investors than only modern “images” (Miao, 2011). Since modern infrastructures such as highways, railways, airports, telecommunications and utilities are an indispensable part of the city development and urban planning, it’s hardly to imagine what will happen once they are abandoned in the quick upgrading of urban renewal in China.

1.1.2 Challenges and opportunities for abandoned railways

With the acceleration of urbanization and the expansion of the cities’ scale, abandoned infrastructures have gradually become a major problem affecting the development of the city. Taking the railways as an example - the object this thesis will focus on - currently, there are nearly one hundred abandoned railways across Chinese major cities. These abandoned railways used to contribute to the city’s economic role and were part of the urban transportation network, an integral part of the urban history. However, due to lack of management and careful planning, they gradually turned into a place hiding dirt and dust and are also regarded as roadblock and the blind angle of garbage, emerging as a negative space of the city. As being abandoned and ignored for a long time, the abandoned railways may lead to a variety of new troubles for the urban development and residents lives.

(1) They obstruct the urban traffic: Some disused railways across the city central area, directly connected with the existing traffic road, moreover, the raised tracks make the vehicles inconvenient to pass and easy to have rear-end accidents.

(2) They destruct the city’s landscape image: Some abandoned railways located in suburbs that are not connected with the city’s main traffic artery, there are weeds on both sides and garbage everywhere, and even some criminals steal the railway tracks and equipments in order to earn money, leaving the railway and local urban image dirty and dilapidated.

(3) They affect the residents’ lives: The raised tracks not only bring inconvenience to the city public access, and even pose a big threat to their safety, especially for cyclists and children play on them. In addition, the weeds and garbage badly damage the ecological environment of the surrounding communities.

(4) They endanger the public security: The abandoned railways often occupied by the rangers, scavengers and drug addicts, and with full of illegal constructions or shantytowns built along them that seriously affect the urban image and make them become places of high crime.
rates in the city and a big risk for the public security.

(5) They have an impact on the overall urban planning: The disused railways have their historical particularity of the issue of property rights which lead to some abandoned railways in the embarrassing situation of neglect. Thus how to deal with the abandoned railways became a tough problem for planners in urban planning.

The abandoned railways in the city caused a great deal of negative impact on the urban environment and the city residents' lives, thus highly attention worth paying to the problems and appropriate transformations are urgently needed to change the situation. While in the transforming and reusing, some problems can be also identified as:

(1) Lack of consideration or attention towards the connection of the site with the wider area: In the cases of the existing abandoned railway renovation and re-use, the majority of them consider the transformation only considering the situation of the site itself, not on the entire city or a larger scope. The linear characteristic of abandoned railway decides its connecting and guiding function, while there is no connection between the various transformation cases. So in order to change this condition, it requires a systemic theoretical support.

(2) An extensive way of use (粗放型利用方式): The standard approach in China towards dealing with the abandoned railways mostly concentrates in dismantling the tracks simply to revert them into arable lands or roads. This extensive way not only fails to save the land resource but also has a negative impact on the city’s economic growth and the improvement of the urban environment.

The abandoned railways present city authorities with challenges but also with opportunities. As it causes a series of environmental and social problems, reasonable planning and transformation is imminent, following for example, the intention to build the “Ecological City” which is quite popular and emphasized in China. The concept of ecological civilization related to the “Eco-City” concept was presented in the 17th National Congress of the Communist Party of China, reflecting upon the cost of environmental pollution in the relationship between human and nature, and stressing the need to establish a harmonious relationship between them. It provides political support for building the eco-city in China, and an important opportunity for renewing and transforming the abandoned railway, as it belongs to the urban wasteland which needs to be restored according to ecological and environmental principles. Opportunities can also be offered by the abandoned railway itself with some potential values such as its historical context, cultural heritage and potential to realize the surrounding neighborhoods.

Hence, how to revitalize these abandoned railways and promote their potential value have become urgent issues facing many cities. Many scholars and organizations worldwide are taking up projects such as the High Line in New York and the Promenade plantée in Paris, seeking for ways of how to renew, transform and reuse these sites, recycle and reuse the existing landscape resources, making the landscape and ecology reborn, while preserving the continuity of the site’s history and exploring its special value in the modern era.
To research a long-term strategy for the urban development and a need for a theoretical system to support the transformation of abandoned railways, in my perspective, the “Greenway” concept (Little, 1990, Fabos, 1995, Ahern, 1995) can offer an effective solution to the above issues. Thus this thesis will discuss it in Chapter 2 about ways of integrating and taking advantage of abandoned resources through applying the Greenway concept into the renewal and design of an abandoned railway, in order to turn “waste” to “resource”, The intention is to connect the abandoned railways to the remaining urban areas and establish a green corridor system that is convenient for people living, working and enjoying their leisure time in this area. The greenway approach to the redevelopment of an abandoned railway has a positive significance for the improvement of the urban ecological environment and the perfection of the urban functions to achieve the goal of sustainable development.

1.2 Aim and Research Question

Main aim: This thesis aims at making a design proposal for the revival and transformation of the area around the abandoned Nanjing West Railway Station, following the principles of the Greenway approach, and that makes use of local cultural and history to create a lively district that connects back to the rest of the city and establish a local greenway system.

Research Question: How the greenway concept and its working principles can be used in the transformation of an abandoned railway area in Xiaguan District, Nanjing?

1. What working principles of greenway can be concluded from the literature of greenway concept? This question will be discussed in chapter 2 (literature review).

2. How can the principles found in literature and tested in the three examples be adapted to the local context of Xiaguan abandoned railway? This question will be discussed and tested in chapter 5 (design proposal) and chapter 6 (conclusion and discussion).

1.3 Introduction to the case

1.3.1 Case Background: Nanjing Xiaguan District

Xiaguan District, one of the six administrative districts of Nanjing, China, is located in the northwest corner of Nanjing inner city (Figure 1-1, 1-2). Its total area is about 30.91 km², including 24.29 km² of land territory and 6.62 km² of river territory. The population is approximately 300,000 inhabitants and 6 neighborhoods with 57 communities are administrated there.
The Urban Renewal on an Abandoned Railway area based on the concept of “Greenway”

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Fig.1-1 The location of Xiaguan District in Nanjing and the main city area (source: Nanjing Planning Department, 2010)

Fig.1-2 The main road network and railway system around Xiaguan District (source: made by author)
Xiaguan District is an important part of the historical legacy of Nanjing, especially as the transport center and with prosperous business activities that could be found in the area. Many historical events happened here since the Ming Dynasty and contributed to the development of Xiaguan and Nanjing in a variety of fields. Xiaguan’s role was particularly outstanding in the transportation either on waterway or railway, business and trade activities, and modern industry. However, not all of these events are positive, seen by the decline of the waterway and railway transport status. (Figure 1-3)

The prosperity of Xiaguan faded since the 1990s, with the development of highways and railways, the water transport of Yangtze River was heavily impacted and began to decline, leaving the valuable water front along the river occupied with the factories and piers nearly abandoned and dusty yards. Together with the extension of the railway lines, some railways in Xiaguan were also abandoned. Thus with the loss of traffic dominance, the regional urban functions were also weakened, the economic and social development of Xiaguan stepped into the bottleneck period and has been gradually marginalized. Therefore, it needs a comprehensive regeneration.

In my thesis, I will focus on the renewal of the area along the abandoned railway, which belongs to the Nanjing Western Railway Station, following the concept of greenway to make a connection with other green spaces and bring a new vitality to Xiaguan.

1.3.2 Challenges and Opportunities

Challenges

Most parts of the railway in Xiaguan District are abandoned now, however the track is still there, but the weeds and rubbish are everywhere around it (Figure 1-4). The surrounding road network is messy (Figure 1-5), the housing quality and environment is poor and many old buildings are...
in ruins (Figure 1-6). The streetscape is messy and boring and some fish markets along the street affect the traffic and environment badly; some illegal shantytowns are built along the rail tracks (Figure 1-7). The most basic public infrastructure and environmental characteristics are very bad, adding to a lack of respect for the history and culture of the site.

![Fig.1-4 Weeds and rubbish on the abandoned railway](image1)

![Fig.1-5 The abandoned railway across the urban road](image2)

![Fig.1-6 The demolished buildings](image3)

![Fig.1-7 The Shantytown along the abandoned railway](image4)

(source: site photos taken by author)

**Opportunities**

On the other hand, Xiaguan has a good location that next to the Yangtze River and Huimin River connected to Yangtze River flows through this district. It will mean an opportunity for the riverfront green land. There are also some public green spaces, including natural scenery, urban parks and the city wall with greenery on both sides, close to this area, and they can be connected with each other by the greenway. From the cultural perspective, Xiaguan is rich in its history and there are some historical buildings and monuments are still kept, which may contribute to the greenway design to express the history and culture of Xiaguan. Besides,
Nanjing is making efforts to build the eco-city and the government or some related departments are trying to construct greenways in Nanjing in recent years. Three major greenways, including city-wall circular greenway, Inner-Qinhuai River greenway, and canopy-road greenway, are designed as a permeating framework to guide new green space location, configuration and continuity, and to link existing parks. Additionally a comprehensive trail system mainly for pedestrian and cyclists are preferred by the public and the government (Jim, Chen, 2003). In that case, political support can be got to transform the rails to trails and create part of the city’s greenway.

1.4 Outline of the thesis

The thesis is structured in four parts. The following section is a review of the current research on greenway theory. The literature review first discusses the origin and evolution of the concept in a western context. This is followed by the definitions and its application in abandoned railways with some rail trail cases presented in both western and Chinese cities. At last, from the planning principles and experience of cases, how to adapt them to the Xiaguan abandoned railway project is briefly discussed.

In chapter 3, the methodology is discussed. This section outlines the methods and the necessary tools were used when undertaking the case study and further explanation of why this is the preferable method for the thesis is explained here. Besides, an introduction of my case in Xiaguan District and why this is an interesting case to study is promoted. Moreover, it illustrates the data I collect to answer my research questions and the analysis of the collected data in addition to the important aspects learn from the literature review, and that will guide my empirical analysis.

Subsequently, in chapter 4 the case study section gives a more specific and further analysis on the current situation of the Xiaguan abandoned railway according to the key elements found in above sections. A location analysis is made of the area where the proposal will be made and the surroundings of the study site are also analyzed. Then in chapter 5 the design proposal comes based on the greenway concept and all the previous analysis.

Finally, the last section in chapter 6 concludes the thesis with discussion and thinking of the design proposal.
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Literature Review

- Greenway Concept
- Greenway Approach
- Application in Abandoned Railway Rail-To-Trail

Methodology Case Study

- Current Situation
- Potential Assessment
- Local Context

Conclusion

Design Proposal
Chapter 2. Literature Review – From the greenway concept to the greenway approach

The term of greenway has been identified as a current trend in the research and professional work among landscape designers and planners (Little, 1990; Fabos and Ahern, 1996; Ribeiro, 1998). The modern definition of Greenways was originated in the USA and Europe. The development of modern greenways has experienced an evolution more than two centuries, from boulevards focusing on the landscape function to ecological corridors emphasizing the ecological network of green space. In this literature review, it will first talk about the origin and evolutions of greenways. Then, it will discuss the parallel definitions one over another to form a more comprehensive understanding of the greenway concept and to summarize my own illustration as the working principles of the greenway approach. Last but not the least, it will focus on how greenways serve as a design tool and be used in some existing examples, especially on abandoned railway corridors, which can be used as trails that link populated areas.

2.1 The Evolution of the Greenway Concept:

The greenway literature can be organized into five phases according to Fabos (2004) (Table 2-1). But the origin of greenways can be traced back to earlier time in European countries.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Time</th>
<th>Achievements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Phase</td>
<td>1867 ~ 1900</td>
<td>Early greenway plan, represented by Olmsted, Boston Park System or Emerald Necklace</td>
</tr>
<tr>
<td>2nd Phase</td>
<td>1900 ~ 1945</td>
<td>Greenway Movement on Landscape level</td>
</tr>
<tr>
<td>3rd Phase</td>
<td>1960s ~ 1970s</td>
<td>Greenway planning under environmental concept: Design with Nature</td>
</tr>
<tr>
<td>4th Phase</td>
<td>1980s ~ 1990s</td>
<td>The naming of the greenways (Little, 1990)</td>
</tr>
<tr>
<td>5th Phase</td>
<td>1990s till now</td>
<td>The discovery of greenways abroad (Fabos and Ahern, 1996)</td>
</tr>
</tbody>
</table>

Tab. 2-1 Five phases of greenway literature development

To analyze the origin of greenways we need go back to the establishment of the first public gardens, arborized streets and parks that connected different urban spaces in 18th century (Sarmento, 2002). The boulevards of Paris can be a good example of the new urban structures which provided a tree lined street for the visitors. This experience could be regarded as the rudiment of greenways. Later in the second half of the 19th century, Frederick Law Olmsted developed this idea containing a broader scope such as environmental protection, preservation and conservation of heritage and landscape resources, which was much more similar with the
modern definition of greenways. In 1860, Olmsted proposed the first landscape pleasure drives for horse-drawn carriages, parkway, inspired by the European boulevards.

In the late 19th century, Ebenezer Howard put forward the idea of Green belt in the concept of Garden Cities, which described a buffer zone of rural, forest or park areas, surrounding the urban spaces (Hall and Ward, 1998). Almost at the same time, park systems became a popular tool of planning, which connect watercourse to mountain or other corridors in urban areas without motor traffic and create recreational open space on the fringes of urban areas instead of the middle of urban areas in park belt. “The Emerald Necklace” (Figure 2-1) designed by Olmsted should be the first and most famous masterpiece of park systems. It was based on a linear system of green areas along water lines and swamps, which aimed to treating problems such as water pollution, flood control and urban sprawl, together with providing recreational and leisure spaces (Hall and Ward, 1998; Turner, 1998).

Fig.2-1 Frederick Law Olmsted’s ‘Emerald Necklace’ plan for the Boston Park System, the first greenway in the USA, 1880s.

Following Olmsted, another giant in greenway planning is Charles Eliot. He expanded Olmsted’s greenway system and created a park system for the whole Boston of about 600km² as the Metropolitan Boston Park System (Figure 2-2). Charles linked together five parks or green spaces on the outskirts of the Boston metropolis and the linkages were accomplished through five shorter coastal river corridors, such as the Charles River Greenway Corridor to the ocean and the Boston Back Bay area (Fabos, 1968, pp.57-77; Newton, 1971, pp.318-336).
In the second half of the 20th century, greenway was more regarded as linear zones focusing on environmental issues. At that time, a number of green trails and greenways for multi-purposes were built throughout the United States and Central and Northern Europe.

In the 1980s, the development of greenway stepped into a new phase and the concept was first officially proposed. The definition or statement on greenways in the USA was included in the report of the American President’s Commission on American Outdoors in 1987 and then gradually become widely accepted. In this period, greenways were not only aimed at improving urban leisure spaces and preserving the visual quality of urban landscapes, but also served as multi-purpose spaces, including dimensions such as environmental conversation, heritage preservation, protection of cultural diversity and public participation in the initiatives and strategies of development and landscape conservation (Fabos and Ahern, 1996).

More recently, greenway planning is more connected with sustainable development and with the need for sustainable transportation in urban areas. Such as the initiative Rails-to-trails in the United States; In Belgium, where the European Greenways Association was founded, the disused railways are being transformed into greenways for tourism at primarily. The greenway network of program RAVeL (Reseau Autonome de Voies Lentes), based on disused railways, pathways and canals, is currently 900km long (European Greenway Association, 2000). In Spain, over 1000km of the disused railways have been converted into greenways. Examples from France, the United Kingdom and Luxembourg would add to the list of cases illustrating the emphasis on reusing abandoned railways for leisure and transportation and underlying the economic and social benefits of such developments (European Greenway Association, 2000).
At the regional level, the most significant greenway planning can be the New England Greenway Vision Plan (Fabos, 1999) (Figure 2-3). It planned for all six states in New England and connected the land area of more than 42 million acres. The vision plan combines natural protection, recreation and historic and cultural resources as a single-purpose and lay emphasis on linear features, connectivity and multiple uses.

Fig. 2-3 New England Greenway Vision Plan (Fabos, 1999)

2.2 The Greenway Concept

2.2.1 Definition

The "Greenway" concept refers to a green land network including linear elements and contains the related concepts of ecological, recreational, cultural, aesthetic, and sustainable development of land. Also it is an approach conceived for a multi-purpose planning and management of an area. Broadly speaking, the Greenway is a general term used to connect a variety of linear green open space, including planning and design from the bicycle paths in the communities to the habitat corridor guiding the wildlife for seasonal migration; from urban waterfront to the shade trail along riverbanks away from the city (Ahern, 1995, Hellmund and Smith, 2006).

However, attempting a definition of Greenway is quite difficult and challenging, as it varies in different environments and under different conditions, for example, ecological networks, ecological corridors, environmental corridors etc. and different researchers define it differently. So there has always been some limitation with its definition. The early Greenway concept was a corridor-like private and public area, with recreational land and water, that was intended to make it easy for people to access the open space from where they lived; Greenways were also
defined as a channel closely linking urban to rural areas (Hoover and Shannon, 1995); or as forming a network system to provide landscape elements of ecological, recreational and cultural value for communities (Ndubisi, Demeo and Ditto, 1995). Urban environmental planners considered that the greenway’s objective is meant to make a region greener, healthier and more livable (Lindsey, 2003). The “Italy Greenway Association” believes that, from the mobility point of view, greenways are a system of routes, dedicated to a non-motorized traffic, connecting people with landscape resources (natural, historical, cultural, etc.) and the "centers of life" (e.g. municipal offices, sport and recreational facilities, etc.), both in the urban areas and in the countryside. (Toccolini, Fumagalli and Senes, 2006). Moreover, there is more emphasis on the ecological theory and process, on the interaction between social and ecological functions and on the potential of a ecological network beyond regional administrative boundaries and administrative privileges (Jongman, 1995). Some scholars believe that the greenway helps to maintain regional biodiversity and is an important measure to reduce habitat fragmentation, with different widths and connected into a network-like corridor system (Fabos, 1995). Therefore, we can say that, the formation and development of the greenway concept is the crystallization of the enhancing public awareness of the environmental and cultural values (Mugavin, 2004).

Since the modern concept of greenway emerged in the 1980s, many more definitions by different scholars emphasizing different perspectives were put forward one after the other, which have all contributed to the improvement of the greenway definition. These definitions can help us to form a general idea of what greenway is by perceiving the common characteristics they all have and by weighing how one definition emphasizes one aspect over another I will discuss here some main elements that will be particularly useful in my case.

At first, the definition or statement on greenways in the USA was included in the report of the “American President’s Commission on Americans Outdoors” in 1987 and then gradually became widely accepted. This definition of greenways highlights the spatial connectivity, linking rural and urban environments, and also making the open space and landscapes more accessible to the population centers.

After years of research, the theoretical studies on Greenways have been more matured in the United States. Little made a more concrete and practical definition in Greenways for America in 1990. Little’s definition shares the same basic ideas as the President’s Commission; furthermore, it underlines linearity of greenway and recognizes specific types of greenway depending on their location, spatial configuration and purpose. Many other authors (Smith and Hellmund 1993; Flink and Searns 1993; Erickson and Louisse 1997) of greenway books, journal articles and reports cite the definitions of Little and the President’s Commission.

Turner analyzed greenways in London, looking for common patterns among successful examples. He was inspired by the pattern language technique of architect Christopher Alexander. Turner concluded there are seven types, or ‘patterns’, of greenway which he named: parkway, blueway, paveway, glaze way, skyway, ecoway and cycleway. (Turner, 1995)
Subsequently, Ahern also defined the Greenway based on a literature review combining the experiences of the application of the concept to the American context:

Greenways are networks of land that are planned, designed and managed for multiple purposes including ecological, recreational, cultural, aesthetic, or other purposes compatible with the concept of sustainable land use.

(Ahern, 1995)

His definition aims to reveal that the greenway space structure is linear; connection is the most important feature of the greenway; greenway is multi-functional, including ecological, cultural, social and aesthetic function; greenway is sustainable and the balance of natural protection and economic development; It is more comprehensive and mainly included all the key points of the modern greenways and I think such key terms can be a more suitable way to define the greenway, paying much more attention to sustainable landscape development either for the nature, eco-system or for the society and people.

Greenway networks in Europe are often known as ecological networks, even if their purpose is also more than nature protection. The organization for greenways was established in Europe - the European Greenways Association, defines it as "communication routes reserved exclusively for non-motorized journeys, developed in an integrated manner which enhances both the environment and quality of life of the surrounding area. These routes should meet satisfactory standards of width, gradient and surface condition to ensure that they are both user-friendly and low-risk for users of all abilities." (Lille Declaration, European Greenways Association, 12 September 2000).

Another definition included in the book "Designing Greenways: Sustainable Landscapes for Nature and People", shares certain general characteristics with the above ones, and highlights the landscape integrity in greenway planning, concluding that, greenways are corridors of land and water designed and managed for multiple purposes, with an overall aim of sustaining the integrity of the landscape, including both natural and social components (Hellmund and Smith, 2006).

These definitions show a diversity of understanding of greenways along with the change of time and the development of society. Though different scholars may focus on different aspects of greenway, while sharing some common terms, they all contribute more discussions and reflections to better understand and apply the concept of Greenway. From my point of view, some key elements of greenway concept can be concluded as the approach or working principles to guide my analysis and design: Linearity, Connectivity, Accessibility, Multi-purpose, Non-motorization and Sustainability. They will be further analyzed in Chapter 2.3.
2.2.2 Classification

Different scholars also gave different versions of classification for greenways, but these often share some commonalities, for example, the division usually reflects the function intended behind the particular greenway, or then the landscape features that dominate a particular type of greenway.

Fabos divided greenways into three categories according to practical needs, when managing the design and implementation of the New England greenway network planning as: ecological greenways, recreational greenways and cultural and historic greenways.

Ahern made the classification based on different angles. According to the spatial scale, it can be divided into four types (Table 2-2). The table indicates a hierarchical classification of greenway orders, in the same manner that streams and rivers are classified in geomorphology and physical geography (Ahern, 1995). Greenways can also be classified by functions as: biodiversity related greenways, water resources related greenways, recreational greenways and historical and cultural resource protection greenways.

<table>
<thead>
<tr>
<th>Order</th>
<th>Area ( (\text{km}^2) )</th>
<th>Physiography</th>
<th>Political Units</th>
<th>Functional Orientation</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 - 100</td>
<td>Small Streams Ridges</td>
<td>Municipal</td>
<td>Implementation Management</td>
<td>Platte River. Minute Man</td>
</tr>
<tr>
<td>2</td>
<td>100 - 10,000</td>
<td>Rivers Regional Features</td>
<td>County Province</td>
<td>Coordination Policy</td>
<td>Quabbin N. Brabant</td>
</tr>
<tr>
<td>3</td>
<td>10,000 - 100,000</td>
<td>River Basins Mountains</td>
<td>States Small Nations</td>
<td>Policy</td>
<td>Netherlands Georgia</td>
</tr>
<tr>
<td>4</td>
<td>&gt;100,000</td>
<td>Continental</td>
<td>Large Nations and Continents</td>
<td>Policy</td>
<td>EECONEET</td>
</tr>
</tbody>
</table>

Tab. 2-2 The classification of greenway based on spatial scale and associate attributes (Ahern, 1995)

Charles Little made a more systematic classification for greenways in “Greenway for America” and he thought there are five basic types of greenways depending on the formation conditions and the functions:

1. Urban riverside greenways: usually along a neglected and dilapidated urban waterfront, being built in part of or the entire re-development plan.

2. Recreational greenways: various types of roads full with unique characteristics and that usually cover a long distance, based on natural corridors, such as valleys, abandoned roads and public channels.

3. Ecologically significant natural corridors: usually along rivers and streams, sometimes along ridgeline for wildlife migration and species exchange, natural learning and hunting by people.
(4) Scenic and historic routes: generally along a road, highway or waterway, the most typical one is the dedicated channel along the road provided for backpackers, so that they have at least one space to avoid cars.

(5) Comprehensive greenway systems or networks: usually based on the natural terrain, such as valleys and mountains, but sometimes, in order to create an alternative municipal or regional green infrastructure, it is just some random combination of greenways or of types of open space.

In China, Yu summarized the development and evolution of the greenway concept using the approach of historical analysis and top-down planning. In his perspective, greenways can be divided into three categories according to the forms and functions:

1. Riverfront greenways along the riverside or water boundary;
2. Park road greenways or road greenways with traffic function;
3. Rural greenways distributed along the rural border.

A much simpler classification just based on the location would be to divide greenways as: rural greenway, urban greenway and community greenway. The community greenway mainly connects residential green space; and urban greenway connects city parks, squares, recreational space and scenic spots. The rural greenway is relatively more difficult to build, for lack of the tourists’ needs. However, it’s not so difficult to build the urban greenway, which can take full advantage of the existing parks or green spaces and other facilities, making them link with each other and can be effective and widely distributed. In addition, the most significant difference between greenway and general green parks is that greenways do not need land acquisition and almost do not take up the land resources of urban construction. (Zhou, Yu and Huang, 2006)

Conclusion

Although showing the diverse classifications according to different criterion, many aspects in common can be found, especially in those classified by functions from Fabos, Ahern and Little. Generally, in my perspective, greenways can be divided into three types as: ecological or natural greenways, recreational greenways and historical and cultural greenways. However, a comprehensive greenway network with a combination of all the three types is often presented in planning and designing a greenway.

2.2.3 Benefits of Greenways

There are at least three significant benefits from greenways (Fabos, 1995) and some indirect benefits are also expressed in a long term.
(1) Ecological benefits
Greenways protect the ecologically significant natural systems: mostly along rivers, coastal areas and ridgelines; maintain bio-diversity and provide for wildlife migration.

Greenways are not only the significant corridor habitat to protect the wildlife, but are also able to create the habitat chain and network within the existing habitat areas to prevent the degradation and fragmentation of habitats, so as to protect the biodiversity and the existing physical environment and biological resources in the natural environment. In addition, they can also act as an emergency buffer to protect the water resource and achieve the effect of air purification by absorbing the pollutants in the water, woods and bushes. At the species level, greenways are corridors for population dispersion, gene exchanges and even for the wildlife migration when climate changes; At the individual level, they are corridors for daily activities and seasonal movement of animals.

When applied into the abandoned railway transformation, the linearity of greenway can enhance the connection of the natural elements in the landscape, increase the habitat connectivity and enhance the movement and transportation of nutrients, species and energy, thereby reducing the fragmentation of the landscape (Xiang, 1996). Besides, the greenway construction can link the landscape along the railway with each other, expanding the area covered by the greenway to form a stable, continuous urban green network system, improve the ecological environment of the city and make a contribution to achieve the sustainable development of the city.

(2) Recreational/Social benefits
Greenway networks not only provide a much better and enjoyable ecological environment, but also provide people with extensive recreational opportunities with metropolitan regions and rural areas for walking, hiking, bicycling, swimming, boating among many other outdoor recreational activities. So greenways, as alternative traffic corridors, can link origins and destinations, with beautiful landscape along the road, providing a means for pedestrians and cyclists to travel to and from places they want to go (Conine, Xiang, Young and Whitley, 2004).

Under the guidance of greenway, the abandoned railway segment based on recreation and culture will make fully rational use of the urban land and create more green infrastructure to provide a green exchange open space for local residents. Parts of the railway can be used to prevent natural erosion which means to retain the original traces, thus it can become a trail preferred by backpackers, photography enthusiasts and hikers.

(3) Cultural benefits
Greenway networks provide the population with significant historical heritage and cultural values. The majority of greenways are along rivers and seashores and these are the areas or corridors where an estimated 90% of heritage areas and cultural resources are located (Dawson, 1995 and Lewis, 1964). The heritage corridor is a product of the combination of greenways and the
regionalization of heritage protection, and a linear cultural landscape, which represents the route of early human movement and embodies the regional culture development.

The abandoned railway witnessed the economic development and historical evolution of a city and a region, carries the history and culture of a generation. Therefore in the transformation process, we can use the greenway concept to keep it, which will evoke the memories of urban history of the residents, or to give it a new meaning, which may attract more young people and tourists from other places to promote the local cultural exchanges.

(4) Economic benefits
Despite the cultural significance of greenways, its economic function cannot be ignored either. Greenways, like other forms of green space, can affect local and regional economies. This is true both in the usual sense of generating monetary wealth (through increased business activity or property values) and also through the production, ideally in an environmentally sustainable fashion, of material resources through community gardens and forests or, in a sense, the production of energy from non-motorized transportation (Hellmund and Smith, 2006, pp.160).

After the transformation and renewal based on greenway theory, the new railway improves the overall image of the city and expresses the urban culture. Through a combination of the surrounding land-use planning, enriching the tourism resources of the city to attract the local residents and visitors from other places, stimulating the consumption of local transport, catering and accommodation it contributes to the economic development of the urban district.

Conclusion

From the multiple benefits of greenways, their previous value in different aspects can be convinced and I can also believe that greenway can help make communities more active and friendly places to live. As it can help residents living in the communities ensure that their neighborhoods are good to live, so that they can avoid of the heavy traffic in the city and save lots of time to better spend with their families and friends, and children can safely walk or bike to a park, school, or to a neighbor’s home.

I think if the greenway concept is correctly used in the abandoned railway area, the bad situation such as the environment pollution and traffic trouble can be substantially improved and replaced by a totally new livable neighborhood.

Then the problem goes to their application and how to adapt them into my case of abandoned railway renewal, which can be translated as how to turn “Rails” to “trails”. Only by making this concept applicable to the urban design projects, can it embody its real value and achieve its ultimate goals. For that purpose, in Chapter 2.3, I will discuss how greenways can be used as a tool to guide the design.
2.3 Greenway approach in abandoned railway transformation

2.3.1 The applicability of greenway approach in abandoned railway area

Greenways can be established on abandoned roadbed (Fabos, 1996). With the historic heritage and cultural values of the old railway, we can take such measures as ecological restoration and creation of recreational trails with nice landscape along it to realize its multi-function.

Transformation and reuse of the abandoned railway originated from the Greenway movement in the United States. Abandoned railways have the characteristics of linearity, connectivity and accessibility that are in common with greenways. Although without multiple functions, they have the potential to be built with ecological, recreational and cultural functions just as the three types of greenways made by Fabos (1996).

(1) Greenways of ecologically significant corridors and natural systems;
(2) Recreational greenways, often near water, trails and scenery;
(3) Greenways with historic heritage and cultural values.

According to Fabos, with the rich potential of natural, recreational, historic and cultural factors, the abandoned railway can be a good foundation to create a greenway with a combination of all the three types. So the functional features should be taken full account of when transforming the abandoned railway based on the characteristics of different greenway types to make the abandoned railway after transformation become an integral part of the entire greenway network of the city, in order to achieve the goal of ecological protection rather than replace the other types of planning (Tan and Zhao, 2007). It can be illustrated by a vivid graphic to briefly show how the greenway concept works in a transformed abandoned railway. (Figure 2-4)

![Fig.2-4](source: made by author)
2.3.2 Working principles of greenway approach

1. **Linearity** – the most visible characteristic of greenways, not simply aims at describing the shape of it, but laying the foundation and creating good opportunities for the connectivity and accessibility aspects. As a long and continuous corridor, allows to wind through a variety of neighborhoods, making them connected and more accessible than nonlinear green space, due to its high ratio of edge to interior area and can contribute to social equity when the greenway connects both communities of high income and low income groups, but they can have an equal access to the greenway to exchange or enjoy the nice environment together (Hellmund and Smith, 2006).

2. **Connectivity** - as a spatial characteristic of systems (i.e. landscapes), which enable and support the occurrence of specific processes and functions, through adjacency, proximity or functional linkage and connection (Ahern, 2003). Much of the literature about landscape ecology focuses on the value of connectivity for maintaining biodiversity in nature.

3. **Accessibility** – close to where people live and work, easy and convenient to reach, making the open space and landscapes more accessible to the population centers

4. **Multi-function** - designed and managed for multiple purposes including ecological, recreational, cultural, aesthetic, or other purposes compatible with the concept of sustainable land use.

5. **Non-motorization** – as alternative forms of transportation, trail recreation and human need or preference for nearby nature and recreation (Kaplan, 1998). Transportation here means moving between an origin and a destination. Greenways are often particularly designed and implemented for pedestrian and cyclists, so it may contribute to many social issues in metropolitan areas, such as traffic reduction, reducing air pollution and a healthier population. In many regions of the U.S., it proved to be immensely popular when the unusual integrated bicycle trails are provided (Flink and Searns 1993).

6. **Sustainability** - an overall aim of sustaining the integrity of the landscape, including both natural and social components, to achieve the ultimate goal of urban sustainable development.

In addition, greenways also enhance the connectivity between people and nature, which can be the most abstract benefit, providing for routine and close to where they live and work. The connectivity potential of greenways can influence patterns of social interaction (human-nature interaction), which is provided through large parks in cities historically (Fabos 1995).

2.3.3 Steps for greenway planning and design

The greenway concept has a history of five hundred years in the urban planning and design of North America and Europe. Though scholars have different definitions on it, the principles and methods of its planning have been maturing over time and through its application in different contexts and projects. The application of greenway is very common in regional planning and
urban planning of America and Europe, and it has become a mainstream approach of today’s urban planning in those countries. As a current trend, but there is no uniform rules of the greenway planning, due to the varied landscape characteristics, land conditions and community demands. Some greenways are designed to highlight the recreational features, some designed to emphasize the role of biodiversity protection, and some are intended to dig its potential of protecting historical and cultural resources. Actually, many designs combine a variety of functions as an aggregate (Xu, 2010).

As an all-inclusive system, greenway joins downtowns and inner city neighborhoods, through suburbs towards the countryside, serving large population groups, the concept of greenway must be applied at all scales (Anthony, 1995). So the greenway concept needs to be adopted in the abandoned railway as the overall greenway planning at the macro-scale and the ecological restoration at micro-scale, making the greenway effectively integrated into the communities to serve for the local residents’ daily life. Some steps of greenway planning and application in abandoned railway are raised by Conine, Xiang, Young and Whitley (2004):

(1) Identification of goals and objectives
The foremost step is to establish the goal of transforming the abandoned railway to a greenway, which is the most fundamental and usually including field surveys, exchange with neighboring residents and government managers. This is a process of “needs assessment”, which is to ascertain the views and requirements of them and then take a comprehensive consideration of all the needs which will be reflected throughout the planning process, bringing tangible benefits for local residents.

(2) Assessment of potential demand areas
These areas are geographically separated locations where certain types of human activities take place. Such as public green space, commercial and residential land and ecological protection green land. From a planning perspective, it’s necessary to link various types of green space and can act as origins or destinations of potential ecological corridors. So it requires the analysis of the number, location and type of the surrounding ecological green space in the abandoned railway renovation process.

(3) Assessment of potential connectivity supplies
Greenway is an issue of system, in addition to the need of transforming the railway itself, there are still some potential connectivity resources in the demand areas, which are often with linear characteristics, natural or artificial linear landscape in this area, for instance, the streams and the existing transportation infrastructure. Making the abandoned railway combined with potential connectivity resources will help to form a greenway network in the site.

(4) Assessment of site suitability
This aims to determine the most suitable areas for the construction of a future greenway. An area’s suitability for greenways is determined by a rating and weighting method (RAW method)
(Dent, 1978; Hopkins, 1977; Xiang, 1996), and equals to the summation of weighted capability scores of all the contributing factors in support of a future greenway (Simberloff, Cox, 1987, pp.63-71). But in this thesis, the abandoned railway for recreation is treated as a form of greenway, so we simply need to do the qualitative analysis of the surrounding situation to determine which specific types of greenway it can be transformed to.

(5) Assessment of accessibility
It involves both approachability analysis and proximity analysis. An area may have a high assessment of the site suitability, but limited by the existing transportation facilities, its accessibility is poor for potential trail users. People can take advantage of the existing roads by driving, walking or cycling to reach the origin of the trail. So the existing intersecting streets have a higher assessment. For the implementation of proximity analysis, it needs to identify the appropriate walking distance from the demand area. For study object of this paper this means to analyze the existing traffic conditions around the abandoned railroad and to identify the suitable walking distance to reach the track line.

(6) Delineation of corridors
After the determination of the demand area and potential connectivity resources, the main area of the greenway can be delineated. The most ideal situation is to identify that the greenway is able to meet the established objectives and as well as providing multiple functions. However, under normal circumstances, there are alternative ways to connect the same demand areas.

(7) Evaluation
Finally, all the alternative greenways need to be compared with each other and then the decision can be ultimately made through investigation or communicating with local principals, and professional planners. For the study object, this mainly means to select the surrounding demand areas and potential connectivity resources with a combination of the transformation types of abandoned railways.

2.3.4 Examples of rail-trail projects using a Greenway approach

Rails-to-Trails in the U.S. Context

A brief review of the historical development in American landscape planning shows an situation that much of public lands were added to the US National Park and US Forest systems over the past two centuries (Ahern, 2004). They are far from human population and much of them are mountainous and arid, which less suitable for agriculture and urban uses, while greenways are quite different from these national parks and focus on linear areas, more close to the population centers and designed for multiple purposes.

A great number of practical projects of the transformation of abandoned railways following the greenway approach have been taken up in the USA, Europe and South Korea. In this regard,
the United States plays a leading role on the practical experience. The Rail-Trail Movement (Rails-to-Trails Conservancy, 2001) in America can be an important milestone of the greenway development in history. Since the 1960s, with change of urban structure and the development of urban transportation, numerous of railways are abandoned after the main freight transport turning from the railway to the truck. As the “Rails-to-Trails” movement came into being, with many abandoned railways transformed into greenways. Trails are paths used for walking, bicycling, horseback riding or other forms of recreation or transportation. They are not just transport corridors for urban residents, but a concept combines dedicated with non-motorized.

Representative Rails-to-Trails examples worldwide
Here are three examples of rail-trail greenway in the renovated areas, showing how to address the greenway approach with the natural resources, how cultural or historical elements are expressed and how linearity, accessibility, connectivity, multi-function, non-motorization and sustainability were considered in each of them.

1. Promenade Plantée & Viaduc des Arts
The Promenade Plantée, which means tree-lined walkway in English, is a remarkable case of rails-to-trails in the city central area in Paris. This old railway linking the two cities of Paris-Strasbourg began from an elevated section of Place de la Bastille to the eastern edge of the city (Figure 2-5). Many parts of the railway line are still in use now but has been upgraded to a high speed rail system, with the introduction of the SNCF’s RER “A” commuter rail line in the 1960s, which made the elevated portion of the line quickly been abandoned (Cities, Spaces and Great Places: The Blog, 2011).

Place de la Bastille was chosen as the site for the state opera house and the renovation design of this abandoned railway included a promenade, integrated into the site plan to make use of the viaduct. And the elevated viaduct consisting of 64 well-restored red brick vaults, was converted into shops and studios along the street, which known as the Viaduc des Arts (Le Viaduc des Arts, 2012). The greenway approach was well applied in it and after its implementation a new life was brought to the neighboring residents.
Linearity – As a part of the abandoned railway, they made use of the linear space above the viaduct to create a peaceful promenade, or a pathway system. The promenade extended onto the surface beyond the viaduct without being interrupted by new development. With the lush mature trees and ever-changing greenery on both sides, the trail has been developed into an excellent linear green space to relax and keep away from the city’s busy intersections (Figure 2-6, 2-7).
Connectivity and Accessibility — The original viaduct divided neighborhoods and created large portions of isolated space, while the promenade project reconnect the neighborhoods and spaces along the corridor by re-establishing access beneath the vaults (Figure 2-8) and by converting orphaned space to accessible public space, such as parks and squares, and into offices and new apartments that connect onto the promenade (Figure 2-9). With the offices and apartments, the promenade can have sufficient daily use and bring vitality to this site. Bridges are commonly used either across over a large lawn or a river to establish the connection between two areas that were not well linked before (Figure 2-10, 2-11) The Promenade Plantée, a trail system and a peaceful park space for local residents is an access point into the city from their buildings, and can also be used as a jogging trail.
Fig. 2-8 The access up towards the Promenade Plantée

Fig. 2-9 The promenade across apartments and offices
Multi-function – Being transformed and reused as restaurants, cafes, artist studios and exhibition halls, the restored vaults converted to deal with some commercial activities (Figure 2-12). They offer craftspeople or new artists and designers coming out of school, with the opportunity to operate a shop in these unique spaces for a period of five years at affordable rents and also present residents and visitors to engage with the districts’ craftspeople. And the linear park above can simply be a space to relax or recreation (Figure 2-13). By renovating the vaults, it helps to recognize the area’s heritage while creating new opportunities for businesses and future development. So this is a space mixed with culture, commerce, transit (Figure 2-14), public space and housing functions.

Fig.2-10, 2-11 Bridges across over the park and river to connect the promenade (source: http://www.geolocation.ws/v/P/42863366/promenade-plante-paris/en)

Fig.2-12 The vaults transformed to commercial shops as an art district
Non-motorization – The promenade above the viaduct is reserved for foot or bicycle traffic, which helps to avoid the city’s heavy traffic especially in rush hour, so some residents prefer commuting to and from work along its length as it may save more time and be safer as well (Figure 2-15). With some benches along the promenade, people can also stop and sit aside to enjoy their leisure time in the sunshine (Figure 2-16, 2-17), which can contribute to the slow life in the city. Without the annoying noise and air pollution of the rapid urban traffic, this green linear space seems rather peaceful and comfortable in the city that makes the residents as well as tourists are willing to stay in or pass by it.
Fig. 2-15 The promenade with a separation for pedestrian and cyclists

Fig.2-16, 2-17 Promenade for strolling, jogging and biking with benches aside for resting (source: [http://iaintheurbanist.wordpress.com/2011/06/12/paris-viaduc-des-arts-and-the-promenade-plantee/](http://iaintheurbanist.wordpress.com/2011/06/12/paris-viaduc-des-arts-and-the-promenade-plantee/))

**Sustainability** – The affordable rents of the renovated vaults provided opportunities to new artists to help remain the local artisans, which reduce the negative impacts of the increased land value and gentrification. It also implies that “robustness”, a long-standing principle in urban design, should be considered at the beginning of working on an infrastructure project. Planners need to consider how it will be used in the future when its current use was abandoned. They design to sustain the local values and cultural heritage instead of ensuring when the use of that infrastructure changes and when it has to be torn down or rebuilt.
This brilliant and amazing project constructs a comprehensive system with a combination of culture, commerce, transit, public space and housing, enriching this neighborhood of Paris city and making it a landmark (Figure 2-18). The success of this project cannot owe to any individual, but to the efforts made together by the city government, planning authority and public that makes the wise project happen and becomes an example for other cities to learn.

2. The High Line
The High Line is a public park built on an historic freight rail line – section of the New York Central Railroad elevated above the streets on Manhattan’s West Side. It is owned by the New York City, and maintained and operated by Friends of the High Line (High Line: the official web site of the High Line and Friends of the High Line, 2000). After its abandonment in the 1980s, this line has been redesigned and transformed to an aerial greenway as the High Line Park with an inspiration of the similar project in Paris (the Promenade Plantée). It runs from Gansevoort Street in the Meatpacking District to West 34th Street, between 10th & 11th Avenues (Figure 2-19). The first section of the High Line opened on June 9, 2009, extending from Gansevoort Street to West 20th Street and the second section, which runs between West 20th and West 30th Streets, opened June 8, 2011. The third and final section between West 30th and West 34th streets are still under construction. The High Line design is a collaboration between James Corner Field Operations (Project Lead), Diller Scofidio + Renfro, and planting designer Piet Oudolf (Figure 2-20). It has become one of the most famous and representative projects of landscape urbanism or the greenway design in recent years. From the perspective of greenway concept and approach, we can have a further and deeper understanding on the reuse and transformation of the elevated railway.
The Urban Renewal on an Abandoned Railway area based on the concept of “Greenway”

Zhou Quan

Fig. 2-19 Map of the High Line showing its location (source: google map and illustrated by author)

Fig. 2-20 The plan of the High Line and explanation on the features and access of each section (right) (source: http://www.thehighline.org/about/maps)
Linearity – The first section of the High Line is only 0.8km long and between 9-18 meters wide, looks quite narrow relative to the traditional parks or green space (Figure 2-21). As it is in the city, bringing a unique experience and many potential users, there should be diversification and differentiation of functions in such small linear space to arouse people’s interest and meet their various demands, just as what the city’s infrastructure acts. The linearity cannot be the limit of space, but providing opportunity for a flexible and diverse space. Specific to the surface treatment of the High Line, a mutual penetration of hard pavement and soft plant was used by James Corner and his design team showing different proportions and types in different segments, so that the linear space become much more attractive with the ever changing surface forms. The concrete planking deck interlaced with greenery (Figure 2-22), wood benches peeling up from the ground (Figure 2-23) and the preserved iron tracks (Figure 2-24) all respect for the linearity as the most widely-used elements and facilities throughout the project.

Fig.2-21 The perspective of High Line Section1 showing its linearity
The Urban Renewal on an Abandoned Railway area based on the concept of “Greenway”

Zhou Quan

Fig. 2-22 The concrete planking deck interlaced with greenery
Fig. 2-23 wood benches peeling up from the ground

Fig. 2-24 The preserved iron tracks with some wild grass and flowers planted inside
(source: http://www.thehighline.org/galleries/images)

Connectivity and Accessibility – The High Line runs nearly 30 feet in the air through three of Manhattan’s most dynamic neighborhoods and sometimes adjacent to or even through the privately owned property, that links them together as an elevated corridor. These neighborhoods were dominated by industrial and transportation uses when the High Line was built in the 1930s. But now many of the warehouses and factories have been converted to other uses such as galleries, design studios and residences (official Web site of the High Line and Friends of the High Line). As the High Line hanging in the air, its external transport linking the neighborhoods and the linear park has been a crucial part to realize the connectivity. Thus five accesses are planned in the first section of High Line, including two elevator accesses to ensure the flow of people gathering and dispersing reasonably (Figure 2-25). Also, the High Line is fully wheelchair accessible. Moreover, the High Line can be conveniently reached via some methods of public transportation, such as subway and bus.
Multi-function – The multiple uses of the High Line can be concluded as three types of urban social activity: looking, moving and gathering. The High Line provides abundant opportunities for looking at the city, at each other, at one self, moving aimlessly or purposefully, and gathering with friends, with strangers and with one’s thoughts (Shapiro, 2011). The 26th street viewing spur provides a framework for looking to enhance views of the city rather than blocks (Figure 2-26); moving through the High Line with the ever changing space and plantings all along the way can be quite interesting (Figure 2-27); and the 10th Avenue Square can be a perfect place for gathering to experience the park and the surrounding cityscape in a unique way (Figure 2-28).
In my opinion, the implementation of these functions should thanks to the wise design mainly on the surface treatment and spatial variation. The soft and hard elements are spliced artfully together throughout the project: some of the area is all covered with hard pavement but with the wild plantings growing between the gaps of it; some area is 40% of wild plantings and 60% of the hard pavement; and some are completely planting surface with a bridge to pass by. The linear space with varying width and its setting facilities such as the benches, stairs and platforms make the tempos and densities of activity different (Figure 2-29, 2-30): from quite sitting, reading, viewing, and sunbathing to picture-taking, talking, walking and playing. In that case, the High Line, as an extraordinary public space offers all kinds of visitors a variety of choices to enjoy what they like.

Fig.2-26 The 26th Street Viewing Spur with a framework to view the cityscape

Fig.2-27 The Wildflower Field with both native species and new species that ensure bloom throughout the growing seasons
The Urban Renewal on an Abandoned Railway area based on the concept of “Greenway”

Fig. 2-28 The 10th Avenue Square with steps and ramps allow visitors to inhabit this structure and enjoy the midtown views.

Fig. 2-19, 2-30 The varying space with hard pavement, soft plantings and benches (source: http://www.thehighline.org/galleries/images/high-line-park-photos)

**Non-motorization** – The traffic in the High Line is only pedestrian available, but there are bike racks just located outside the stairs of entrances. Without motor vehicle and even bicycles here, the moving speed is slow so as the life style, generating stark contrast to the fast and noisy traffic below in the city. Furthermore, the design of the linear park can be more free and flexible regardless of the motor traffic, since pedestrian can move randomly and they only need more narrow and small space for moving comparing with cars. So that more space are left for plantings, benches and other facilities, which seems rather important in a linear public space. For example, the area between 22nd and 23rd Streets (Figure 2-31), where the only lawn of the High Line located, lifting seated visitors above the walkway and offering views of the city skyline. A stepped seating feature adds another layer of use to this central gathering area. So benefit from the non-motorization, space can be more changeable both on its materials and layers, which enable a slow life but create a more rich and vigorous urban public space that will appeal to more and more pedestrian to spend their leisure time here.
The Urban Renewal on an Abandoned Railway area based on the concept of “Greenway”

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Fig. 2-31 The 22nd Street Seating Steps/23rd Street Lawn with a narrow pedestrian lane aside (source: http://www.thehighline.org/galleries/images/design-slideshow-2008)

Sustainability – The sustainability of the High Line is mainly expressed through the selection of plantings and its design concept emphasizing the significance of “time” for the city itself and its ecological process (James Corner). The High Line’s planting design by Piet Oudolf from Netherland is inspired by the self-sown landscape that once grew spontaneously on the abandoned rail tracks for about 25 years since the trains stopped running. His design respects for the natural process and selection mainly choose the native species rather than some common species and the species of perennials, grasses, shrubs and trees were chosen for their hardiness, sustainability, and textural and color variation (High Line official website). Today many of the species that originally grew on the High Line's rail bed, interspersed with new species that ensure bloom throughout the growing seasons are incorporated into the park's landscape, creating an ecological and sustainable planting landscape of local characteristics, simple maintenance requirements and the realization of self-seeded (Figure 2-32, 2-33).

Fig. 2-32 Typical landscape with planking
The design of the High Line based on the urban form and the original pattern of the rail tracks, synthesizing multi-disciplinary approaches and some ecological modern science and technology to transform the abandoned elevated rail structure (Figure 2-34), water supply and drainage, and the electricity, gradually enhancing the site’s ecological diversity and community stability over time.

3. Xiamen Railway Culture Park
The old railway of Xiamen Island in China was used to be a part of the railway between Yingtan, Jiangxi and Xiamen, Fujian, built in 1955 and began to be abandoned since 1980s. It starts from Xiamen Railway Station and ends at the Peace Pier with the total length of approximately 4.5km (Figure 2-35). Today, Xiamen old railway has become an important carrier of the traditional cultural heritage in the city, and also one of the basic elements composing the urban landscape and its historical and cultural characteristics. In October of 2010, the leadership of Xiamen decided to reconstruct the abandoned railway to be a recreational corridor and the designers with the planning concept of “urban historical and cultural greenways” aims to show the railway...
culture of Xiamen. The Xiamen Railway Culture Greenway as a demonstration area in the construction of the city’s greenway learned some experience of greenway construction from Ljubljana, Germany (Yan and Ye, 2012).

**Fig.2-35** Map of the Xiamen Railway Culture Park
(source: baidu map and illustrated by author)

**Linearity** – It based on the linear space both outside and inside - the abandoned railway line as the green open space (Figure 2-36) and the tunnel as an exhibition gallery (Figure 2-37, 2-38) make the straight and long trail changeful and more interesting.

**Fig.2-36, 2-37, 2-38** The linear trail both outside and inside the tunnel
(source: baidu image)

**Connectivity and Accessibility** – From the traffic, the Xiamen Railway Park improves the transportation of this area and optimizing the landscape: through the construction of this trail,
the connectivity of the surrounding road network is improved (Figure 2-39) and it has become more accessible, convenient and comfortable for the residents along the railway (Figure 2-40). Different entrances were set where people can easily reach from different directions (Figure 2-41, 2-42). From the cultural context, the Xiamen Railway Culture Greenway built strong historical and cultural atmosphere of urban greenways: with the special historical background of the railway, it links a series of humanities and natural landscapes, including the Botanical Garden, Martyrs Cemetery, White Deer Cave, Hongshan Park and so on (Figure 2-43). The trail can not only serve the surrounding residents, but also attract population for leisure and fitness.

Fig.2-39 The surrounding traffic of the Xiamen Railway Park

Fig.2-40 The trail passing through some old residential areas
Multi-function – Xiamen Railway Park is divided into four zones from southwest to northeast as: Urban Recreation Zone, Style Experience Zone, Residents Living Zone and Railway Culture Zone (Yan and Ye, 2012) (Figure 2-44). It forms a good combination of the linear abandoned railway and green open space, started from the protection of historical heritage and made use of the site characteristics according to the local conditions, at the same time integrating with landscape, ecological, historical heritage conservation and community construction, so that realizing multiple functions of ecological improvement, heritage protection, landscape upgrading, recreation and education (Figure 2-45, 2-46). In addition, a few of retails and cafes were opened along the railway, so that a commercial function can be added (Figure 2-47). It needs to be
underlined that the Xiamen Railway Park makes use of the abandoned tunnel, decorating part of it as the science knowledge exhibition hall (Figure 2-48). So that people are allowed to learn the railway history both from the old railway itself, and from the new space of science knowledge, integrated with the patriotic education.

Fig.2-44 Map showing the function zoning of Xiamen Railway Park (source: baidu map and illustrated by author)

Fig.2-45, 2-46 The trail built on the preserved railway tracks for walking under the shadow, have fun between the tracks or sitting aside (source: baidu image)
Non-motorization – Take place of motor traffic in this greenway, the pedestrian lanes and bicycle paths meet the demands of slow-moving traffic and slow-moving environment of the residents and also today’s China, as the motorization in China has entered a peak period, which caused many social and environmental problems, such as serious traffic jam and traffic accidents, air pollution and noise pollution, that to a certain extent endanger the residents’ lives and safety meanwhile hinder the urban development. Some railings were thus set at the entrance to keep away from the motor vehicles (Figure 2-49), ensuring that pedestrian and cyclists can move smoothly inside. However there was no division for dedicated bicycle lanes (Figure 2-50, 2-51), which can be further considered in late improvement.
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Sustainability – The case in Xiamen illustrates that the urban historical and cultural greenways will become one of the most effective methods to make functions of modern urban green space more comprehensive, to improve the life quality of people, to promote the development of social civilization and energy saving in the city and finally contribute to the sustainable development, which are highly emphasized in China today. Therefore, the construction of urban greenways will have a stronger necessity in Chinese cities with rampant motor vehicle.

Above all, it can be found that, the rail trails in Paris and New York are both elevated and hanging in the air, while excellent connections with outside were established and accesses
were easily to reach for local residents as well as visitors. But a unique landscape, which is rather different from the cityscape at the bottom, is standing green and quiet there. The rail trail in Xiamen has a common typical feature with that in Paris is that they put a high focus on a particular local culture, which is expressed in specific and dedicated space. The local craft culture of Paris case and the railway culture of Xiamen case both show their respect for the local culture and history, providing opportunities for young generations to learn from them and sustain them. The High Line also contains a variety of cultural elements, such as keeping and preserving some of the original rail tracks, which is similar with that of Xiamen Railway Park. However the most outstanding breakthrough and achievement of High Line should be its brilliant design methods and the selection of plantings, which has been a teaching example for more than linear public space.

Ultimately, despite following the most fundamental working principles of greenway approach, greater importance should be attached to the local characteristics, either on the ecological species or the cultural elements and then together with the help of a smart design method, a greenway can truly play its role and achieve its goals. More specifically, the form of transforming the abandoned railway into a greenway, focusing on the overall ecological benefits of the city, usually considers a combination of urban landscape construction and the historical and cultural heritage corridor, aims to improve and enhance the quality of urban public open space. Nevertheless, in the process of the transformation, such factors need to be taken into account as the location and direct of the railway, the native landscape characteristics along as well as the historical and cultural resources. In addition, the natural landscape pattern of the city, the historical and cultural context and public open space are also need to be deeper researched.

2.4 Conclusion

Scheme to show the framework of Chapter 2
Chapter 3. Methodology

In this chapter the reason why a case study approach was utilized as a research method and the selecting criteria of the case are further explained with an identification of the advantages and disadvantages of case study.

In order to further investigate the case and answer my research question, such empirical data as maps, site photographs, official documents and reports from the municipality were collected mainly by field observation and some existing documents. The collected data will be analyzed according to what has been learned from literature review in chapter 2 and added with some other aspects such as the local conditions and culture which I think they are important to focus on as well.

3.1 Motivation for a case-study

As illustrated in the aim and research question of this thesis in chapter 1, the purpose of the thesis is to find out the working principles of the greenway approach and how these principles can be applied in a design proposal to renovate an abandoned railway area and create a lively neighborhood that connects back to the rest of the city. In order to answer the research question of how to test the guiding value of the greenway concept and its working principles, one way can look deeper into the principles and then see how they work in a specific local context. This makes the case study approach an appropriate methodology. A case study examining an abandoned railway and its surrounding neighborhood will provide a suitable site to practice the principles and maybe will enrich the principles from realistic aspect during the research process. Although it is a case of an abandoned and un-transformed site with a serious current situation, its opportunities and potential cannot be neglected and under the guidance of the greenway approach, a bright way will be led for the regeneration of this case.

As it is defined by Yin (2010) a case study approach is an empirical investigation which examines a contemporaneous phenomenon in deep and in its real life context, especially when the limits between the phenomenon and the context are not clearly evident. Another definition on case study by Berg (2007) is stated as a method involving systematically gathering enough information about a particular person, social setting, event, or a group to permit the researcher to effectively understand how the subject operates or functions. Hence this is a method that can give the researcher extremely concrete and detailed information on the investigated topic by looking into small examples or a single case in its context.

Since the case study approach is here applied to an abandoned railway area, several benefits of this approach can be listed as:

Firstly, under each situation, public space and its guidelines or design principles have their own realistic carrier instead of as a general image. So the value of a greenway approach and its working principles will be embodied by the carrier of the abandoned railway (the reason will be discussed in 3.2). Only in that case can an evidence-based design attached
appropriately to the local conditions can be proposed. Secondly, the study of each situation can be conducted in depth instead of in breadth. The strength of case study enables researchers to study things in detail (Denscombe, 2007). For the case of this thesis, the detail things of current situation, especially the historical and cultural context need to be studied in depth. Finally, the case study approach considers the case as a whole to discover how other parts affect one another (Denscombe, 2007). With a case study in the abandoned railway, and the guidance of greenway approach, some experience can be gathered during the design of this project, which may affect future projects in at least a certain aspect to become better ones.

Nevertheless, the negative aspects of case study can not be ignored even though it is the preferable method for analyzing contemporaneous empirical cases in details and with attention to the contextual wealth and interaction with the case. They are listed by Yin (2010) as: (1) lack of rigor in the case-study by the researcher, (2) case-study takes too long and results in massive and unreadable documents, and (3) case-study provide little basis for scientific generalization.

Therefore, the findings and conclusion of the case study do not mean the result is representative to all the other cases in other places. I should not regard the cases as a sample, but to go in-deep in the research attempting to find exemplar cases which will provide strong data for my theory.

3.2 Selection of case

As the case study approach is conformed to conduct the research, a selection of the case is followed. According to some subjective and objective reasons, I decided to choose the case of an abandoned railway – Nanjing West Railway Station in Xiaguan District in Nanjing, China, for several reasons:

First, and from a personal perspective, as Nanjing is my hometown city that makes me more familiar with its cultural and historical background, which has a positive effect on my research to be more attached to the local tradition and habits of people’s lives. Besides, I have been to the Xiaguan District and the abandoned railway for more than once and conducted a field investigation on it. The first time I’ve been there, I can’t even imagine that there still exist such a complicated district in modern Nanjing City. There is the Old Town within the Ming Dynasty City Wall and some historical old streets, but also highly modern urban areas, coexisting with the undeveloped rural areas. The abandoned railway of the old Nanjing West Railway as a visible barrier for urban traffic and the cityscape has of course become one of the most impressing images for me. All these stimulated my determination to make my own efforts to improve the current status as an urban planner, though my personal ability and strength is quite limited.
Additionally, from a case-perspective, Nanjing as an ancient city in China has nearly 2000 years of development history. Its varied topography comprises mountains, low hills, low terraces, plains and rivers. The Capital Plan implemented in 1928 extended the city significantly to the north, but expansion until the 1950s was confined mainly within the 14th-century Ming Dynasty city-wall. Considering that the Xiaguan District lies in the northwest corner of the Nanjing City and adjacent to the Ming Dynasty city-wall, which is an important cultural and historical landscape line of Nanjing, with some other public open space surrounded such as the Lion Hill, Yuejiang Tower, Xiuqiu Park and Xiao Taoyuan Park, a city-wall circular greenway can be designed. This is a greenway at the city scale together with the other two major greenways – the Inner-Qinhuai River greenway and the canopy-road greenway as a permeating framework to guide new green space location, configuration and continuity, and to link existing parks (Jim and Chen, 2002). Furthermore, the abandoned railway within Xiaguan District as an available but ignored linear open space located in the city, close to residential communities and also easily access via public transport, which exactly match the favorable conditions for urban greenway construction, indeed provides an appropriate opportunity to transform the disused rail to be a significant part of the city-wall greenway system and create a lively and sustainable neighborhood for the surrounding areas. So this could be a special and interesting case worthy of attention and in-depth study.

On the other hand, the old Nanjing West Railway is a general case of transferability, which shares similar problems or challenges and also opportunities with the general abandoned railways, which have been illustrated in the background in Chapter 1. Thus after a case study on the Xiaguan abandoned railway, some solutions to the problems as well as some strategies of developing the opportunities can be learned or transformed to be used in other abandoned railways with a combination of their local conditions. As a greenway will be converted from this abandoned railway and the case study will based on the greenway concept and its working principles, some common aspects can be also taken to analyze the design of other types of greenways.

So both generability and particularity can be obviously found in the case of Xiaguan abandoned railway. In my point of view, this could be a typical case for abandoned railway transformation and greenway application, which will not only offer a realistic carrier for the greenway approach, but also make a contribution to the establishment of the city-wall greenway system in Nanjing and create a better neighborhood for residents in my hometown.

3.3 Collection of data

In order to answer the research question, abundant data is necessary to be collected following the selection of the case. Apart from the literature review through searching academic articles in chapter 2, which have given some up-to-date view on the greenway, some other documents also need to be collected from maps, aerial photographs, on site visits and the photographs of the site. In addition, official documents and reports from the municipality on the general
development and control planning of Xiaguan District can be available and useful for the research.

Afterwards collecting the data, I mainly held two perspectives to proceed with the analysis that is the method I will confront the gathered data. They are the current situation analysis and the potential assessment.

3.4 Analysis of the collected data

The current situation analysis includes two aspects that are current problems and existing advantages or favorable conditions; meanwhile the potential assessment covers the scope of potential demand areas, potential connectivity supplies, accessibility and site suitability or potential functions.

As the site photographs and some official documents were collected, the existing problems can be directly found or analyzed from them. While to analyze the local context, six aspects need to be further concerned, which mainly includes the location, surrounding land use, road system, and ecological green space, history and culture. Some of the history has been mentioned before in the introduction and it will mainly focus on the abandoned railway in later analysis. Besides, the vegetation coverage around the abandoned railway is also helpful for the ecological restoration and the selection of new species. The public psychology and need which mainly refers to the surrounding residents may also determine the public participation after the railway is transformed.

According to the working principles and planning steps of greenway approach, the assessments are divided into the four aspects. For the demand areas and connectivity supplies, I need to keep an eye on the maps of the whole district even the entire city especially the districts surrounding Xiaguan. It should be visible and clear to see the connectivity when selecting the demand areas form the aerial maps and photographs. For the accessibility, I can refer to the map which shows the existing road system to take advantage of it and also make appropriate adjustments if necessary especially for the non-motorization transportation. Lastly, the site suitability which is to determine what specific types of greenway the abandoned railway can be transformed to or what other functions can be added to this greenway. For analyzing this part, in my perspective, the history, the site images of Xiaguan, and the official documents on the future and planning development of Xiaguan can be mostly focused on, because the timeline from the past, to the present and to the future presents a more comprehensive and in-depth knowledge and understanding of Xiaguan as well as the residents living there. In that case, the multi-function selected can be suitable for the site providing satisfying services and recreation for the residents there.
Chapter 4. Case Study

4.1 Analysis of the Current Situation

In the impression of Nanjing people, Xiaguan District today is an area where one encounters many old buildings with a poor situation in its quality, environment and public infrastructures. However, it once was one of the most prosperous regions of Nanjing as the riverside old town. But it has now gradually become “the largest shanty town of Nanjing”. In this thesis, I draw the focus on the old Nanjing West Railway area, which has been an abandoned railway now and can cause many problems for the future development of this district, which I will discuss later. Although some challenges about the abandoned railway in Xiaguan have been put forward in the introduction to this thesis, some problems need to be further emphasized and the design proposal will be guided to address them.

4.1.1 Assessment of main problems in the area

1. Very poor sanitary conditions and ecological environment
The area around the abandoned railway has become a place where residents dump their garbage, piling up junk and waste that makes it extremely filthy. Very little green vegetation but weeds and an increasing fragmentation of the urban landscape lead to the weakening ecological function and the lost of the significant linear corridor. (Figure 4-1, 4-2)

Fig.4-1, 4-2 The abandoned railway with garbage and weeds around it

2. Blocking the urban traffic
Parts of the abandoned railway are across the urban roads, affecting the integrity of the urban road network, the road alignment and the smooth flow at intersections. In order to separate the tracks and the roads, some iron pillars are temporarily used at some sections, which may cause
more danger for the pedestrian and cyclists when they pass through from the road to the railway. (Figure 4-3, 4-4)

Fig.4-3, 4-4 The Abandoned rail tracks across the urban main road and some parts use standing pillars as a separator

3. A problem for the city image
The shantytown is built everywhere along the abandoned railway and the surrounding building quality is very poor. Moreover, some buildings are demolished into ruins and some are under demolition, which makes the cityscape look messy and unclean (Figure 4-5, 4-6). Moreover, the residents or slum-dwellers there often like to discharge the sewage outside on the railway that makes the accumulation of sewage water, is a problem for public health and causes bad smells.

Fig.4-5, 4-6 The shantytown along the abandoned railway and demolished buildings in surrounding area
(source: photos taken by author)
4. Lack of planning and management
Due to the approval work on railway abandonment and its renovation lags behind, this region has become a blank, out of touch and vulnerable area of the city management.

4.1.2 Characteristics of the landscape structure
From the perspective of landscape ecology, the landscape space of the abandoned railway as part of the city system, it has the common features of the general urban landscape structure, such as artificiality, openness, Incompleteness, complexity and fragility.

Characteristics: The abandoned railway space as a special branch of the urban corridor system, allows it an approach for greenway due to:
① Continuity and diffusion: The abandoned railway has the elements of continuity and diffusion that all linear landscape has. For this reason, after transformation it can spread from one city area to other areas in different scales and formats, making the green space of the entire city connected together as a greenway network.
② Functional diversity: As a ribbon space system, the abandoned railway lost their original transport function, while as a form of linear space it plays a role in the maintenance of biodiversity and providing a corridor space for the wildlife migration.

Apart from the characteristics above, much more uniqueness of the abandoned railway in Xiaguan District should be found due to its superior location and rich historical background. The development potential needs to be searched first and then assessed in different aspects according to the greenway planning and design steps, which will be discussed in chapter 4.2.

4.1.3 Analysis of the local context

Location
The study area is located in the middle of Xiaguan District, adjacent to the Yangtze River. It covers a section of curved railway tracks which used to be part of the Nanjing West Railway Station and has been abandoned now. This railway is extended to the Nanjing Railway Station, which is the main train terminal in Nanjing currently. (Figure 4-7, 4-8)
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Fig. 4-7 Aerial map of Xiaguan about the location of the study area
(source: google map and illustrated by author)

Fig. 4-8 The main road network and railway in Xiaguan and surrounding area
(source: made by author)
Government Developing Orientation

Xiaguan is a large district among the six districts of Nanjing city, second only to Xuanwu District. According to its complex situation and the official overall plan for the next 20 years of Xiaguan, it is divided into five planning areas and four developing axises will be established (Figure 4-9). This study area belongs to the Riverside Modern Services Area (滨江现代服务业聚集区) and just along the rapid transit axis. Furthermore, it is also indicated in the overall plan that the demolition and construction work of the Riverside Modern Services Area has been started recently, the relocation of Nanjing West Railway Station will be fast, and the urban area renovation and infrastructure improvement will be soon taken up. Therefore, under this overall planning requirement, the study area can be first analyzed within the whole Riverside Modern Services Area, which will give a more macro sight into my case and make my design proposal meet the demand of future development.

Fig.4-9 The overall plan for the next 20 years on spatial layout and function planning of Xiaguan (source: Source: Nanjing Planning Department (http://news.longhoo.net/2010-12/04/content_4675407_4.htm))

Land Use

Making the railway as a boundary, Xiaguan District can be mainly divided into two parts: north of the railway and south of the railway. Because the railway cuts the district into two parts, it can be an important link between the south and north part, instead of being a barrier between the two parts. It is mainly located in the south of railway part, which is closely connected with the city central area. (Figure 4-10)
Fig. 4-10 The current land use plan of the study area (source: map made and photos taken by author)

Road Network

Both strengths and weakness can be found in the road network of this area. The viaduct express road helps shunt the motor vehicle, reducing the pressure of the main road and accelerating the moving speed of traffic. The Huimin Road and Zhenghe express way connect well with the main road of Jianning Road and Zhongshan Avenue and also some secondary roads and local roads. It’s not difficult to find that the traffic system in the south is much better than that in the north of this area, since the abandoned railway here causes the fragmentation and disorder of the road network, especially on the north of the district. (Figure 4-11)
Public Green Space

There are rich resources of natural landscape and cultural and historical scenic in the surrounding area, creating a good natural and human environment for the renewal of the study case. The Yuejiang Tower on Lion Mountain occupying the highest point of this area is at the south of the railway and can be seen from a distance if there are no high-rise buildings blocking the sight. It serves as potential landmark for the district (Lynch). The Ming City Wall makes a connection of the Lion Mountain and the Xiuqiu Park, and the moat also flowing through these two places, which can witness the change from the natural mountain landscape to the artificial park. Such wonderful experience will go further and can be more interesting if another green element is added in the railway area at the north connecting with the green space at south. Besides, the water resource of Yangtze River, Huimin River and Daxing Pond cannot be ignored, as another type of the public green space - the waterfront green space can also be joined to the green linkage. (Figure 4-12)
Culture and history – Nanjing West Railway Station

The Nanjing West Railway Station, which is located at the north part of Xiaguan District, was built in 1908 and it was the first train terminal in Nanjing at that time. And then it was repaired in 1947 and 1950, which made it to be the biggest railway station in China at that time (Figure 4-13). However, with the rapid development of Chinese railway industry and the relocation of the main train terminal in Nanjing, it totally stopped passenger transport in 2012 and only a few sections are left for freight. But according to the government planning, all the railway transport here will be stop and move to the periphery in the near future, and later replaced by other functions. Therefore, the railway station and railway tracks here will be totally abandoned then. In my opinion, the abandonment doesn’t mean the end to them but a new start in different field that can also play its role. Their cultural and historical significance cannot be ignored at all, instead the influence can be expanded and the interior connotation can be deepen and sublimated. And only when they are kept and properly reused and transformed, can these meaningful significances be realized and achieved.
The most particular characteristic of this abandoned railway is that this section is mainly a ring railway with parallel rail tracks at some parts. These parallel tracks occupy a relatively larger proportion of land and according to the need of the greenway transformation, which part can be kept and which should be removed needs to be further considered. Most buildings inside the ring are residential and the land outside between the Huimin River and the railway are mainly for transportation, storage yards and public facilities. Due to the closure of the Nanjing West Railway Station and the poor quality of the housing buildings, the majority of these buildings will be dismantled and a totally new planning and design will be conducted to improve the overall environment quality and present a new urban image to the citizens according to the government proposal for this area. (Figure 4-14)

Fig.4-13 The changes of the Nanjing West Railway Station in historical development
(source: baidu image)
4.2 Potential Assessment

4.2.1 Goals and Objectives

In order to establish a greenway in this abandoned railway area, an overall planning objectives and positioning needs to be set first according to the official developing plan.

Fig.4-14 The existing railway tracks in the study area (source: map made and photos taken by author)
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Functional orientation:

a) Using the greenway as a connecting corridor, building a core riverside area of Nanjing city with the main functions of business and trade, recreation and tourism and residential areas,
b) Transforming the area into a waterfront city center, reproducing the historical prosperity, establishing a model of the urban renovation and creating livable and harmonious homes.

Objectives:

a) Concentrating the essence of the ancient capital and highlighting the modern civilization.
b) Creating more green space and commercial areas at riverside to revive the vitality of this area;
c) Integrating main landscape resources and protecting cultural and historical heritages;
d) Conducting a comprehensive transformation of the dilapidated houses.

4.2.2 Potential Demand Areas

As it’s possible and necessary to connect different types of green spaces, such as public green parks, residential green spaces and ecological protection green land, they can thus be regarded as the start or end of the potential ecological corridor. From the analysis map of the public green space, it can be found that the green space is mostly concentrated in the southeast of the study area, and fortunately, they have been already connected together with each other by the city wall and the moat. So the only thing that needs to be considered is how to connect the transformed greenway to them. In that case, the demand areas in this vertical direction can be: Lion Hill Park, Xiuqiu Park, Bazi Hill and Xiaotaoyuan Park. (Figure 4-15) In addition, the riverside area is also a potential green space, so the demand areas may continue all the way till the waterfront, forming an arched greenway system.
4.2.3 Potential Connectivity Supplies

The connectivity resources are often with a feature of linearity just like a line to string two points together. Except the abandoned railway that needs to be transformed, the city wall can be an appropriate potential resource to create the connectivity. In my opinion, the city wall itself can be simply treated as a viaduct stone greenway. It has all the basic elements that a greenway should have and more importantly, the Ming City Wall possesses the characteristics that many greenways do not have - its long history and rich cultural connotation. With these advantages, the city wall can be a good resource to connect with the transformed abandoned railway and better link the demand areas along them together. Furthermore, a new link for the connectivity can also be created to make a connection between the abandoned railway and the city wall. The linkage can be both visible from the appearance and also invisible from the cultural significance included in the connectivity resources.

4.2.4 Accessibility

As illustrated before in the current road network, the traffic system in the abandoned railway area is a little poor so that the accessibility to the railway has correspondingly been quite weak. For a greenway, the accessibility for pedestrians and cyclists is the main study object. The surrounding road network and traffic conditions of the abandoned railway need to be adjusted...
and improved first, then the suitable walking or biking distance can be finally determined, making the greenway conveniently reachable from different directions at any time. Since this is a ring-like railway, the distance from inside and outside the ring should be equal to majority of the residents as far as possible.

4.2.5 Site Suitability

According to the overall functional orientation of this entire area more green space in needed for recreation, leisure and tourism. These will be added especially along the riverside and the reserved rail tracks. The residential area can be mostly concentrated inside the ring, which seems more private and quiet, and it can be more livable if some courtyard or private gardens are added between the buildings. The area outside the ring may be mainly occupied by the commercial and office buildings. The commercial shops or restaurants prefer being distributed close to the riverside, because the waterfront recreational green space can drive the coastal economy by attracting surrounding residents, visitors and tourists. The old railway station and the area to the south can be converted to a cultural and creative district. The railway station can be transformed to a railway museum and other buildings can be used as studios or galleries to express the local traditional culture such as the history of Ming dynasty and the status of transportation hub in Nanjing’s history.

4.3 Conclusion
Chapter 5. Design Proposal

5.1 Overall Objectives:

1. Reuse and redesign the abandoned linear rail track, and take full advantage of the local history and culture;
2. Create better connections for this district and establish a greenway system, making it more accessible for pedestrian and cyclists and also public transport;
3. Integrate multiple functions in the transformed railway area and improve the mixed-use functions of the surrounding area;
4. Improve the neighboring quality of life and create a livable and sustainable community;
5. Making this site to be one of the attractions of Xiaguan, Nanjing for tourists

According to the official planning of Xiaguan District (Figure 5-1, 5-2) and the need for a greenway design on the abandoned railway, an overall plan of this study area is first processed and later a detail plan of the abandoned railway transformation will be proposed.

Fig.5-1, 5-2 The current land use and new planning land use of Xiaguan District by the Nanjing Planning Department and Xiaguan government (source: Nanjing Planning Department)
5.2 Overall planning of the study area

Road Network

In the new road network one more express way was added to the north, which enhances the connection between this area and the northern area at the riverside. Besides, it can also make the railway area more accessible. In that case, the abandoned railway is just between the two express roads and it may cause some pollution and noise, so green buffer is needed along the road to reduce the negative impact of the heavy traffic. On the other hand, such express road is necessary in the urban area in Nanjing to reduce the traffic pressure, especially when this area is regenerated and attract more people here in the future. In addition, more branches are added to make the local roads better connected with each other and with other road levels. The southern part is mainly formed by grid network and the northern part can be regarded as a ring road network created by the railway. Nevertheless, it's not for cars but will be a ring rail-trail just for pedestrian and cyclists. The added branches make it easier and convenient to access from different directions. (Figure 5-3)
Land Use

Compared with the current land use, the most significant characteristics of the new planning are the mixed-use land and a large proportion of green space replace the original functions of industrial, riparian freight and storage, which will be moved to periphery. The mixed-use with residential and modern services such as business, commercial and tourism are particularly emphasized in this area, especially inside the ring railway. The riverside green belt and the ring rail-trail will both make a contribution to the greenway establishment link with the existing green space and city wall towards the south and even towards the east along the railway till city central area in a long term. (Figure 5-4) Furthermore, the public infrastructure will be improved to create a livable environment for local residents and the natural landscape and cultural resources will be made fully use of to improve the urban image and increase the entire environment quality.

Green Space

In order to transform the abandoned railway as part of the greenway system in this area, the ecological environment along the railway should first be restored with some local vegetation or wild species, and then more plantings for each season can be added and more fruit trees that can attract birds and other animals to increase the bio-diversity and make it a natural green
space. To continue the greenway till the riverside and take advantage of the landscape resources along the river, it can be a most reasonable and suitable option to build the green belt along Yangtze River and also the cannels. In this space, some lawn areas can provide people places to gather together, enjoying the nice view to the river and the sunshine. Moreover, some recreational paths and bridges should be more interesting to walk or bike along the green area. Together with a boulevard connecting the Xiuqiu Park with the riverside green belt, a round green link or a greenway system of this area is almost established.

As this area outlines with red is in a large scale of nearly 2 km² and it’s difficult to do a detail design for an individual. But this overall plan can give a framework for the detail plan, which just focuses on the abandoned railway area of around 0.74 km², locating between the two express roads and ends at the northernmost railway.

5.3 Design Proposal

This is almost a triangle site surrounded by V-shaped express roads and an abandoned railway track. This old train terminal area is totally transformed to a rail-trail for different functions, with a new mixed-use neighborhood along the trail and more green space are brought to this site, including a ecological protection park, a sports park and the riverside green belt. A red pedestrian corridor is also new added to enhance the connection between these spaces and
with the surroundings. Meanwhile, the old building of the railway station and some storage warehouses are kept for some new uses. It is also a particular and creative transformation that one section of the railway track is reused for a new means of public transport that can carry people from the city central area to the old railway station. (Figure 5-6)

Fig.5-6 Master Plan

**Zonings**

This site mainly consists of four areas from north to south according to the different functions (Figure 5-7):

The Ecological Protection Area surrounded most of the other areas is most significant for the ecological restoration of the local species and the water quality, as it’s located close to the Yangtze river and two channels and the original environment has been seriously polluted and damaged. So it can fundamentally improve the environment here and may also provide a protection for the inside areas.
The Modern Mixed-use Area is a completely new neighborhood, because the old buildings here are almost with a poor quality and of rather high density with many small blocks, moreover, a great number of them have already been removed and new buildings with mixed functions will replace them. These buildings are almost enclosed or semi-enclosed type with a courtyard inside and some local paths connected them with each other. The Mixed-use mainly involves residential, commercial and offices also with some public services, such as medical care, community center and schools. This part is most significant for the local residents and creating more commercial opportunities for the local economic development.

The Recreational and Sports Area mainly covers a new central park and a rail-trail boulevard. This central park is designed around the existing pond in order to provide more public space for either recreation or outdoor sports. Besides, as the wooden bridge connected with the pedestrian corridor at both end, it also create the linkage between the riverside and the city wall.

The Historical and Cultural Area is divided into two parts of a railway museum and a creative art district. The buildings of the old railway station and some storage houses are almost kept and reused for new functions. The old West Railway Station and the platform are reused for the railway museum and also can be the new LRT station. The buildings with bigger blocks are used for creative art work shops, studios and galleries for more young artists.
Layers

The design proposal can be separated to eight layers from the bottom to the top according to the different types of the urban space. (Figure 5-8) They act different roles in their respective fields that the road system and pedestrian corridor provide the connectivity, accessibility and also non-motorization, the green space including the street trees and courtyard together with the water resource all contribute to the ecological and recreational functions of a greenway, and the mixed-use buildings with the old railway station benefit for the cultural and historical function. However, only when all these urban elements combined together can the value of the transformed rail-trail be fully presented, and the goal of sustainability will be possible to achieve.

Fig.5-8 Layers illustration
Linearity

It mainly includes two aspects: the reserved railway tracks and linear green space.

I only kept these railway tracks in black, which was shown in Figure 5-9, because I think the parallel tracks in each section took too much urban space that may disturb the urban traffic and cut the blocks into fragment, which can be a boundary or obstacle for the new planning and also for local residents. These tracks in black won’t hinder the new traffic system but can create connections between the roads. Moreover they can also be representative for the abandoned railways heading towards different directions.

The linear green space mainly consists of the linear ecological park along the railway form the southeast to northwest and the riparian green belt with some winding routes inside. Besides, the tree-lined streets such as the boulevard in the middle with big trees on both side, also can be regarded as a part of the linear green land. (Figure 5-10)
Connectivity

To create the connectivity, it mainly involves the connection inside the site and the connection with outside – surrounding areas.

Inside connection- road pattern (Figure 5-11): As this site was mainly for railway before, only a few roads pass through this area. These old roads have been kept with the rail-trails and new roads and paths are designed in relate to them to make a better connection within this area. This pattern also makes it a totally walkable and bikable area throughout the site.

Connection with outside – greenway linkage (Figure 5-12): In this regard, the connection mainly refers to the two demand areas - the Lion Mountain and city wall area and the riverside green area. After the transformation, this abandoned railway area acts as a link making these two almost parallel areas connected and forming a greenway system. In this proposal, this red pedestrian corridor going up and down is to enhance the connection between the two areas and also become a dynamic landscape which provides recreational function as well. Besides, some pedestrian bridges are built over the channels to make the space on both side of the river connected.

Fig.5-11 Road pattern form inside connections
Accessibility

As there is no metro lines passing this area and the bus stations around are also not close to it, the accessibility of this rail trail mainly benefits from the surrounding road network (Figure 5-13) and a new planning means of green public transportation – light rail transit, which is connected with the Nanjing Railway Station (Figure 5-14). So it’s convenient for people to take a light rail from there and ends till the old West Railway Station with several stops at different access of the rail trail. The stop was supposed to set with a catchment area of 400 meters and people can choose where to take off according to their destination.
It can be seen that the site is surrounded by three main roads with four lanes, but they won’t be the boundary of the rail trails, instead, they promote the accessibility, since more people can drive here and turn into the local access from different directions (Figure 5-15). However, cars are allowed only in a few lanes mainly across the buildings, people can park their car in the parking lots or along the car road and walk or bike into the trail.

![Fig.5-13 Road hierarchy and new planning public transport](image1)

![Fig.5-14 Bus stops around and connection with Nanjing Railway Station](image2)
Multi-function

The multi-function of this rail trail is decided mainly according to the different functions of the four parts, which is shown in Figure 5-16.
The ecological trial is located at a side of the ecological protection park (Figure 5-17). The vegetation there is rather natural and native as the original species are almost kept and some new species are planted to improve the environment. Furthermore, with the railway bicycle running on the track, it can also act as a recreational trail for people to enjoy and experience the nature. Moreover, it’s also necessary to improve water quality and make the riparian environment clean. This greenway type was shown in detail of the functions in section A-A’ (Figure 5-18) and the trail width with the expecting image is shown in Figure 5-19. In this trail, the path for cyclists and pedestrian is separated by the railway track with railway bicycles running on it providing a recreational route for people to experience the ecological landscape and have fun on the new kind of bikes. This park is also divided into several small parts with many intersecting long and short routes inside. Most area of this linear park is for landscape reservation, but the top one at the corner is more for like a public park for people walking, jogging and also cycling in it.
Recreational Function

The recreational function is along the red corridor from the riverside all the way to the city wall passing through the central park in this area. The red corridor is a dynamic pedestrian only recreational trail going up and down, sometimes acting as a bridge over the river, sometimes changing to be the pavement and sometimes becoming an elevated bridge over a main road. In this section, it’s a ring rail trail with paths shared by both pedestrian and cyclists for daily transition, but pedestrians can also walk on the railway tracks here as some green pavement.
covering on. At one side of this rail trail, some commercial shops, cafes and restaurants are provided. (Figure 5-20, 5-21, 5-22)

Fig.5-20 Detail plan of the pedestrian corridor and part of the ring rail trail

Fig.5-21 Section B – B’
For the central park area, it mainly provides recreational facilities on the pond as a wooden bridge and wooden deck link with the Chinese traditional pavilion on the green island in the center of water. A variety of space for outdoor sports is provided in this park as well to serve the surrounding residents and also bring vitality to this area. (Figure 5-23) This section of rail trail is a tree-lined boulevard with big trees also planted in between the railway track as the separator for pedestrian and cyclists, and it should be a nice place in the summer for the shadows. (Figure 5-24, 5-25)
As the old railway station is reused for a railway museum and the old storage warehouses are reused for a creative art area, the historical function can be quite clear and emphasized by the railway history. (Figure 5-26) In this section of the railway, it’s a particular transformation that this railway track is reused for a green public transport – LRT (Figure 5-27), which is more welcomed and advocated by public. This is also a reflection of the historical function.
Non-motorization

The non-motorization doesn’t mean this is a car free area, but that this area is more welcome to pedestrian and cyclists and also green public transport. Cars are allowed in only where there is a necessity mainly around the mixed-used area with residential. On the contrary, this site is totally walkability and almost bikability, because most paths inside are only “people friendly” rather than “car friendly”, especially along the rail trail and in public green space. The red corridor only for pedestrian gives a stronger emphasis on the non-motorization. (Figure 5-28)
Sustainability

In this term, it's difficult to make a judgment immediately, but in a long term, it can mainly be considered in three aspects from the urban design perspective as: Sustainable Ecology, Sustainable Culture and Sustainable Neighborhood and life.

Sustainable Ecology

Various environmental characteristics are involved in this site both water system and the green space system. (Figure 5-29) Water system includes the Yangtze River, canal, pond and moat; and public green space mainly including the ecological protection landscape, riverside greenbelt, public parks and the mountain forest. With a combination of them, both indigenous and exotic wildlife habitat will be provided, which can contribute to the bio-diversity maintenance and create a wealthy ecosystem that fundamentally change the poor environmental situation.
Sustainable culture and history

As retaining historical buildings of the old railway station as a railway museum and new use for the light rail station, the railway history in the West Station will be recorded and remembered by people and the new use for a light rail station will form a link between the old transportation means and the new green public transit, which can be regarded as the upgrading and sustainability of the transport history. As the warehouses reusing for the artistic use, the building style can be transformed a little and transformed to the workshops, studios or galleries and maybe the offices for some new industry. It will help to gather the arts enthusiasts together exchanging with each other and create rich cultural atmosphere in this area.

Sustainable Neighborhood and life

The sustainability of a neighborhood and the residents’ lives will mostly benefit from their close location to the rail trial, the mixed-use function (Figure 5-30) and the new building types and layout. As this neighborhood is almost surrounded by the ring rail trail with an axis in the middle, therefore, the residents here nearly have equal access to the trail and can benefit a lot from this multi-function rail trail. The mixed-use function with commercial along the rail trail can drive the economic development along and provide some basic service that local residents can easily reach. The mixed-use buildings combine with residential and commercial or offices in different floors of one building, which can save urban space. These new buildings with communal courtyard inside will bring more green space and provide a better view of landscape, which can improve the living quality as well as enhancing the communication between people, so that a sustainable and harmonious neighborhood can possibly be created.
The Urban Renewal on an Abandoned Railway area based on the concept of “Greenway”

Zhou Quan

Fig. 5-30 Mixed-use function of the buildings

Fig. 5-31 Building types transformation

better ventilation | more green space | more interesting activities | more accessible

Original Types and Layout of Buildings

New Types and Layout of Buildings
Chapter 6. Discussion and Conclusion

This thesis focused on how the greenway concept and its working principles can be applied into the transformation of an abandoned railway area. The thesis took the Nanjing West Railway Station of Xiaguan District as a case study intending to create a comprehensive greenway that connects with the local greenway system and gives a new life to the surrounding neighborhoods as well as retaining its valuable history and culture.

Through reviewing abundant empirical literature, studying and analyzing the practical examples of abandoned railway transformation both in China and abroad, and the case study in Xiaguan District, Nanjing, based on the greenway concept, six working principles of the greenway approach are established to guide the transformation during the design process as: Linearity, Connectivity, Accessibility, Multi-function, Non-motorization and Sustainability. Furthermore, according to the assessment of local context and future potential, the transformation of a comprehensive rail-trail, such as ecological, recreational, historical and cultural was set and proposed for the design in the study area.

Such conclusions can be achieved after the six working principles elaborated in my design proposal:

Linearity: I made use of the linear railway to create the linear green space, such as the ecological park, riverfront green belt and the Rail Boulevard, providing transition as well as good environment for the residents. This is the most fundamental element but rather significant due to its extensibility. It enables the linear greenway or ecological corridor to reach more areas and benefit more people along them. In addition, the linearity includes many forms such as straight, curve or ring, that all make the greenway work and act their own roles in the rail-trail transformation.

Connectivity: I add many paths in between the ring rail-trail to create the inside connection and mainly add the red corridor and some pedestrian bridges to create the connection with surrounding demand areas. It’s important to link the surrounding ecological green space together to form a greenway system, adding new potential green areas along the way of this system as much as possible, and by creating new linkages such as roads and paths or bridges over rivers and over roads. The rail-trail not only connects the green space along it, but also the surrounding communities, with local paths and corridors. From the local paths to the rail trails and then to the urban roads, the connectivity can be formed both within this greenway area and with surrounding areas.

Accessibility: A new main road was added for cars, many local paths are added mainly for pedestrian and cyclists, and the new public transport LRT was created to make it accessible and convenient for more people. Different entrances were also set in different directions. The main roads allow people to drive here and park their cars to access the rail trail. The public...
transport can be more convenient and efficient for people to get an access. Moreover, the access of different levels should be set according to the flow of people from different directions and it’s better to provide different ways of access according to the area function. For example, in my design proposal cars are allowed to access in the residential, commercial or office area but only pedestrian and cyclists are allowed in the ecological and recreational area.

Multi-function: Different section of the abandoned railway was proposed to have a main function and people can choose where to go or stay according to their preference. A comprehensive greenway is a combination of ecological, recreational, historical and cultural functions. They coexist but may not equally and simultaneously be present everywhere in the rail trail. Just one or two of the functions might be focused on in a section of the rail trail. This entails that the effect of each function can be maximized and people can clearly make their selection and decision on where to access according to their preference and need. For an abandoned railway, it’s important to restore the ecology while keeping with the original species and choosing the native species to plant; the recreational function can be created by adding more public green space and facilities to attract people to come here and spend their leisure time; the historical and cultural function can be achieved mainly through retaining the railway tracks and some of the buildings to reuse them for new functions that connected with their original ones.

Non-motorization: The rail-trails are all for pedestrian and cyclists, dedicated corridors such as red corridor and pedestrian bridges are also created for them to emphasize the non-motorization in this site. It’s difficult to avoid the motorized traffic in a large-scale urban area, however, in a greenway corridor it means to reduce the motor vehicle as much as possible, leaving more space for pedestrian and cyclists. In the rail-trail, the path at both side of railway is almost for non-motorization and in some sections where is wide enough, the trail can be separated by the railway track for pedestrian and cyclists; In the shared path, a line between them can also divide them, for example through crossings and elevated pedestrian bridges.

Sustainability: It was not as visible as the above principles, but can be expressed through the sustainable ecology, sustainable culture and history and sustainable neighborhood and life. This principle should be examined through all the factors of local context in a long term, because the greenway design on an abandoned railway is a long and lasting process. What we can do now is try to make the new planning be well adapted to local conditions, assess the flexible factors as much as possible in the planning process and make preparations for them, and more importantly, the maintenance can largely contribute to the sustainable development.

By studying the abandoned railway area in Xiaguan District, Nanjing, this thesis contributes to the application of greenway approach to the abandoned railway transformation and provides both theoretical and practical experiences for the later transformation in other cities of China. However, the transformation of the abandoned railway integrated supports for a multi-disciplinary perspective, such as urban planning, urban rail transit, rail technology, landscape
ecology and ecological restoration, and also largely influenced by the complex local context, such as the topography, vegetation coverage and public participation.

There are, of course, some limitations that I would like to mention and acknowledge here. This thesis just focuses on the greenway concept and mainly uses the six principles to guide the rail-trail design. Due to its wide range of study content, the lack of my knowledge and practical experience and time, the research is not deep enough. Moreover, many new problems that would surface with a longer research time, and/or implementation of the proposal, are excluded in this thesis. But some might still be considered in last reflections, such as how to deal with the contradiction between the ecological protection and security and how to avoid the major problems of urban design in modern China occur in the greenway building again, as the greenway system is a repair to the caused damage and a return to natural ecology in urban area.

As a link of the city’s memory, the abandoned railway recorded the mark of the urban development. Although it has been abandoned with a poor condition and caused many social problems, in the new era of urbanization and landscape urbanism, through careful planning and design, considerate of local potentials and context, it will be no longer an obstacle to the city’s development but a valuable asset for the city after the transformation. In a long term, the establishment of the city’s greenway system and the construction of an eco-city will not be far in Nanjing and the dream of a livable and harmonious society will finally be realized.
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**Websites:**


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