Walkable Design Neighborhood

A sustainable Urban Form

A comparison between Nanjing official future plans and walkable design proposal based on Smart Growth principles along with Space Syntax Theory
Abstract
Recent developments in urban china have not taking to account sustainable course of actions. More precisely to mention walkability, car independency, social encounter and local business are the missing principles in new developments specifically high-rise neighborhood developments. The configurations of these kinds of developments cause a threat for the future of study area. It was investigated by means of space syntax theory and its framework around natural movement through the analysis and synthesis. To practice design Task in Urban Design field a neighborhood one block far from waterfront in Nanjing was chosen. Current situation was investigated via observation by author besides future plans of neighborhood proposed by Nanjing planning Bureau were examined under Smart Growth principles and space syntax theory. Design task was done based on guidelines derived from design theory part and analysis. Guidelines were localized by means of integrating principles derived from case studies investigation.

The evaluation of design task concluded that principles around configuration are needed to be integrated in neighborhood developments with the aim of achieving walkability. Smaller blocks considered as a crucial configuration attribute for similar projects aiming walkable neighborhoods as sustainable model.

Keywords: Urban Design, Development, configuration, attraction.
Space syntax, natural movement, Nanjing, China, Smart Growth, Sustainable, walk able
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Chapter One: Introduction

Background

General Condition of New Urban Developments in China

Fast growing rate of urbanization in China has been caused different challenges along reaching sustainability in Chinese cities. Although Chinese cities are experiencing the second round of development in general and third in particular—refers to current situation of urban planning practice called “third spring” in urban China (Leaf & Hou, 2006) – during last four decades started by adoption of market-oriented economics in 1978 and has became more broad in urban area after 1991 by land market establishment, still the principles around sustainability are neglected. Considering the important role of China on impacts on environment in global scale and besides the effect of built environment on local people’s life, it is urgent to integrate more sustainable guidelines into the design proposals during the developing/renewing process of urban environment.

“It would be a disaster, not only for China itself, but also for the entire world, if China devastates its physical and social environments in the way that much of the developed world has been doing through its extreme dependence on the automobile.” (Kenworthy & Hu, 2002, P.4)

Urban mobility as a key to reach a connected city has been missing “the centrality of the human element of networks” (Rooij, 2012) in recent neighborhood development projects in urban China. This is simply the result of not taking into account other factors which are operative to encourage people using the physical networks—walk and bike—namely “mix land use and accessibility”, “safety and streetscape”, “contact and social encounter”. It happens when streets or even walkways are designed only just to link the separate places up together (connectivity) - geographical point of view- without considering the functions and behaviors which are necessary to be in attendance combined with them.

“One of the many ways that sustainability can be achieved is through the advancement of walkable neighborhoods”. (Glanz, et al., 2012, P.72)

Beside the benefits that motorization has on societies relates to social welfare and economic growth, it has severe cost in terms of air pollution, health impact, energy consumption (Chen, et al., 2010). These costs are the crucial barriers for having sustainability in our cities. Although still the amount of private car owners per person are low in China comparing to developed countries but the way that most of urban project developers have been dealing with their design proposals are to impose people to use their cars instead of walking, biking or using public transport. This way of design and planning has been taking place particularly in high income neighborhoods which most of people own cars. This kind of developing which decreasing the level of walkability of the area has been criticized by different researchers via emphasizing on walkability, accessibility and in general human scale proportion of design. Considering the sharp rate of urbanization-13.46 percentage points from 2000 to 2010 (NBSC, 2010) and motorization (cars and motorcycles)-twentyfold
from 2000 to 2010-it is obvious that this kind of development will cause serious threat for social and environmental sustainability of urban China in early future. [“The expected number of cars and motorcycles in 2030 is more than double in 2010 which means there will be more cares in china in 2030 than there were in the entire world in 2000” (Watts, 2011)]

Therefore defining series of guidelines for urban design projects aiming encourage their habitants to walk, bike and also using public transport is vital. The goal of these guidelines should be *sustaining for a longer time* than current state to reduce environmental impact during demolishing and constructing process. Besides its benefits on public health it could also help to reduce energy consumption with the result of decreasing Co₂ emission which is main factor in climate change; this would be a win-win solution related to urban design filed in terms of both local and global scale. By providing healthy community where its inhabitants could walk, bike and use the public transportation we could look forward to more social encounter and preserve environment more which also boost local economy.

**Main concern in this Thesis: Urban Mobility relate to people that improve connectivity of city have been neglected**

**Self Motivation**

Most of developing projects in china are not considering the principles around environmental and social sustainability and mostly it considered only “profit point of view” by concentrating on the short-term return (Miao, 2011). As my personal experience and observation during my internship in china in two different landscape architecture offices and also the same impression from my classmate’s during their internship proves Miao critics about recent developments in recent decades in Chinese cities such as “Ignorance of available research”, “The professional’s negligence of previous research”, “…lack of data and experience in a young market...” and so on (Miao, 2011). These are the main causes of recent problematic developments of public spaces in urban china. Hence Lack of knowledge especially about sustainability among urban designers, landscape architects and planners, also weak ability to how to integrate these principles into design proposal was noticeable.

Those reasons mentioned before has caused recent urban development areas- from different range of scales; community, neighborhood, district, etc.- different issues such as less connected to surroundings, less accessible to different range of services and more precisely less walkable and bikable (be able to bike). These problems (low level walkability and bikability) cause neighborhoods become less livable, less healthy. Gated communities, urban sprawl inside the city, huge block size and so on are the results of new no-proper developments that do not offering local people walkable and healthy neighborhoods. For me as an Urban Design student who would like to explore and experiencing the city freely-free to move- by walking or biking these phenomena catch my eyes most while exploring new development project areas in china.

**Main concern for Author: New urban developments are not considering the principles around walk ability, bike ability or generally livability. In other words neglecting human scale relate to urban mobility in their new designs.**
General Condition + Self Motivation

- Neglecting Centrality of Human Element of Networks
- Weak Urban Design and Planning

Design Task Project
Aiming having proper Urban Mobility


**Research Background**

**Respond to the Problem**

As it explained before the weak ability within integrating relevant research into design proposal and also practical problems relate to urban mobility concerning human element, this thesis aims to do the design proposal for a neighborhood in China to show the possibility of integrating the theory into design process in a way that solve the current problems and also wisely respond the future problems that may arise.

Smart Growth principles as a toolkit during the developing process has gained successful results to transform the communities to become more livable due to providing their habitats more ability to walk, bike and more accessible destinations or even cleaner air. (ICMA and EPA 2006)

SG is a broad topic which is consists of social, economical and environmental views. This thesis will focus on principles which are related to Urban Design with focusing on Urban Mobility concern.

Although “yet... there is no single way to pursue sustainability” (Layard, et al., 2001) the reason of choosing SG as a toolkit is that; first of all the principles that they mentioned are widely pointed out by different researchers and organizations (maybe with different topics. Some mentioned them to achieve sustainability; Layard, et al.(2001), Litman (2012), some cited as principles to achieve livable/healthy communities; CNU, SG, GU. Secondly the problems that this thesis aims to solve could be divided in SG principles. Thirdly because the task of this thesis is Design Proposal for a neighborhood placed on an empty land (current situation of the area is empty land—all the buildings turned down), it needs series of comprehensive principles to design a neighborhood to practice urban mobility of the study area.

"In 1996, the U.S. Environmental Protection Agency (EPA) associated with several non-profit and government organizations to form the Smart Growth Network (SGN). It was arise in response to increasing community concerns about the need for new ways to GROW that boost the economy, protect the environment, and enhance community vitality. The Network’s partners include environmental groups, historic preservation organizations, professional organizations, developers, real estate interests; local and state government entities.”

-From “This Is Smart Growth” written by EPA and ICMA in 2006
Theoretical Framework

Smart Growth

Context Differences Challenge: U.S context and China context

Lack of unique and proper guidelines that could assist urban designers, urban planners and developers to improve walkability – as an important element to achieve sustainability- of Chinese neighborhoods has caused different attempts to integrate other movements from western countries (Europeans and U.S) into development process of Chinese cities. Successful achievements of these movements to develop more walkable and livable neighborhoods is another reason for specialists to choose the integration of these movements into developments of urban China since still “it remains a significant challenge for Chinese planners and decision-makers to ensure that the many positive land-use and transport qualities of Chinese cities are protected against the excesses of automobile dependence, while still reaping the full benefits of rapid economic growth.” (Kenworthy & Hu, 2002, P.13)

In this manner the differences between the context of urban china and the origin of movement was the most important challenge. In this thesis also this issue was the main challenge for author to deal with. To sort out this important matter the following course of actions were done step by step:

First; making use of other scholar findings with similar issue,

Second; localizing the SG principles by integrating guidelines derived from case studies within Chinese context and

Third; evaluating the design proposal to understand weather SG principles could increase walkability of neighborhood with Chinese context.

Smart Growth in Chinese context

In urban China “many developments of variable densities lack a mixture of uses; many public investments inhibit walking, bicycling, and transit ridership; and development processes fail to include public participation and are not particularly predictable or fair.” (Song & Ding, 2009, P.24) In addition to that “Much of the road surface is now dedicated to motor vehicles, while pedestrian and cycling facilities are degraded.” (Kenworthy & Hu, 2002, P.8) Considering these problematic issues in urban China we could hope that “smart growth may provide a powerful means to redress unsustainable development patterns occurring in many Chinese cities.” (Appleyard, et al., 2007, P.14)

According to Chen (2008) smart growth principles are crucial to “improve quality of life” in urban China; “Many principles of smart growth, such as promoting mixed land uses, establishing walking communities, and creating a sense of place and attractive communities, tend to create a harmonious built environment for citizens. This concept is especially important for Chinese cities with high density populations... Chinese mainland cities also can learn from urban design in such modern high density cities, as Hong Kong and certain Japanese cities.” (Chen, 2008, P.123)

Therefore, considering these scholars, “the principles of smart growth are as pertinent to China as they are to most parts of the United States” (Song & Ding, 2009, P.24) In the other words SG principles are constant issues while context of projects change from one to another despite the fact that the level of each principle may differ from one context to another. It
means that for example in one context mix land use is weakness while in another context it is strength but obviously it is an important matter to consider in both contexts.

**Smart Growth principles**

*International City/County Management (ICMA) and EPA cooperated in writing Smart Growth principles which published by smart growth network.*

**Mix Land Uses**

“Multi-purpose design and planning is critical to sustainable land use” (Roseland, 2007,p.133). Mix Land Uses refers to establishing different land uses such as commercial, residential, recreational and so on in close proximity to each other. Mixed land uses play a significant role to accomplish livable neighborhoods by providing different range of activities close to each other (ICMA and EPA 2006) that:

- Make walking and biking possible by reducing travel distances (Litman, 2012); Increase the number and activity of people on the street will strengthen the sense of security

- Attract larger group and more diverse of people that support feasible public transport, supply economic advantages

It happens in different degrees; Building itself, along the street, neighborhoods, district and so on.

**Take Advantage of Compact Building Design**

Compact building design or densification has become a key concept “to increase the efficiency of land use and reducing the overall impact of growth” (Roseland, 2007, p.137). Densification here means increasing the *Floor Area Ratio (FAR)* that it is Floor Area divided to lot area.

Compact building design or densification has social, economical and environmental advantages (Jenks, et al., 1996); it is more efficient (Stretton, 1996). It decreases footprint of new development by maintaining more open/green space that could control runoff water more efficiently due to preserving larger amount of land that absorb and filter runoff water. Therefore the area needs less drainage while less urban runoff pollution would produce less nonpoint source water pollution (SGN, n.d.). It supports public transportation economically. It decreases the cost of constructing and maintaining different services and utilities per-unit basis. (Jenks, et al., 1996) (SGN, n.d.)

**Density Indicators:** density in general is represented by Mass divided by Volume. In this thesis the density indicators which are used refer to householders density (persons/km^2) and built area density called Floor Area Ration (FAR).

**Urban Mobility:** Urban Mobility may argue in different factions namely social, ecological, economical relate to human. Mobility itself could be referred to mobility of people, goods, information or other species (Rooij 2012). In this thesis mobility refers to mobility of people.

**Open space:** Represent the space between buildings which could be natural like parks, lakes, etc or could be built area like roads, bridges, squares. It may be private, public or semi-public.

**Place/Non-place:** according to Marc Auge (1995) which is mentioned by Hajer & Reijndorp (2001), “Places are marked by identity, social relations and history, while non-places have no identity and are difficult to define in social or historical terms”. (Hajer & Reijndorp, 2001, P.45)
“Yet infill can provide enormous advantages for existing residents of a community, for example by providing new restaurants, cafes, parks, transportation options, and public spaces, and can increase rather than diminish property values.” (M. Wheeler, 2004, P.195)

Create a Range of Housing Opportunities and Choices

The significance of this principle is to attract different range of peoples and families with different incomes. It helps to create a vibrant neighborhood by housing various demographic groups and householders.

Existence of residential buildings itself “…is also a key factor in determining householder’s access to transportation, commuting patterns, access to services and education, and consumption of energy and other natural resources…” (SGN, n.d.)

Create Walkable Neighborhoods

Walkable communities increase social and physical health while decrease auto-dependency. Achieving walkable neighborhoods depends on two main factor connectivity and accessibility. Connectivity refers to physical infrastructures with the function of linking together such as pedestrian network, street network and bicycle network. Accessibility refers to how close are the destinations together that depends on level of mixed use, compactness. “To foster walkability, communities must mix land uses and build compactly, as well as ensure safe and inviting pedestrian corridors”. (SGN, n.d.)


Preserve Open Space, Farmland, Natural Beauty and Critical Environmental Areas

Sense of place: It refers to characters that non-place should have to consider as place which are recognized by its users.

Public space/public Domain:
Not every Public space is public Domain. Social encounter, physical exchange should happen in order to call it Public Domain. (Hajer & Reijndorp, 2001)

Theming, Compressing, connecting: the first two refers to characteristics of a place that are meaningful to certain group of people and connecting refers to relations between these places. (Hajer & Reijndorp, 2001)
Preservation open spaces (here natural areas) has two main advantages. First, it leads the new developments happen in existing built areas. Secondly it improves quality of life by its significance role in purifying air and water (health benefits), housing plants and animals (environmental benefits), placing leisure occasions (social benefits).

“Since a better connection between human and natural environments is a central challenge of sustainable development, neighborhood planning should seek to create a variety of open spaces and natural areas.” (M. Wheeler, 2004, P.203)

Strengthen and Direct Development towards Existing Communities

Build and construct in existing communities help to reduce cost of construction due to services and infrastructures that already exists in communities. It makes the process of open space preservation easier.

Developments within the existing communities also improve the densification and compactness of neighborhoods and more importantly reduce extra costs of urban fringe development. (SGN, n.d.)

Provide a Variety of Transportation Choices

Providing different kind of transportation systems prevents neighborhoods to become overcrowded. It helps to reduce car dependency.

Multi-modal transportation system supports different range of people from who has car, bike, motorbike etc or who wants use public transport and walk.

Another two Principles

There are another two more principles which are not affective in this project. The first one is “Make Development Decisions Predictable, Fair and Cost Effective”. It is economic point of view in developing process which should have profit for developers and government’s role in supporting by providing the infrastructures. The second one is “Encourage Community and Stakeholder Collaboration in Development Decisions”. It is not applicable because there is no stakeholder living in the project area. These two principles would be discussed after design proposal in short.
Case background

Nanjing (Chinese: 南京; pinyin: Nánjīng; Wade–Giles: Nan-ching), is a capital city of Jiangsu province in China with the population of approximately 8.1 million people on September 2012 (NBSC, 2012).

Figure 1 The location of Nanjing in Jiangsu province (Source: NC, 2009)

Nanjing is the second-largest commercial centre in East China region after Shanghai and ranked seventh in the evaluation of cities with “Strongest Comprehensive Strength” according to the National Bureau of Statistics of People's Republic of China and second place of “cities with most sustainable development potential in Yangtze River Delta”. (NC, 2009)
The city has won the “First Historical and Cultural city in China”, “National Civilized City”, “National Sanitary City”, “National hygienic City”, “National Garden City” and also “UN Habitat Special Honor” awards. (NC, 2009)

Its role in National development strategy is to become the gateway city to connect the east and west of Yangtze River basin as National transportation Hub, Also playing the role of pilot city in science, technology and innovative urban in its region. (NC, 2009)

**History, geography, Social life**

Nanjing located in the lower reaches of the Yangtze River; it is located at intersection of vertical coastal Chanel and horizontal Yangtze River Chanel. It is an important industrial city and economic center which is playing an important role in transportation hub in East China. It is one of the four major cities along the Yangtze River beside Shanghai, Wuhan and Chengdu.

Nanjing is one of the four great ancient capitals of China and also capital of six different dynasties. It makes Nanjing important in attracting tourism.

Project area is located in Xiaguan District, one of the six administrative districts of Nanjing Inner city. Xiaguan district is in Northwest of Nanjing, beside the Yangtze River.

The Area of Xiaguan district is about 30.91 square kilometers including 24.29km$^2$ of land territory and 6.62km$^2$ of river territory. The length of Yangtze riverbank is 9.3 km. it has the population of 306500 by end of 2009. It governs by means of six jurisdiction streets (neighborhoods) and 57 communities.
1911 A.D. Republic of China: Pukou Railway Station was completed. 1920 A.D. Republic of China: Xiaguan power plant was brought to exertion. Dr. Sun Yat-sen’s Coffin was moved from Beijing to Nanjing Zhongshan Ferry terminal, Zhongshan Avenue and Zhongshan Mausoleum were built for the event, which established the basic framework of the urban structure of modern Nanjing. 1927 A.D. Republic of China: Nanjing became the capital of Republic of China. “The Grand Capital Planning” determined Xiaguan as the area of ports of the capital city. 1933 A.D. Republic of China: The train ferry from Xiaguan to Pukou started to exertion, till 1973. 1937 A.D. Republic of China: Nanjing was captured by Japanese army. More than 300,000 civilians were killed during 6 weeks, including 100,000 killed in Xiaguan. 1947 A.D. Republic of China: Nanjing west terminal railway station was completed. It was the biggest railway station in China at that time. 1949 A.D. Republic of China: The communist army strode across Yangtze River. Nanjing was liberated. The obelisk at the crossing plaza of Zhongshan Avenue and Rehe Road was set up in 1979 as the monument to this event. 1968 A.D. People’s Republic of China: The first Nanjing Yangtze Bridge was completed. 1999 A.D. People’s Republic of China: Huimin River was filled. The construction of Huimin road started. 2001 A.D. People’s Republic of China: Yuejiang Tower was completed. 2005 A.D. People’s Republic of China: Huimin Road was renamed as Zhenghe Road. Overhead express way was constructed. (NC, 2009)
New Developments in Nanjing

Hosting the Youth Olympic in 2014 and the influential location of Nanjing-Yangtze River Delta economic zone—with the strategically vision for this area cause rapid new developments especially alongside the Yangtze river recently.

Yangtze riverside as a local/national/international element

Yangtze riverside as local/national/international element play a significance role in developing process in Nanjing. It is very common for cities along the Yangtze River to use waterfront as their main concept for developing to create a great vision for their city. This kind of visioning (city branding) has gained a magnitude achievement in tourism industry like Bond Area Development in Shanghai.

“...make use of this deep harbor bank, strengthen the urban life function and tourism landscape bank... to support the position of Nanjing as the national main hub port...” (Nanjing overall urban planning 2007-2020, Chapter 8)

Postal card/tourism way of development

Although attracting tourism has a lot of values for a city but local people are the missing factor in this kind of development.

Massive way of development+ zoning development+ Gated communities+ Car dependent neighborhood

The number of projects that deal with a large area is noticeable. These massive developments which bring a lot of benefits for their developers, mostly deal with big neighborhood scale, hardly ever consider the human scale. In case of Xiaguan district, these kinds of projects are everywhere.

Figure 5 The distribution map of new developments in Xiaguan district (Source of the base map: ©2013 Google)
Although gated communities have gained some advantages such as providing safer place for residents and attract more house buyers, it causes certain problems due to legibility of the site. It has direct affect on walk ability of the site. When gated communities taking place in large scale with too long fences and walls it make not even the neighborhood less walkable but also it would create considerable divergence-disconnection- between different parts of the city that it causes in reducing the quality of urban mobility within the city. Figure above illustrates the sequences of this kind of developments. (Number one is the study area; number two is residential area which has developed with the same developer that will develop the study area; number three is mix use area; number four is hotel.)

“...isolated street neighborhoods that do have definite boundaries can be found in plenty, to be sure. They are typically associated with long blocks (hence with infrequent streets), because long blocks tend almost always to be physically self-isolating. Distinctly separate street neighborhoods are nothing to aim for.” (Jacob, 2011, p.157)

Problem statement relate to theoretical framework; Possibilities and Opportunities

Car-oriented urban development has some advantages specifically for increasing the mobility relate to inhabitants which is “offering people the opportunity to make and maintain social contacts, to relax, and to develop their talents” (Rooji 2013). Despite these, previous approaches in urban design field such as CNU and Smart Growth has shown that there are several problems associated with this type of development namely social, cultural and environmental sustainability; in social manner the main issues are disconnecting people, reducing social interaction and level of community health. In environmental manner the energy consumption is main concern.

Despite car-oriented development which has caused neighborhoods become less walkable/bikable, also other ways of developments that mentioned before has reasoned the same issue; less walkable/bikable.


The following parts describe the study area issues related to SG principles. At the end the result illustrated in SWOT table.
Mix Land Uses

Figure 6 Land Use Map (Source: NJUPA, 2010)

Mix Land uses in future plan taking into account just in big scale which is neglecting the foot access due to their long distance from each other. It will make the area car-dependent in future.

Compact Building Design

Figure 7 Height Portion Map (Source: NJUPA, 2010)

The high rise building proposal for the study area in Nanjing future plan provide the high density for the area. It is the opportunity to make the area more compact.
Different range of housing and choices is the missing element in future design proposal of the study area. The proposal plan consists of 17 high rise building which is offering same kind of housing.

Walkability/Bikability

In chapter two and three I will go more deep on principles and barriers of walkability and pedestrian movement in study area. Here are three different criteria and their problems according to their related theories:

Accessibility: According to attraction theory of pedestrian movement which has considered movement as being ‘to and from’ built forms with various scales of attraction (Hillier, et al., 1993), as it explained before the land use future plan is not in a way that promotes walkability of the neighborhood because it doesn’t offer the proper degree of attractions. In the other hand the destinations are not in walkable range specifically considering the residential blocks of study area as an origin.

Connectivity: the study area is surrounded by two stories highway in east (See Figure 9), Yangtze River in west, Qinhui River in south and wide Zhongshan road in north. It brings about low connectivity of the study area in relation to a larger scale of urban system.

The urban grid configuration of future plan of the study area also will decrease the proportion of “natural movement” (Hillier, et al., 1993, P:31) relate to study area compare to previous conditions of it. Considering the
higher density of study area in future it is obvious that the area will face certain problems due to pedestrian movements.

**Safe and inviting pedestrian**: Except water front scenery in west and south border of the area (that build recently), other accesses do not have safe and inviting condition.

![Figure 10](image1.png) **Figure 10** The current condition of pedestrian and bike route along elevated high way in east side of study area

![Figure 11](image2.png) **Figure 11** No proper pedestrian route and bike route, north side of study area

**Variety of transportation**

Figure 12 shows that the most part of the area doesn’t have access to public transport which is less than 500m. The bus stations accesses are not in approximate distance especially south and west part of the area that there is no station, however there are access roads surrounding the area. Existence of public transport stations in approximate distance is crucial to encourage inhabitants using public transport. Pedestrian access and bicycle access are limited to access roads which are not even in a good condition. *(Figure 10 and 11)*
In the other hand existing of two different metro lines near to study area with the access distance of less than 1500m, and also ferry station with same situation are the distinctive opportunities for the study area. by supporting them with proper local accesses these opportunities could increase public transport usage. Nanjing west station is another opportunity that provides long distance access to other cities.

**Development towards Existing Communities**

There is no existing community in the study area anymore because the whole area is demolished. The only Elements that still remain are road structure, some greenery and small lake. Figure 13 show the remained elements from 2005 until 2011, which also shows the speed of developing in Nanjing waterfront. Developments in China generally is accompanied by wide spread of demolishing but at least in this case they kept the trees (See Figure 14) as the main element of greenery.

**Figure 12 Public Transportation and their distances to study area (Source of the base map: ©2013 Google)**

**Figure 13 Nanjing 2005 versus Nanjing 2011 (Source: ©2013 Google)**
Figure 14 New developments are coming, High rise developments in south of the study area

Sense of Place

“Landscape” as a meaningful element for Chinese people which is considered as “theming” in public domain does not have the “connecting” factor and barely has the “compressing” factor in future design proposal of study area. Gated community design as a most important barrier for achieving “connecting” factor is noticeable. (according to Hajer & Reijndorp (2001) that pointed out three main factors for designing public domain; “theming”, “compressing”, “connecting”)

In the other hand, to see the problem from Auge definition for places (1995), the future plan of the study area has difficulty to identify its history and social terms since the developer decide to turn down all the elements that remain from before. It contains different elements from natural landscape aspects to different social groups dwellings. It will harm the connectivity related to time that it is “continuity in identity”. The term “continuity in identity” has emphasized in New Charter of Athens as the main difficulty beside “physical terms” which are both necessary to have connected city. (Rooij, 2012)

Open Space

Comparing the future plan for new developments with previous condition of study area shows that more open space is preserved in new one. This is strength of future development of the area.

Possibilities

The location of the study area as an opportunity, that it is being near to major public transport stations and also waterfront scenery, could assist developers to reduce car dependency by encourage habitants walking, biking and using public transport in their developing area with providing proper design proposal. This is helpful; to reduce the impacts on climate change by reducing the Co2 emission from transportation, to bring down car dependency simultaneously increasing the social encounter and public health.

Conclusion

Table 1 summarizes problem statement part in SWOT format. This is to clarify the issues of study area under Smart Growth principles. It also simplifies the importance of each issue during the process of implementing SG principles into design.
<table>
<thead>
<tr>
<th>Strength</th>
<th>Compact Building Design, greenery and waterfront scenery (open space), variety of transportation,</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weakness</td>
<td>Land use, Range of housing, walkability,</td>
</tr>
<tr>
<td>Opportunity</td>
<td>New development (Sense of place, walk ability, preservation)</td>
</tr>
<tr>
<td>Threat</td>
<td>Lack of Mixed use, Car-dependency development, sense of place (continuity in identity)</td>
</tr>
</tbody>
</table>

Table 1 The SWOT table of study area according to Smart Growth Principles,

**Objectives**

The main objective of this thesis is a design proposal for the study area by focusing on physical urban mobility related to it. The design task was chosen because of the motivations mentioned earlier in the Self-Motivation part. Urban mobility issue was selected due to the reasons explained before in General Condition of Urban China.

The alternative objective of this project is to define a toolkit during design process of a neighborhood to increase walkability (in general any concern that promote urban mobility of the area considering human element as main factor). Since SG principles was chosen as theoretical framework in Chinese context then it needs another primary objectives as follows;

- investigating issues around walkability of neighborhood relate to study area under SG principles
- investigating about local identity of study area and Chinese urban aiming localizing SG principles in order to use it as a proper toolkit to transform study area to be more walkable (different contexts challenge)

Final objective will be the comparison between design proposal and official plans to evaluate how walkability is supported in them. This part will add valuable information about integration of Smart Growth principles into Chinese context since it became one of the recent concern among urban designers and planners. (Song & Ding, 2009) (Appleyard, et al., 2007) (Chen, 2008)

**Aim**

I. Design Theory: To research guidelines that promotes walking/biking/public health during designing and planning process of neighborhood and urban mobility network

II. Combining design theory to design: To apply this set of guidelines to a case-study in Nanjing

**Research Questions**

- What are the principles around walkable neighborhood generally and particularly under smart growth framework?
- What are the barriers/possibilities to have walkable neighborhoods under the theoretical framework relates to study area?
- What should be done in order to localize the Smart Growth principles before implementing those principles into design process using case studies from Chinese Context?- What are the
characters of local identity relate to study area and Chinese context?

- How walkability supports in official plans and design proposal from author according to SG principles and Space Syntax analysis?

**Methodology**

This thesis aim to do an Urban Design Proposal for a neighborhood in Nanjing relate to urban mobility of neighborhood. To achieve this, SG principles were chosen as Theoretical Framework due to its success in developing walkable neighborhoods. Beside SG principles, space syntax analysis was chosen to understand the configuration barrier of the area to achieve the aim.

The procedure of this thesis follows steps defined in diagram below:

The primary data relate to study area (history, geography, social life, future plans) was conducted from official websites. The current situation of study area was investigated by means of observations by author. The theoretical framework was studied by means of reading existing researches about the issue such as books, websites, and journals and so on.

Analysis and synthesis was carried under the theoretical framework which has lead to preparing SWOT analysis. The SWOT analysis and case studies under the theoretical framework has directed to prepare Design Guidelines. Design guidelines were integrated by means of author following his way of designing. The design proposal was evaluated in terms of aims and research questions of thesis.

![Figure 15 The overall structure of thesis](image)

**Thesis Delimitations**

This thesis is Design task for an area in Nanjing, China. The main concern of design issue is Urban Mobility relate to human. The theoretical framework is the limitation of this project. The sustainability topic applies different concerns most namely environment, economic and social. This thesis doesn’t concern the economical issue but it will consider the milieu to do economical activities which it is then the design of neighborhood. The environmental and social aspects are concerned wherever has joint domain with urban mobility. Smart Growth principles via space syntax analysis are the theoretical framework.
The study area is limited to its borders which are Huimin Road in east, Tangshan Road in west, Nantong Road in south and Zhongshan road in north. Since the main matter of this thesis is urban mobility then the surroundings are taking into account in connectivity part.

**The significance of the study area**

The study area -which was the location for Zhangjiawei community that has been demolished- is the last neighborhood before reaching waterfront. It plays a significance role to connect city to waterfront. Constructing elevated high way in east and wide streets in north and south may cause the area isolated from the surroundings and overall city. This would cause the city less connected to waterfront as the area is the last vicinity to coastal area.

**Thesis Outlines**

The following chapter is literature review where the design theory would support (; theoretical framework). The aim of this chapter is to answer the first research sub-question of this thesis which it is: “What are the principles around walkable (livable) neighborhood?” with the introduction of “why walkable neighborhood is important design issue to achieve sustainability?” and “how Smart Growth principles answer the need of walkability within neighborhoods?”

The third chapter is about investigating the current situation of study area in depth under the theoretical framework that discussed in chapter two. It has done by analyzing the empirical data which are observation (surveyed by author) and future plans of study area (proposed by Nanjing planning bureau). It continues by putting the analysis together (to synthesize) to examine “the barriers for having walkable neighborhoods..."
under the theoretical framework?” It is completed by providing SWOT table to fully answer the second research sub-question: “What are the barriers/possibilities for having walkable neighborhoods under the theoretical framework?”

Chapter four aims to investigate the Chinese Urban form by studying the case studies relate to Chinese culture. The results have been integrated into the design process by means of localizing the design guidelines in chapter five. It plays a significance role to give an image about “sense of place” from Chinese point of view. It is regarded as an introduction to respond to another research sub-question of this thesis mentioned before; “How to combine theory to design during design process?” This question has been fulfilled in chapter five and six by integrating the design guidelines into design process which has concluded the Planning Proposal for the study area in chapter six.
Chapter two: Literature Review

This chapter provides the theoretical support for the main task of this thesis that it is Design Task. It is achieved by addressing minor research questions that are derived from the first research question of this thesis - (What are the principles around walkable neighborhood generally and particularly under smart growth framework?)- And tried to discus in each part.

“The neighborhood scale is particularly important because of a widely perceived need to reinvigorate a sense of community in postindustrial society.” (M. Wheeler, 2004, P.183)

Why walkable neighborhood is important design issue to achieve sustainability in urban area?

“Neighborhoods are one of the basic building blocks of cities, modest size physical units that make up the residential portion of the urban area and form the environment that we all inhabit every day. Planning and design at neighborhood scale affect our daily lives, determining what facilities are available locally, how far we need to travel, and much about our opportunities for interacting with our neighborhoods...the “hood” may also denote a particular cultural or social grouping of people living in proximity to one another... .” (M. Wheeler, 2004, P.181)

“There is no (and perhaps should not be any) single accepted definition of sustainable communities. Communities must be involved in defining sustainability from a local perspective.” (Roseland, 2007, P:26)

According to sustainability model revealed in “Our Common Future” commitment in 1987 well-known as Brundtland Commission that it is: Development that ”meets the needs of the present without compromising the ability of future generations to meet their needs.”

The walkability could argue in three different categories; Socially, Environmentally and Economically based on Bruntland notion of sustainable development. (Figure 1)

Figure 1 the Bruntland notion of SD

The effect of walkable neighborhood from social point of view could be seen in two field; mental health and physical health of the society. The main problems which have caught the eye of researchers who involve in public health are isolation and obesity. Obesity is the result of not having physical activity. Physical activities contain everything that makes our body move. In this case walkable communities could provide the built
environment for its inhabitants to do physical activities. It is same for isolation which could be eliminated by increasing amount of physical encounter.

“Many public health issues are particularly pressing at the neighborhood level. One of the foremost, increasingly recognized these days, is the degree to which the neighborhood supports walking and outdoor activity. Such activity can help reduce obesity, improve cardiovascular health, promote community interaction, and enhance a sense of personal connection to the local landscape and place.” (M. Wheeler, 2004, P.214)

<table>
<thead>
<tr>
<th>Walking (Physical Activity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social</td>
</tr>
<tr>
<td>Physical encounter, social health: 1- mental health (isolation), 2- physical health (obesity)</td>
</tr>
</tbody>
</table>

Table 1 the effect of walkable neighborhoods

In terms of environmental matters it is one of the key solutions to encourage people walk/bike to their destinations instead of using cars. For longer trip it is also the key to use public transportations. These kinds of transportations have less environmental impacts that support sustainability of our environment. (Environmental friendly)

“...When the development is in occupation, the ongoing energy and resources expended to sustain the development- the maintenances requirements, the energy requirements of the development (heat, light, electricity, etc.), the waste disposal requirements, and the travel requirements of the occupants- the impact extends even further.” (Carmona, 2001, p.167)

In economical point of view, walkable neighborhoods will increase the amount of pedestrian flow which could boost “the passing trade”.

In other hand, walkability component plays a significance role in visions and aims for sustainable communities in different authorities. Figure 2 shows the components of sustainable communities conducted by Egan in 2004 asked by ODPM (Office of the Deputy Prime Minister, UK). He explained as Transport and Connectivity component to provide “Facilities to encourage safe local walking and cycling”. (Egan, 2004)
It is also commendable to mention that the studying area due to its location and position, that it is adjacent to River as location and creating a neighborhood as position, has a valuable affect on Sustainability as whole. Figure 3 shows the influential domain of each parts of settlements in different scales on the whole earth. It is originally done by Barton et al. (1995) which was mentioned by Carmona. (2001. P.168) This figure demonstrates the importance role of Sustainable Neighborhood to achieve Sustainable World. “...at each level the designer should attempt to maximize the degree of autonomy by reducing the impact of inner spheres on the outer spheres...Therefore, at whatever scale they are working, built environment professionals—urban designers, planners,...and developers- all have an important role to play in building and managing sustainable urban form.” (Carmona, 2001. P.168)
This project involves directly on second sphere and because of the location that it is adjacent to the Yangtze River has direct influence on third sphere.

**How smart growth principles could support the need of walkable neighborhoods?**

To answer this question firstly it should be defined what is walkable neighborhood and what are its principles. As second stage those principles need to be compared with Smart Growth principles to show the possibility of supportive role of smart growth principles to achieve walkable neighborhood and also achieving sustainability following that sequence.

**What are the principles around walkable neighborhoods?**

If walkable neighborhood defines as the built environment that is; “easy enough to walk”, “attractive enough to walk” or even “No other way than to walk”-in general “be able to walk”- then it is necessary to describe the origin of walk. According to Longman dictionary “WALK” means “to MOVE forward by putting one foot in front of the other”. It is then about “Move” and “Movement”. Therefore walkable neighborhood could be explained as “built environment that is able to Move with foot”, or “built environment that there is ability for pedestrian movement”.

Thus the second step would be defining pedestrian movement. According to Hillier et al (1993) there are two ways to classify pedestrian movement; first derived from attraction theory and second based on configuration of urban grid. The attraction theory illustrates the pedestrian movement based on origin and destination (OD). On the other hand “…accessibility of destinations is a factor in the choice of destinations…” (Hillier, et al., 1993, P.30) Therefore in this case accessibility is the key to define pedestrian movement. Secondly, the spatial configuration of the urban grid cause certain type of movements that is “natural movement”. It is explained by Hillier et al in 1993 that configuration of urban grid have influence on the proportion of movement while there is no impact from movement on configuration. It is the same situation regarding configuration and attractors that there is no influence from attractors on configuration but configuration has effect on it.

![Diagram](image)

**Figure 4 the influential Diagram, Source Hillier, et al., (1993, P.31); the relation between Attraction and Movement is symmetric while another two relations are asymmetric**

Therefore “...we would expect the grouped attractors to act as multipliers on a basic movement pattern generated by the configuration”. (Hillier, et al., 1993, p.31) Consequently it is necessary to delineate firstly the principles of walkable neighborhoods due to its spatial configuration of urban grid and then attractors. It means the area should prepare the possibility of walking at the very beginning of urban shaping process. It would be done by means of creating the linkage of series of “spatial elements through which people move such as streets, squares, alleys and
so on” (Hillier, et al., 1993). After that it is time to make the area attractive by way of **distributing attractors throughout the system**. It may come about in opposite way where the attractors are come first and spatial elements arrangement next but still it is not in opposite what mentioned before, for the reason that the moment spatial elements shape the built environment, the configuration of urban grid bring about “Natural Movement” which is different from those movements to attractors that spatial elements was built to access them.

“...there is also concern within the research on walkable communities regarding the ability to identify the influence of the physical environment on human behavior...Physical determinism is the theory that the physical environment is responsible for the behaviors that occur within a given culture within a specific geographical location. Self-selection is the theory that an individual selects a location based on personal needs which may be financial, physical, and/or emotional. Both of these theories are mentioned in the research on walkable communities but their influence may be difficult to detect due to the inability to significantly separate observed behavior from personal preferences and from the presence or absence of environmental features.” (Glanz, et al., 2012, P.74)

Rooij (2012) shows these relations in another way (figure 5). It shows more details about the external influences on each aspect to satisfy the demand change of each aspect. For example increasing the demography of an area (external factor) would increase the interaction between people which influence the activity patterns of people. This requires new travel patterns demand to support the changes in activity patterns. Changes in travel patterns would be maintained by changes in transport system by means of external influences (technological developments).

![Figure 5: Spatial structure, transport system and activity-travel patterns of people. (Source: Rooij, 2012; Rooij, 2005)](image)

In reverse the external influences on transport system would influence in travel patterns that it might cause the change in spatial structures.

Additional clarification to this figure is needed to describe how these relations are linking to previous diagram. Hillier et al. description is actually a fact about configuration of an area (spatial structure) and its relations to movement and attractors (travel patterns) while Rooij diagram shows a process that describe how the changes in each part would/could be influenced/supported by others. To more precisely, Hillier chose the term “Structure” that “it describes a set of relations that hold at a particular point in time.” (Hillier & Hanson, 1984, p.93) while Rooij chose the term “changed and changing spatial structure”.
Comparing these two descriptions was to clarify that if the “spatial configuration” of an area could not support the demand of travel patterns then the technological developments in Transport Systems would be necessary. This also shows the correlation of urban design and transport engineering field. In this level it is worthwhile to enlighten again the vital role of urban design in reaching Sustainability since the ‘Sustainable Transportation’ depends on urban shape (or configuration of space or spatial structure). It will apply in design part to propose the need of proper transport system.

So far it has described that walkability principles depend on configuration of space and attractions. Following next two parts will explain walkability principles independently due to configuration and attraction, then it will bring together to conclude the common definition about walkable neighborhood. This would clarify the principles around walkable neighborhood which will be used as the basic definition for this thesis;

**Configurational walkability**

“Many urban form elements contribute to the feel and function of a neighborhood. The nature of the street fabric is one of the most basic and determines many other elements of neighborhood form. Grids, curvilinear streets, cul-de-sacs, and other street forms all produce radically different neighborhood characteristics, even with the same overall density and building form.” (M. Wheeler, 2004, P.186)

According to Longman Dictionary configuration means the shape or arrangement of the parts of something. Here, according to the design task of this thesis which is neighborhood, “something” refers to study area, which also is expandable due to scale; neighborhood, district, town, city, or in general societies. Consequently “parts” may refer to buildings, streets, trees, etc (physical environment) or its habitats (people). Therefore it is about the arrangement of people and space in environment (human societies). According to Hillier & Hanson (1984), human societies are “spatial phenomena; They occupy region of earth’s surface and everything transmit within and between regions”. (Hillier & Hanson, 1984, p.26)

In a reverse condition from configuration definition the existence of society cause special configuration; spatial phenomena arranges space using its parts (manmade design) which create a definite pattern of physical domain. It also arranges people in space by defining the locations of people in the system and due to these locations they are in relation together which together could be classified as aggregated or separated places. The latter arrangement stimulates different patterns of movement and encounter between those places which could have diverse volume of amount; dense or sparse. (Hillier & Hanson, 1984, p.26-51)

Since “walking” is one kind of movement therefore with the eye of previous explanations it is very important to define the walking movement pattern related to configuration of space. It seems two main spatial order, arrangement of people in space and arrangement of space itself, are the main elements in configurational walkability. It is very important to consider these two elements in the process of designing while the aim is achieving walkable communities.

Since the arrangement of space, “Configuration of urban grid, is the main generator of patterns of pedestrian movements” (Hillier, et al., 1993), it is
primacy to consider this element and its results. The most important result of spatial configuration just by itself is **Natural Movement**;

“Natural Movement in a grid is the proportion of urban pedestrian movement determined by the grid configuration itself. Natural movement, although not always quantitatively the largest component of movement in urban spaces, is so much the most pervasive type of movement in urban areas that without it most spaces will be empty for most of the time...natural movement is the logic that links spatial configuration to movement. The key element in this relation is that natural movement is a global property of a configuration in that it responds to configurational parameters which relate each spatial element to every other element in a system which may be several kilometres in diameter.” (Hillier, et al., 1993, p.32)

**But what are the characters of natural movement and how to evaluate them?**

Space syntax theory and its way of analyzes was proposed in 1984 by Hillier & Hanson which was to recognize “the morphological logic of urban grids and their growth”. (Hillier, et al., 1993. p.32)

Natural movement theory is one of the result of series of researches have done to understand the “social logic of space” and “spatial logic of society” (space syntax). Space syntax is to investigate the urban grid quantitively regardless of space use. Since urban grid is “cultural phenomena” – it produces meeting theme with diverse arrangement—therefore natural movement as a result of urban grid would be cultural phenomena. It grasps distinctive forms in each culture due to its urban grid differences. (Hillier, et al., 1993) This feature would be discussed in “sense of place” part since it is its cultural point of view.

Space syntax analysis are based on dividing space to open space and primary cells (buildings, blocks) and finding the relation between each other and within each. The point here is not to explain space syntax analysing in detail (it is described more in space syntax part), but it is to understand its components which make the analyse possible. Space syntax is based on two kind of map, axial map and convex map, or one-dimensional and two-dimensional maps, and their graphs.

“Axial map of an urban grid consist of the longest and fewest straight lines that can be drawn through the spaces of the grid so that the grid is covered...The axial graph is thus a representation of the grid in which the lines of the axial map are the nodes and the intersections of the lines are the edges...The axial graph is sufficient for the post-diction of movement.” (Hillier, et al., 1993. P.34-35)

Obviously due to this explanations the main component of the axial graph is “the number” of nodes and lines or street segments and intersections. It does not take into account of the length of street segments or the width of intersections. Therefore whenever the natural movement has a high proportion it means the number of street segments and intersections are high in number.

This is comparable to Jane Jacobs clarifications in her book “The death and life of great american cities” about having city diversity. One of the principles which has pointed out is “small blocks”; create more links among origins and destinations by making the blocks smaller or in other hand increase the number of blocks. (Jacobs, 2011) . At this point we
could link city diversity to natural movement. It seems that an area with higher natural movement degree is more desirable considering Jacobs explanations to have diverse city or in another point of view the more walkable the more diverse. Space syntax techniques helps to define these common senses in quantitative matter.

This configurational aspect of societies is very crucial to attain walkability specially where the huge size of blocks has became pervasive way of development in urban China specifically the study area of this thesis (see figure 5 chapter 1 ). Although Jane Jacobs explain it in other way in 1961 by showing it in a schematic way but natural movement theory could support her idea in quantitative manner. It will also help to convince the developers and planners to understand their wrong way of development by stronger evidences clarifying that social features has been neglected.

Attractional walkability
Attractional walkability here in this thesis refers to any aspect that attracts people to walk. It could divide in two major sets; first group involves with street attributes namely safety- division of pedestrian, bikeway and motor vehicle way, quality of pavement, eye on road, desirable eyesight- greenery and street art and so on. Second group refering to accessible destination which are desirbale for habitats to ‘walk to’ such as retails, parks, services, public transport stations, etc. (SGN, n.d.) The latter group is related to attraction theory according to (Hillier, et al., 1993) while the first one is related to streetscape.

Walkable Neighborhood
Including the previous part the walkable neighbourhood could define as a neighbourhood which is configurationaly walkable additionally supports by attractions. Or in the other word “the arrangement of primary cells of neighborhood (buildings and blocks) in a way that natural movement quantity be the appropriate one additionally those cells have the proper function and also the linkage between cells be in the accurate manner in terms of appearance and safety”. This will be the reference definition of walkable neighborhood in this thesis.

Smart Growth and Walkable Neighborhood
How smart growth principles could support the need of walkable neighborhoods?
Comparing smart growth principle ‘walkable neighborhood’ by the reference definition of walkable neighborhood confirms that the SG principles could support the need of walkable neighborhoods since according to this principle, walkable neighborhoods are the result of two main parameters; first, properties – like housings, offices and retails- and services- like transport system, schools, libraries- should be in accessible distance rate; second, there should be a possibility for pedestrian flow . (SGN, n.d.)

Besides this, other SG principles therefore would be considered as supporting role to promote walkability, namely “Mix Landuse”, “Compact building Design”, “Attractive communities with a strong sense of place” and “Variety of Transportation choices”. Beside these principles another principle called “Create a Range of Housing Opportunities and Choices” will help neighborhood to attract more people from different range of groups which is necessary from the social point of view. It is important because creating one area from one social group will isolate and disconnect them from other groups. That will reduce the level of social
encounter. In the other hand it helps to reduce the entire amount of ‘distance to work’ for those who work in study area.

The comparison between reference definition and SG principles and their groups bring together in figure below.

Figure 6 Walkable Neighborhood Principles

Another two principles of SG named “Strengthen and Direct Development towards Existing Communities” and “Preserve Open Space, Farmland, Natural Beauty and Critical Environmental Areas” therefore are not related directly to walkability of neighborhood but the presence of them are crucial to achieve sustainability. Except natural components of area that aren’t demolished by developer the others are demolished. For that reason preservation of these elements should be considered as opportunity to increase sustainability level in constructing period of new neighborhood. Since each neighborhood needs these natural elements—trees, greenery, natural beauty... as an attractional component then by preserving them it could help developer to save cost of extra constructing beside its environmental advantages. It is same situation for another principle. In view of the fact that there are no physical elements left from before therefore the only opportunity to develop towards the existing community is to preserve the identity of previous communities which were there before demolishing. The most important identity that also relates to the concern of this thesis is that the previous communities were walkable and well connected to surroundings. By creating the new walkable neighborhood that is well connected to surrounds the continuity of identity will sustain. As it mentioned before the continuity of identity is the piece of evidence to have connected city- here related to time- and accordingly sustainability.

Attractive Communities with a Strong Sense of Place

“Using local culture to inform the nature of growth can create a sense of place that is socially and culturally relevant”. (Stohr, 2013)

“We read space, and anticipate a lifestyle.” (Hillier & Hanson, 1984)

These two sentences are the basic knowledge framework in investigating local identity in case study chapter. Space syntax theory was applied in reading the spaces of case studies.
Space Syntax Analysis

Space syntax analysis was established to understand the interactions between ‘social structure’ and ‘spatial structure’. To achieve this “Society must be described in terms of its intrinsic spatiality and space must be described in terms of its intrinsic sociality.” This goal “lead to build a broad theory of the social logic of space and the spatial logic of society,” (Hillier & Hanson, 1984, P.26) and it is morphic language;“A theory of morphology”.

Here the concern is not explaining this theory but just its way of analysis. (For more and detailed discussion see ‘Social Logic of Space’ written by Hillier & Hanson, 1984)

These analysis are based on considering the settlements as discrete systems;

**XxyY Model (Bi-Polar system)**

It is necessary to define the settlement (study area) based on this Model before starting the analysis.

**X**: Refers to primary cells or buildings. (Shops, houses...)

**Y**: Refers to the area that surrounds the area of interest and not part of it.

**x**: Refers to secondary boundaries that it is around X and separate it from open space explain below;

**y**: Refers to a continuous system of open space defined by X or x.

Figure 7 Clean map of Study Area and surroundings
Figure 8 schematic relations in XxyY model

Figure 9 shows the application of this model to the study area. The important matter in this application is that ‘x’ and ‘X’ zones are considered as the same which is colored in white (considering the blocks instead of building and intervening area). The exact model would separate them founded on buildings and open space inside the blocks but since all the blocks are not permeable for public because of fences or walls therefore it considered as one. Also because the main concern of this thesis is ‘y’ zone which should be open to public use.

Derived from this model some descriptions could be brought up:

X-x-y-Y: considering this model as Bi-polar system, ‘X’-pole refers to most local parameter- realm of the residents of the community- and ‘Y’ refers to most global parameter- realm of the strangers. Thus the interface involves two kinds of relations:

- Interactions amid the residents of the arrangement
- Interactions between residents and strangers
**Axiality:** Stands for the highest global expansion of the system of spaces brought together linearly or form sociological point of view, global association of the system and therefore its association with admiration to Y; or “To movement into and through the system”. In simple words it is representative of access lines containing roads, streets, thoroughfares in any scale.

**Convexity:** Stands for the highest global expansion of the system of spaces brought together two-dimension. From sociological point of view it is local association of the system and therefore to its association with admiration to X; or “To its organization from the point of view of those who are already statically present in the system”. In simple words it is representative of static public domains.

Comparing these two approaches are the basis of the syntactic theory of spatial analysis. (Hillier & Hanson, 1984, p.95-97)

**Analysis procedure**

The syntactic analyses are based on transformation of the maps into graphs which make it possible to be counted numerically. For achieving this first step is preparing the convex and axial map. Next step therefore is illustrating these maps by graphs that each point in the graph represents the space (axial line or convex space) and each line in the graph represents the relations between the spaces. In this thesis the first step has done by Auto Cad software and the second step has done in DepthmapX software.

**Convex map:** it is based on ‘y’-space map that it is broken up into “fattest possible convex spaces”.

**Axial map:** it is based on ‘y’-space map that “consist of the longest and fewest straight lines that can be drawn through the spaces of the grid so that the grid is covered.” (Hillier, et al., 1993, p.34)

*Open Space Structure*

![Figure 10 structure of ‘y’ domain, public Domain](image)
Figure 11 Axial Map of study area in terms of pedestrian access

Figure 12 Axial Map of Study area in terms of both pedestrian and vehicle access together
After transforming the axial and convex map to graph some indexes can be applied to explain configurational attributes of the area; “Axial Graph is sufficient for the post-diction of movement.” (Hillier, et al., 1993, p.35)

**Axial Graph Attributes**

“The axial graph is the graph in which the lines of the axial map are the nodes and the intersections of the lines are the edges.” (Hillier, et al., 1993, p.34)

- **Local properties**

  **Connectivity:** for observed axial line is the number of nodes in the graph (axial line in axial map) that is directly connected to it.

  **Control value:** describe the value “to which a node controls access to and from its neighbors.” (Hillier, et al., 1993, p.35)

- **Global properties**

  “The density of activities was proved to be clearly related to the grid configuration. In fact, the resulting trend of local integration closely reproduces the distribution of urban activities within each sub-system, while the global integration value influences the attractiveness level of the several sub-systems.” (Cutini, 2001)

  **Integration:** Integration index is the most important measure that directly affect on natural movement; It “measures the mean depth of every other line in the system from each line in turn, relativised with respect to how deep they could possibly be with that number of lines... .The most integrated lines are those from which all others are shallowest on average, and the most segregated are those from which they are deepest.”

  - **Depth**

    It refers to the number of street segments that should be passed to reach or to be reached. For example node ‘F’ is two steps deep from node ‘A’ if we choose the ‘A→B→F’ route or three steps deep if we choose the ‘A→D→J→F’ route. The notion of ‘mean depth’ therefore represents the average depth between observed nodes.
“Syntactic analysis of the axial map produces two kinds of output: alphanumeric data in the form of numbers with spatial parameters assigned to each; and graphic data in the form of ‘core’ maps in which lines are colored up in accordance with their value on the various parameters. The latter are of course crude approximations compared with the former, but they do allow designer an immediate, intuitive grasp of the structure of the spatial pattern of the area.” (Hillier, et al., 1993, p.36)

The latter was applied to show the configurational analysis in chapter three.

- Natural movement

“The fundamental proposition of ‘natural movement’ is that movement in an urban grid is determined, other things being equal, by the distribution of a configurational quantity called ‘integration’ in the axial graph of the axial map of that grid.” (Hillier, et al., 1993, p.34)

Natural movement came to consideration according to need of urban flow prediction in design process since the configuration (spatial order) of area causes this phenomena and it is itself the main core of design task. “We can also assert the reliability of the methods of configurational analysis as a predictive technique concerning the distribution of the levels of attractiveness throughout an urban settlement, with reference to any planned transformation of its grid.” (Cutini, 2001) additionally “centrality, appraised in terms of attractiveness, seems to be determined both by the configuration of the grid and by the presence of the located activities…” (Cutini, 2001)
Chapter three: Analysis/Synthesis/SWOT

This chapter aims to answer the research question:

- What are the barriers/possibilities to have walkable neighborhoods under the theoretical framework relates to study area?

According to reference definition of walkable neighborhood discussed in chapter two, that is;

“[the arrangement of primary cells of neighborhood (buildings and blocks) in a way that natural movement quantity be the appropriate one] Part 1
[additionally those cells have the proper function] Part 2
[and also the linkage between cells be in the accurate manner in terms of appearance and safety.] Part 3

Space syntax analysis will eliminate the need of configurational analysis. This part will answer the research question relate to first part of the reference definition.

To investigate the research question relates to second part of reference definition, attractional movement will explore. Accesibility and landuse maps are basics for this part.

Third part of the reference definition has analysed by on-site observations that it will illustrate by pictures.

These analysis are done under three major group:

I. Connectivity
II. Accessibility
III. –scape

I. Connectivity

Entrances to Site

According to space syntax, it is of great consequence to define the domains of space according to XxyY model introduced in social logic of space (described in chapter 2, space syntax part);

‘Y’ is the "surrounding space that is outside and not part of the settlement"(hillier, 1984), that here it is the river in left, and green place with small river in right, river down, and main road in up, this group is acting like

‘X’ and ‘x’ consider as one because the blocks are closed by means of both fence and wall which make permeability for public impossible.

‘y’ consider streets( all kind), parks and greenery, or in whole all public open spaces, this is the main criteria of design project also;

1.- Access to Y zone
There are 12 different access roads (1, 2...12) to Y zone. Among them only four accesses are directly connect the outside to study area which they are ‘1’, ‘5’, ‘6’ and ‘9’.

Access ‘8’ is also a connection to outside but it acts like distribution point not linear access. (Ferry Terminal)

2- Access to study area

There are 16 different access roads (A, B ... P) to study area; ‘A’ is the main access from city center, which is the same direction with access ‘1’ to Y zone.

‘M’, ‘N’, ‘O’ and ‘p’ are access from east neighborhood. These streets consider as local access.

‘F’ is the direct access from ferry station and bus station (city bus terminal).
‘G’, ‘H’, ‘I’, ‘J’ and ‘K’ are accesses from west area (riverside scenery). These streets consider as local access.

‘B’ is the main access from north. It is the same direction with access ‘5’. Access ‘5’ connects east and west Nanjing through the bridge over Yangtze River.
‘C’, ‘D’ and ‘E’ are local access from north neighborhood.

‘L’ is the only access from south, which is same direction with access ‘9’ that connect south area of Qinhuai River through the bridge.

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Figure 1  The major accesses to study area and ‘Y’ zone
**Conclusion**

Comparing east and west local access groups illustrate that mobility of ‘from and to’ riverside scenery is not in legible and convenient condition since ‘P’ and ‘N’ accesses in east and ‘G’, ‘I’ and ‘J’ accesses in west are dead end and are not continuous. It reduces the level of connectivity that the study area would cause, e.g. to reach riverside from ‘N’ one should walk around the study area and choose another far street to reach riverside. The situation in north and south part of the study area is also ‘not-permeable’.

‘B-L’ and ‘A-F’ street segments are the most integrated streets to surroundings- outside. In other words (according to space syntax) they are the most global streets.

‘6-D’ street segment is the most local integrated access to study area. ‘O-H’ and ‘M-K’ street segments are most local integrated access to riverside scenery.


**Figure 2** The connectivity Map, derived from axial graph analysis
SWOT

Figure 3 Diagram of main movement throughout the study area and main dead end local streets

<p>| | |</p>
<table>
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<td>Strength</td>
<td>Existence of direct connection to surroundings, riverside and city center, to study area,</td>
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<tr>
<td>Weakness</td>
<td>Weak local connections</td>
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<td>Opportunity</td>
<td>To increase the connectivity of local accesses through the study area by design in re-development process</td>
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<tr>
<td>Threat</td>
<td>Neglecting the local accesses would cause disconnection and isolation in future.</td>
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Table 2 SOWT table concerning connectivity to/within study area

Configuration

Arrangement of Space

Configurational analyses has done base on axial map, which is consisting of lines and intersection of lines. The graph that is related is consisted of Node as line representation and link as intersection of lines. “A key property of interest is how the various configurational variables are distributed in the urban grid.” (Hillier, et al., 1993, p.35)
Figure 4 Distribution of Integration index (radius n) relates to pedestrian flow

Figure 5 Distribution of Integration Index (radius 3) relates to pedestrian flow
Figure 6 Distribution of Mean Depth index (radius n) relates to pedestrian flow

Figure 7 Distribution of Mean Depth index (radius 3) relates to pedestrian flow
Figure 8 Distribution of Integration index (radius n), both pedestrian and vehicle access concern

Figure 9 Distribution of Integration index (radius 3), both pedestrian and vehicle access concern
Figure 10 Distribution of Mean Depth index (radius $n$), both pedestrian and vehicle access concern

Figure 11 Distribution of Mean Depth index (radius 3), both pedestrian and vehicle access concern
II. Accessibility

Circle around each destination in figure 18 shows five minutes’ walking measure. It shows clearly that the proximity to public transportations from residential part of study area is a missing element in current situation. Considering that the future plan is denser than the current it is necessary to be concerned about the proximity to public transportation in design proposal.

Figure 18 also proves that there is no consideration of ‘proximity to retails’ in future plan while retails were part of the study area in the past.

In the other hand waterfront scenery is in proximate range from the edge of study area (Less than 800 meters in east, less than 500 meters in south and less than 300 meters in west) as it shows in figure. The Overall SWOT analysis for accessibility brings together in table 5.

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<td>Create proper public transport network by adding new bus routes and stations, locating retails in re-development proposal,</td>
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Table 3 SWOT table concerning Accessibility to major destinations

Figure 12 LandUse Map and accessibility to goods and services
III. -scape

Current situation of pedestrian routes in study area is not in a good manner generally due to new developments (demolishing and constructing), which make difficulties for pedestrian flow.

Trees are distinctive landscape element in all kind of routes, from narrow streets to wide streets. It is strength of the study area that makes the routes more desirable for pedestrian by providing shadow. Providing shadow is crucial to provide convenient pedestrian routes in Nanjing because of the sunshine.
Chapter four: Case Studies; Local Identity

Case ❶: Zhangjiawei Community, Nanjing, China

The identity of study area

The first thing that come to mind by observing the spatial structure of old communities is that they were legible and permeable enough to make the neighborhood walkable. There is no strong border in old structure, which allows the flow of people being convenient. People could go easily almost everywhere they want in surroundings and there were no limitations. Even if there were gated communities their gates were open to public flow in day time. Easy move was the result of spatial structure, which was compact, consists of narrow alleys (see figure 14) and different route choices to walk. Community center in the middle works very well in terms of its different accesses that make it accessible from all over surroundings.

It is now clear why the future development will be less walkable. By constructing gated communities, that limits the flow of people (both local and stranger according to hillier definition); it reduces the number of possible routes choices. It isolated also the gathering places inside the blocks while it worked very well for locals because of its deepness from main streets which make it more cozy and calm for its locals.

Figure 1 XxyY model of old community
Figure 3 and 4 shows the distribution of integration along the area. It clears that there is a hierarchy to reach residential core. The core then is a place for gathering and meeting which consider as a community center.
“Our failures with city neighborhoods are, ultimately, failure in localized self-government. And our successes are successes at localized self-government... both the informal and formal self-management of society.... We must first of all drop any ideal of neighborhoods as self-contained or introverted units.” (Jacobs, 2011, p.149)

Comparing the spatial structure of old community and future plan of study area proves that future plan creates self-contained neighborhood. Gated community in large scale (gated neighborhood) is the main cause of this kind of failure in city neighborhoods.
Beside the configuration of old community, local gardening was another identity of old community. It is the missing element in future plan of study area. (both inside and outside of blocks)
Figure 11 Waterfront scenery, west side of study area

Figure 12 Waterfront scenery, west side of study area

Figure 13 Rest Spot, near bus station

Figure 14 Narrow Streets, remained from demolishing inside the study area

Figure 15 Trees as an important element, along Tangshan street
Main concerns in investigating Suojin community were the block sizes, identity of local shop street, and the functions surround the residential area that make the area walkable and desirable for its habitants.

Shop Street plays a significance role in Suojin community as a dynamic pedestrian road. It is not just a passing route but it is also a place for social encounter and gathering. Retails and restaurants are the basic occupations. The elementary school in the center makes the community more lively and active. It is a place that attracts various types of people.
Case 3: Xin Tian Di Area, Shanghai, China

Main concerns were the block size, pedestrian network, accessibility to public transport, hierarchy of streets, gathering places, height of buildings, functions which attract people there and the land use of surroundings.

Through my visit in China XinTianDi area catch my eyes in Shanghai most as a place that attracts locals and strangers in a way that makes it dynamic and crowded. Proximity to public transport stations, metro and bus stations make the area a desirable place from access point of view. The configuration analysis shows also that access road to the area from east has the high integration index (both local and global measure).
Figure 19 Overview of XinTianDi

Figure 20 Distribution of Integration
Figure 21 LandUse and Public Transport

Figure 22 Distribution of Mean Depth
Figure 23 Different views from XinTianDi,
Chapter five: Conclusions/Guidelines

All the building in the area has turned down and the only thing that remained is street network and greenery. The current street network shows in figure below;

Moreover, the existing of greenery shows in figure 24. New development should follow these routes as much as possible to reduce the extra cost of construction.

These two network should be primary shape for design proposal.
Another consideration from case studies is the human behavior in public domain. Providing spaces for functions investigated in case studies will help to create places which are related to local culture.

Figure 3 Walkable Neighborhood Principles based on SG principles and Space Syntax theory

It is important to merge the local identity investigated in case study chapter to these principles. It has done in next chapter by using local attributes concluded from case studies such as building height, block length, and street and sidewalk width.
Chapter Six: Design Proposal (Planning & Design)

The first step was to design the *configuration* of blocks. Street network as the main element of ‘γ’ Zone that creates the shape of blocks was the main concern of this step. (Figure 1)

![Figure 1 Routes Structure concept](image1)

The existing street network and greenery, the continuity of streets, access to destinations, connecting the greenery scenes were the main concerns of proposing this street network. Size of blocks follows the case studies.

![Figure 2 Configuration proposal](image2)

Based on this, the next stage was to define the blocks. (Figure below)
Next part was to defining the *land use*. Main concerns in this part were hierarchy of different places, their coziness, deepness and most importantly proximity to attractions. Simultaneously the different type of streets proposed based on their adjacency to various functions and space syntax analysis, which mentioned earlier in chapter 3.

Figure 3 bird View of design proposal from south-east

Figure 4 Land Use map
Variety of transportation was the next step that has done by defining new bus stations. The place of new bus stations has chosen in a way that all the habitants from inside the study area would need to walk less than (approximately) 250m to reach the first station.

Figure 5 Street types

Figure 6 Street Sections
Figure 6 Variety of Transportation, bus stations and their routes
Heights of the building were chosen based on height map proposed by NJUPA (2010). Height of the buildings in entertainment area has decided based on case studies chapter.
Entertainment area is a place that supports both locals and strangers. Locals refer to people that live and work there and strangers refer to people outside of that group.

Open spaces inside the blocks are isolated from main streets by means of buildings to make the area calmer. Only pedestrian and bikes could go inside. Trees, benches and fountains will make a desirable place to have social encounter.
Public Park is divided to smaller places by means of pedestrian accesses aiming attracting different users. Lake is the remained landscape element which reminds previous communities that lived here before. Shop Street in west and south, entertainment area in east and residential area in surroundings will make this park to become more dynamic and attract different users.
Pocket parks perform as gathering place and local destinations (convex space which is focal point, attraction point), serve locals and also strangers (belongs to 'y' Zone). Comparing to future plan, this kind of design would increase the amount of public area versus private area (refers to gated communities in future plan and in whole new development in study area and its surroundings). Theming, compressing and connecting were major concepts in pocket parks designing.

Figure 13 location and views of pocket parks
Pocket Park A and C: There are two pocket parks along Shop Street, A and C. All four parts have direct access to residential block from their corners. These accesses are in the same directions with suggested pedestrian routes inside the blocks (see figure 21) which makes a convenient access through these blocks.

Pocket Park B: Two parts in right side are considered as entrances to entertainment area that bicycle parking was proposed. In the left side entrance to Public Park is inviting people. Fountains and benches under trees shadows make it suitable for meeting point. Upper part in Left side suggested having access route into the residential block.

Pocket Park D: Two parts in left side (see figure 15) considered as places to serve students and their parents. It is suggested to design school gates just for pedestrian from this side. Bicycle parking was proposed in both sides. Two parts in right side are adjacent to office blocks. Shelter and Fountain proposed.
Along the Shop Street on the edge of residential blocks (blocks number 2, 3, 5, and 10 in figure 21), it is suggested to have rest spots. These spots will also provide places for informal activity along the Shop Street such as playing games that it is very common in China in public places. (See Figure 16 chapter four)
Smaller blocks make the pedestrian flow less convenient among its buildings inside the blocks because of increased in the number of blocks which still need to be gated - but smaller blocks in design proposal compare to future plan - the mobility between residential buildings themselves (primary cells from space syntax point of view) are less convenient than future plan since two proposed streets divided one block into four smaller blocks that habitants of these buildings need to pass them. (Figure 20)

Since the landscape inside the residential blocks is not the main concern of this project, it suggests that the designer of it consider main accesses between the residential blocks that go throughout its buildings. (Figure 21)

Therefore the pocket park proposed in intersections (Pocket Park A and C) defined as local focal points. It also suggests that allow people living in these residential blocks pass through their gates. This will increase the amount of control value aspect of those blocks relative to each other along with destinations in 'y' zone. (Figure 21)
Chapter Seven: Evaluation/Conclusion

This chapter will evaluate the design proposal under the theoretical framework in three different categories;

- Configuration
- Attraction
- Appearance and safety

Configuration

By comparing the axial map analysis of design proposal with future plan of study area it shows that streets are in a better condition in terms of integration index (both global and local; [HH] and [HH] R3), see figure 1 and 2 below. Better, in a way that streets are more integrated together which cause less isolation in block scale.

Table 1 and 2 shows the Axial Graph Attributes for both proposed plan and official plan. The average amount of global integration has increased due to new street network proposed in design proposal. It rose from 1.36505 (in the future plan of study area) to 1.5183 (in design proposal). This will cause increasing natural movement quantity, which was the important aim to achieve walkable neighborhood.

Figure 1 also shows the integration index for the 10 most important street segments, ‘G’ refers to global integration or [HH] and ‘L’ refers to local integration or [HH] R3). Street number 1 has the highest global integration degree, as it is the main connection to city center (see also figure 1 chapter 3). Street number 5 has the highest local integration degree that will play a significance role in local connections (connection of study area to surroundings).

The latter comparison shows the existence of hierarchy of different domains, local and global. It helps to distribute the mobility of people in different type of streets. From space syntax point of view it means that strangers will use street number 1 more than number 5, and local people use street number 5 more than number 1. This will help to achieve the hierarchy of public places according to case studies findings in chapter 4.
Figure 1 Distribution of Integration radius n, proposed Design

Figure 2 Distribution of Integration radius n, Official plan
Figure 2 Distribution of Integration radius 3

Figure 3 Distribution of Mean depth radius n
**Figure 4 Distribution of Mean depth radius 3**

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Table 1 Configurational attributes summary of design proposal

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Table 2 Configurational attributes summary of official plans
Attraction

In this part, access to major focal points (schools, retails, public transports, parks and so on) investigated due to evaluation of accessibility (as it mentioned in chapter 2). Figure below also illustrate the proximity to other major functions, which are important to achieve walkable neighborhoods.

Shop Street, which considered also as the local identity that mentioned earlier (case study number 2), plays an important local role in connecting north and south of study area. By providing gathering points (pocket parks) along it and taking advantage of existing lake (transformed to Public Park in design proposal), it creates desirable place to shop, walk, rest and social encounter for its habitants. Chinese landscape architecture applied to create elements that are meaningful to Chinese people.

As it illustrated in figure 6 chapter 6, it demonstrates the closeness to public transportations.

It is worth it to evaluate the attraction from the Hajer & Reijndorp (2001) strategies point of view to achieve public domain in design process.

- Theming and compressing that here relates to Chinese landscape architecture and Shop Street as meaningful elements, which applied in design proposal as it mentioned before.
- Connecting which was the most important strategy in design process to provide connected neighborhood as it illustrated in figure 5.
Appearance and safety

Eye on the road was the main strategy in creating safe neighborhood.

Proposing four different types of streets due to their usage (differ from the most local to the most global) will improve their safety by assigning appropriate domain for pedestrian flow. (See figure 5)

Existence of trees along the thoroughfares is crucial to provide desirable pathways for pedestrian in terms of creating shadow since dealing with hot weather is more serious than coldness because of total amount of hot days in Nanjing city.

| Strength | Compact Building Design, greenery and waterfront scenery (open space), variety of transportation,  
|          | ✓ The accessibility to public transportation was improved, new stations and new pedestrian accesses  
|          | ✓ Compact Building design was utilized  
|          | ✓ Greenery was applied as focal points  
| Weakness | Land use, Range of housing, walkability,  
|          | ✓ Land use was replaced due to proximity and desirability  
|          | ✓ More various type of housing in terms of height and configurational attributes  
|          | ✓ Walkability improved configurationally and from attraction point of view  
| Opportunity | New development (Sense of place, walk ability, preservation)  
|          | ✓ Sense of place was applied by means of investigating case studies  
| Threat | Lack of Mix use, Car-dependency development, sense of place (continuity in identity)  
|          | ✓ Provide more mix use area  
|          | ✓ Increasing walkability quality  
|          | ✓ Using the spatial identity of old community  

Table 2 procedure of fulfilling SWOT
Conclusion

This chapter consists of conclusions of previous chapters, which are the answers of research questions.

- What are the principles around walkable neighborhood generally and particularly under smart growth framework?

- “the arrangement of primary cells of neighborhood (buildings and blocks) in a way that natural movement quantity be the appropriate one additionally those cells have the proper function and also the linkage between cells be in the accurate manner in terms of appearance and safety”. (See figure 6 chapter 2)

This definition guided the analysis procedure as it follows:

- What are the barriers/possibilities to have walkable neighborhoods under the theoretical framework relates to study area?

Chapter 2 suggested following main categories in analysis procedure to investigate walkability condition. The major conclusions in each part shows below each as it follows:

- **Configuration**

The comparison between configurational analysis (Integration index and meandepth index as major attributes) between future plan of study area, case studies and design proposal showed that small block size would improve the walkability. In other words the long gated block design is not appropriate form to have walkable neighborhood.

- **Attraction**

It concluded from analysis that planning proposal for the study area from Nanjing planning bureau is not in a way that promotes walkability through it by neglecting Mix land use and proximity to retails and public transport. Comparison between official plans and proposed plan also shows that smart growth principles via space syntax analysis could assist improving walkability of the study area.

The main achievement in this part was that the proximity to focal points namely retails, schools, public parks and squares, public transportations is necessary to improve walkability of the area.

- What should be done in order to localize the Smart Growth principles before implementing those principles into design process using case studies from Chinese Context?
- What are the characters of local identity relate to study area and Chinese context?

Chapter 6 illustrates the step of step of design process with the aim of walkable neighborhood. The structure could apply in design process as a toolkit for other similar projects.

The important point in this part was “how to localized these principles” to use in design process. It accomplished by choosing successful case studies relate to each principle (‘configuration’, ‘attraction’ and ‘scape’) to understand the local identity and combining it to design principles. It concluded that walkable neighborhoods have the smaller block and they
have dynamic community center and shopping street. In all cases, the average of integration index is more than future plan of study area. Space syntax analysis illustrates the local spatial attributes in both numerical and colorful maps that is very useful in localizing Smart Growth principles.

**Other knowledge**

For similar projects, that predicting urban mobility relate to pedestrian flow is necessary, it suggests using space syntax analysis to predict the pedestrian flow (natural movement). It will help designers to understand the different type of streets due to its spatial attributes which is useful in allocating different type of buildings due to their functions.

**Possibility of other researches related to this thesis**

There are possibilities to continue this topic along with other researches. One of the possible researches could carry to compare successful SG projects in U.S context (or other countries) to investigate the effect of different contexts on neighborhood development projects. It could lead to definite principles that are crucial in achieving walkable neighborhoods in global context.
Appendix A

Configurational Attributes for existing condition of study area relates to pedestrian flow

The relation between Connectivity and Integration [HH] indexes

The relation between Integration [HH] and Mean Depth indexes

The relation between connectivity and Mean Depth indexes

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**Configuration Attributes For All Axial Lines**
Appendix B

Configurational Attributes for existing condition of study area relates to pedestrian and vehicle flow

The relation between Connectivity and Integration [HH] indexes

The relation between Integration [HH] and Mean Depth indexes

The relation between connectivity and Mean Depth indexes

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Bibliography


Cutini, V. 2001, "Centrality and Land Use: Three Case Studies on the Configurational Hypothesis”, Cybergeo,.


ICMA & EPA, 2006. This is Smart Growth, s.l.: Smart Growth Network.


