

EXPLORATION OF FOUR FACTORS INFLUENCING PEOPLE'S SOCIAL
ACTIVITIES IN COMMERCIAL PEDESTRIAN ENVIRONMENTS: A CASE
STUDY OF NANJING CITY

by

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ABSTRACT:

Pedestrian environments influence our everyday experience of life in cities. The vitality and image of a city is often gauged by the level of pedestrian activity on the streets(Robertson.K.1994). In recent years, an important aspect of the revitalization movement in city centers has been to focus on the improvement of the quality of pedestrian environments on city streets.

Pedestrian behavior study is an useful methodology that has been advocated by Whyte(1980) and Gehl(1996) in exploring the relationship between people, activity and their environment. This thesis will examine some of the main outdoor pedestrian areas in the central business district of Nanjing, a provincial capital city in eastern China. Through a series of pedestrian studies and on-site surveys, this research aims to explore the factors that influence the way that pedestrians use streets in a commercial environment, and find some solutions and implications for encouraging social activities in the relevant study areas. The author also hopes that this report on the pedestrian environment will one day prove useful on a referential basis for the redevelopment and revitalization of Nanjing City.

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Chapter One: Introduction

1.1 Background

1.1.1 Social Interaction in Public Spaces

Many sociologists and urban planners have stressed the importance of street life in a city, and have advocated the encouragement of social activities on city streets. Jan Gehl is one such advocate. Gehl (1996) proposed that social contact within the context of a city or residential area provides sources of information, inspiration and uniquely stimulating experiences. The process of social contact implies “an offer of valuable information about the surrounding social environment in general, and about the people one lives or works with, in particular... We discover how others work, behave, and dress, we obtain knowledge about the people we work with, live with, and so forth. By means of all this information, we establish a confidential relationship with the world around us... In addition to imparting information about the social world outside, the opportunity to see and hear other people can also provide ideas and inspiration for action... Compared with experiencing buildings and other inanimate objects, experiencing people, who speak and move about, offers a wealth of sensual variation (Gehl 1996. *Life Between Buildings*. PP.23.).”

Wu (1999), in his book *Planning of the City Center District* argued that through social contact, people can exchange information with each other and obtain a sense of psychological satisfaction. It is natural for human beings to want to be involved in social contact and activities within the context of their social environment. It is thus important to protect and encourage social contact between people and to place importance on enriching the social environment. Therefore, there is of value to study the factors that influence people’s use of outdoor environments for social activities and discover ways in which to encourage social activities.

As a significant aspect of the social environment, pedestrian environments influence our everyday experience of living in cities (Figure 1.1). Pedestrian environments on commercial streets are as much of social, as they are of commercial importance (Jacobs 1961 and Carmen 1994). As important public spaces, commercial pedestrian environments in urban centers provide easily accessible sites for social and economic activities such as meeting with friends, enjoying food, window-shopping, participating in commercial shows, or providing children with places to play. These spaces fulfill “the primary needs that people seek to satisfy in public spaces such as those for comfort, relaxation, active and passive engagement, and discovery (Carr 1992. *Public Space*. P.P.19)”. Furthermore, they have served as information and communication platforms for people throughout history (Gehl 1996).

Figure 1.1: Amagertorv: a pedestrian street in Copenhagen
(Source: Gehl, J. 1996.
Public Space, Public Life.
P.17.)



1.1.2 Background of Situation in China

The character of street life in China has changed after the urban reforms of the past several decades (Davis 1995). In the past, China's traditional commercial streets were used by the public as commercial, recreational, work and ceremonial spaces (Wang 2003). Streets were not only the places where people worked and lived, but also served as playgrounds for children. Many people resided on streets, and many resided very close to the streets. These traditional residential patterns brought people together, and ensured that there was life and vibrant activity in the old urban centers. Since the 1980's, most Chinese cities undertook massive renewal projects in their old urban districts. Many residents were relocated out of city centers and into new districts. In 1993 in Shanghai, for example, about 200 redevelopment projects were undergone, and it was estimated that over 1 million people had been relocated from old neighbourhoods and put into new districts (Gaubatz 1999). Nanjing has undergone a similar developmental process. Moving residents out of city centers has resulted in decreasing level of daily social contacts made in local neighbourhoods. Since the beginning of market-oriented economic reform, commercial activities have been highly concentrated in Nanjing's central urban districts. Between the years 1984 and 1996, the commercial building area in Xinjiekou, the central business district of Nanjing, has increased from 100,900m² to 2,740,000m² (Wu 1999). Highly concentrated commercial activities attract a high volume of people to the city center for shopping, dining, meeting friends and other forms of recreation. According to 2004 government statistics, the one-day pedestrian volume in Xinjiekou district during weekdays is about 300,000 to 400,000. During special festival times, such as during the Spring Festival, National Day or Labour Day, the one day pedestrian volume rises to as high as one million.

In the early stages of the renewal process, of the urban centers of most Chinese cities, very little importance was given to landscape architectural design and the design of public realms. The planning and design of public open spaces lags behind the massive construction of buildings. Oftentimes, due to a lack of scientific planning and forethought, the physical quality of open spaces fails to meet the needs of pedestrians for recreational activities and social contacts (Wu 1999). In some city centers, street spaces have been proven to be designed with overly large dimensions, and as a result have lost their sense of intimacy and human scale, both of which are vital for social contact (Zhou 2001). The lack of seating spaces and recreation facilities in the pedestrian environments of public open spaces have been cited as common complaints (Shang 2000).

Figure 1.2:
A pedestrian environment in
the urban center of Nanjing, China



In recent years, the government has begun to realize the importance of developing public amenities and revitalizing open spaces. A large number of revitalization projects for public open spaces is in progress.

Insufficient amounts of information and data have been collected regarding the factors that influence people's use of pedestrian environments for social activities in the urban centers of Chinese cities. Therefore, before beginning to carry out massive revitalization projects, we first need to identify and evaluate the factors that influence pedestrian environments. Doing this research will help us to better understand the influences on the pedestrian environments and will contribute knowledge that could help urban designers, landscape architects, architects and social scientists understand better ways to design and implement policies and plans to encourage more satisfying social life and activities in pedestrian environments.

Based on the above rationale, the author chose the main outdoor pedestrian environments in Xinjiekou, the central business district of Nanjing city, as the research area through which to evaluate the important factors that influence pedestrian's use of streets for social activities. Only by clarifying the influencing factors can we come to understand how to encourage and develop a comprehensive social and recreational city life in public realms, and can we make revitalization projects for public open spaces more practical, satisfying and people-oriented.

1.2 Objectives of the Study

The main objective of the study is to propose recommendations for a feasible revitalization plan in the study area that encourages social activities.

More specifically, the objectives are:

- To identify some important factors that influence people's use of commercial pedestrian environments for social activities;
- To identify the correlation between the focused factors and pedestrian's social activities;
- To propose design considerations and recommendations for encouraging social activities in commercial pedestrian environments

1.3 Research Questions

The final purpose of this study is to make recommendations about how to solve some concrete problems that exist in the commercial environments in some Chinese cities, particularly in those with similar environments to Xinjiekou, the area that is the focus of this report. These concrete problems are the research questions in the study:

- What is the main reason for the pedestrian crowding problem at some locations?
- How can provision be made for movement spaces and rest spaces in a comparably congested pedestrian environment?
- How can the locations and physical configurations of seating spaces be arranged to provide more seating opportunities and to encourage more group interactions?
- How can space for socializing be created in a pedestrian environment that has been built with overly large dimensions?
- Which kind of designs and entertainment are attractive to and preferred by people, and how can the implementation of these be facilitated?

1.4 Scope of Investigation and Focus of this study:

1.4.1 Scope of Investigation

The primary focus of this study is to record and analyze the observation data that is related to some important factors that influence pedestrian's social activities, and to find correlations between the observations.

Actually, the influencing factors are complex. The interaction between pedestrians and auto-traffic, and a rapid growth in car ownership have resulted in some changes to patterns of social contact (Schumacher1978 and Gehl1996). Furthermore, the different cultural backgrounds (Wu1999) have been noted to result in different manners of social contact. Microclimates such as wind, rain and sun can also severely influence how much a space is used (Whyte1980). These are all aspects which should not be overlooked, however limitations of time and man-power have restricted the scope of study.

1.4.2 Focus of the Study

The following specific factors summarize the focus of this study, and provide the foundation for the collection of data and its subsequent analysis.

The focused factors influencing people's use of commercial pedestrian environments for social activities in the study area include the following:

- a) Pedestrian density;
- b) Quantity and quality of seating spaces;
- c) Attractions and entertainment;
- d) Dimension of pedestrian environments

The four above-mentioned factors all play important roles in influencing the social activities of pedestrians. Thus, through an analysis of the correlations between the four factors and social activities, we hope to come up with indications about how to solve some concrete problems and gain insight on how to better encourage street life and social activities in the study area. More specific reasons include the following:

- a) The main reasons for focusing on pedestrian density
 - A sufficient user density has often been regarded as a prerequisite for generating street life and activities (Jacobs 1961, Whyte 1980 and Carmona 2003).
 - Pedestrian studies are the basic methodology applied in this study; pedestrian density evaluation is an important quantitative aspect of pedestrian studies.
 - The data related to pedestrian density (e.g. highest pedestrian flow rate, pedestrian flow distribution, etc.) can help to inform the planning and design of pedestrian environments whether qualified (Gehl 1996).
 - High pedestrian density poses some problems in many urban centers of Chinese metropolitan cities, therefore, analyzing the correlation between pedestrian density and social activities greatly helps to solve some realistic problems related to pedestrian density.
- b) The main reasons for focusing on quantity and quality of seating spaces
 - Quantity and quality of seating spaces have been consistently analyzed within the literature relevant to social life and activities in public spaces.
 - Poor seating quality and lack of seating spaces are consistent problems and are in dire need of improvement in pedestrian environments in many Chinese city centers.
- c) The main reasons for focusing on attractions and entertainment
 - As an important part of public amenities, increasing attention has been paid to attractions and entertainment in pedestrian environments in many current public space revitalization projects.
 - Evaluating their suitability in the study area can help to shed light on some problems that may come up when undertaking revitalization

projects. These include looking into which kinds of attractions and entertainment are most preferred by pedestrians, how to, and where to locate these attractions and entertainment, etc.

d) The main reasons for focusing on the dimensions of pedestrian environments

- The dimensions of a space has been consistently analyzed and found to be of importance by many researchers studying street life and activities in public spaces.
- During recent years, in the developmental process of Chinese urban centers, no dimensional standards for pedestrian environments have been put into effect. The design of the dimensions of pedestrian environments should not be random. On the contrary, they should be based on street capacity and the condition of pedestrian's social activities. Thus, evaluating the existing dimensions of pedestrian environments in the study area helps us to understand and discuss which kinds of dimensions are the most suitable for Chinese metropolitan cities.

Chapter Two: Literature Review

Before beginning an investigation of the study area, a review of the scholarly literature on the influences of people's use of public open spaces was undertaken.

2.1 Introduction of Some Representative Research Studies

Gehl and Whyte are two famous researchers who have analyzed street life and usage patterns through direct observation of how people use outdoor spaces. Their studies are deemed as classics within the literature in the field of public space projects.

2.1.1 William H. Whyte

William H. Whyte started his street life project in New York in 1971 and recorded his observation of the behavior of ordinary people in his famous book *The Social Life of Small Urban Space* (1980), Whyte's work was reissued as a more substantial book, *City: rediscovering the Centre* (1988). His project for public space has pioneered the use of video cameras to analyze patterns of space usage over time.

The work of Whyte is of particular interest with regard to how people use public spaces, Whyte noted that many such spaces appeared little used, some did not and analyzed the possible reasons why some city spaces work for people, and some do not.

Whyte noted that the most sociable spaces usually possessed the following features:

- A good location, preferably on a busy route and both physically and visually accessible;
- Being level or almost level with the pavement (Whyte noted that spaces significantly above or below this were less used);
- Places to sit- both explicit (e.g. benches, chairs, etc.); and integral (e.g. steps, low walls, etc.);
- Moveable seats, enabling choice, and the communication of character and personality;

- Have some external stimulus that provides a linkage between people (e.g. street band, street entertainers, sculptures, food facilities, etc.)

Less important factors include sun penetration, the aesthetics of the space.

2.1.2 Jan Gehl

Reflecting on his influential book *life between buildings: using public space*(1996), Gehl offered a broad vision about the relationships between people and outdoor spaces. His study points out how the physical conditions of outdoor spaces can promote or impede the interactions between people and makes recommendations for how design techniques can encourage active use of outdoor space.

Gehl(1996) in his book '*Public Space – Public Life*' described how the city center and urban life of Copenhagen have developed and changed over the period of 1962-1996, following the many quality improvements. Jan Gehl presents a method for evaluating city quality: both qualitative and quantitative analysis of pedestrian life. Qualitative analysis refers to observing the patterns of pedestrian activities (e.g. commercial activities, standing, sitting on chairs of outdoor cafés, sitting on benches, etc.). Quantitative analysis refers to records of pedestrian volume (e.g. pedestrians per hour from morning to evening, pedestrians per minute etc.) and recording the number of pedestrian activities that occur (e.g. the number of stationary activities).

Gehl (1996) divided outdoor life on public spaces into three categories:

1) Necessary activities

Necessary activities are those that are routine and more or less compulsory such as going to work or to school, shopping, waiting for buses or other people, distributing mail, etc. In other words, it means all activities in which those involved are to a greater or less degree required to participate. Everyday tasks and pastimes belong to this group. In short, necessary activities occur under nearly all conditions, and are more or less independent of the exterior environment.

2) Optional activities

Optional activities include such as taking a walk to get a breath of fresh air, standing around enjoying life, or sitting and sunbathing.

Optional activities are those pursuits that are engaged in if there is a wish to do so and if time and place make it possible. These activities take place only when exterior conditions are favorable and comfortable, when weather and place invite them. This relationship is particularly important in connection to physical planning because most of the recreation activities outdoors are found precisely in this category of activities. These activities are especially dependent on exterior physical conditions. This means that when outdoor areas are of poor quality only strictly necessary activities occur. When outdoor areas are of high quality, when place and situation invite people to stop, sit, eat, play, and so on, a wide range of optional activities occur.

3) Social activities

Social Activities includes greetings, meetings, conversations, children playing

and communal activities of various kinds. Social activities are all activities that depend on the presence of others in public spaces. These activities could be termed 'resultant' activities because they involve from activities linked to the other two activities categories. Social activities take place spontaneously, as a direct consequence of people moving around and being in the same spaces. This implies that social activities are indirectly supported whenever necessary and optional activities are given better conditions. If the quality of outdoor environment is good, optional activities occur with increasing frequency. As levels of optional activity rise, the number of social activities increases. 'social activities' in the broadest possible sense are mainly the most common recreational and leisure pursuits one can carry out in urban centers, alone or in company.

Gehl stressed that there is a relationship between outdoor quality and outdoor activity, stating that outdoor quality of streets and squares can influence how many people will use them, how long the individual activities last and which activity types may develop.

Gehl noted some important physical conditions of public spaces that can increase or reduce social contacts:

Increase social contacts:

- no walls
- short distances between a place to a place
- narrow streets
- one level
- face to face orientation (seating spaces)
- active building frontage(frequent doors and windows facing the streets, detailed facades)

Reduce social contacts:

- walls
- long distances between a place to a place
- wide streets
- multiple level
- back to back orientation(seating spaces)
- negative building frontage (big buildings with long facades, blank walls, few windows and entrances)

2.2 The Four Influencing Factors and Relevant Literature Research

2.2.1 Pedestrian Density

Many researchers agree that some extent of pedestrian density is a precondition for street activities. Pedestrian density is defined as the mean number of people in a place at any given moment (Alexander1977).

Schumacher (1978) proposed that street activity occurs only if it is convenient for large numbers of pedestrians to use the street in various ways. Whyte (1980) mentioned that "Big cities have lots of people in their downtowns. This density poses

problems, but it provides a strong supply of potential users for open spaces in most parts of the central business district (*Whyte 1980. The Social life of Small Urban Spaces.P.P.90*).” In his studies of Copenhagen, Jan Gehl found a strong correlation between the number of people sitting on benches along the city’s main pedestrian way, and the number of people standing or walking. However, if pedestrian density is too high, it may discourage pedestrians’ social activities (Gehl, 1996). Walking demands space, and according to Gehl, the upper limit for an acceptable density in streets with two-way pedestrian traffic appears to be around 10 -15 pedestrians per minute per meter of street width. If the density is increased further, freedom of movement is more or less lost, thus people no longer meet, but rather begin to walk behind one another in ranks.

2.2.2 Quantity and Quality of Seating Spaces

Whyte (1980) and Gehl (1996) both reached similar conclusions in that the most popular plazas tend to have considerably more sitting space than the less popular ones. Seating spaces prolong pedestrian’s stays of duration in outdoor environments, create niches for many social activities like sun-bathing, chatting, playing chess, meeting friends or watching passersby. If these opportunities for sitting are few or bad, people just walk on by. This means not only that stays in public are brief, but also that many attractive and worthwhile outdoor activities are precluded (*Gehl1996. Life between Buildings .P.P157*).”

Quantity requirements:

In her book, *People Places: Design Guidelines for Urban Open Spaces*, Marcus Clare Cooper recommended one linear foot of seating for each thirty square feet of urban open space. Whyte (1980) mentioned that the ideal quantity of seating space is between 6 to 10 percent of total open space (1.8 to 3 square ft. of seating for 30 square ft. of urban open space). These latest figures are used in North American urban requirements, and might be low in consideration of the conditions of Chinese cities.

Quality requirements:

Through his observations, Whyte (1980) mentioned that a critical factor that influenced people’s choice of seating places was the sun. People usually prefer sunny seating areas. He further found that people were attracted to seating environments which provide a sense of enclosure. He also proposed the importance of providing both physically comfortable and socially comfortable seating places. Physically comfortable sitting spaces include sitting-benches with backrests, and well contoured chairs. Socially comfortable sitting is more important, and implies that potential sitters have the ability to make choices for themselves: sitting up front, in back, to the side, in the sun, in the shade, in groups, or off alone.

Gehl (1996) mentioned that seating places that provide a good view of surrounding activities are used more than those from which views are limited. Marcus (1998), Gehl (1996) and Whyte (1980) all discovered that chairs or ledges along buildings, steps, and walls alongside busy streets are some of the most popular

public seating places because these seating places provide both back protection and a good view of surrounding activities.

Whyte (1980), Carr (1992) and Marcus (1998) stressed the important role that movable seating plays in facilitating spatial claims. Movable seating provides people with the opportunity to claim and arrange space to fit their various behavioral needs, such as engaging in group conversations or finding a secluded spot for themselves.

We can generally conclude that good quality sitting spaces have the following attributes:

- a) good view of surrounding activities;
- b) back protection (benches with backrests; along building walls; under trees or under cornices);
- c) provides different sitting choices for people (in back or to the side; in the sun or in the shade; private or exposed; in groups or alone)

2.2.3 Attractions and Entertainment

Optional and social activities will increase if the pedestrian environment contains high levels of interest and aesthetics in terms of people, activities and events (Gehl 1996).

Individuals and events can influence and stimulate one another.

Attractions and entertainment in a pedestrian environment are features that can improve the delight taken in the act of walking and can include such things as people, outdoor exhibits, colorful storefronts, food facilities, sculptures, fresh flags and banners, water features, attractive landscaping, chance meetings, sidewalk cafes and anything else that results in the discovery of something new or vital in one's surroundings (Carr 1992, Robertson 1994 and Gehl 1996).

Whyte (1980) argues that streets should provide some external stimulus which can provide a linkage between people and prompt strangers to talk to each other. The stimulus can be a physical object or sight. Street performances, entertainers, street bands can have strong social effects.

Water features were emphasized by many researchers (Whyte 1980 and Carr 1992) as both attractions and entertainment in public spaces. Buker and Montarzino (1983) found that water was the single most desired feature, mentioned by 98 percent of their interviewees.

2.3.4 Dimension of the Pedestrian Environments

“Dimension” in English dictionaries mainly refers to “the magnitude of something in a particular direction (especially length or width or height)”. Dimension of pedestrian environments here refers to the width of street space for pedestrians.

Jacobs (1961), Whyte (1980), Gehl (1996), and a Chinese researcher, Wu (1999), all discussed that the dimension of street spaces in old cities correlates well with the human sensory apparatus and the number of people who use the spaces. Nowadays, street life is drastically reduced when small units are superseded by large units which are felt to be cold and impersonal, creating holes and voids in the city fabric. Gehl believes that over-dimensional streets disperse activities because there is a long

distance between people from one side of the street to the other in such spaces. Moreover, the possibility of passers-by experiencing simultaneously what is going on at both sides of the street is more or less lost. Gehl noted that in the range of 20-25 meters, most people can perceive the feelings and moods of others relatively clearly, and thus some pedestrian streets with a width more than twenty meters, or squares with a width more than forty meters, are oversized and not conducive to social interaction. Gehl advocated that “the system of public space should be as compact as possible and so that the distances for pedestrian traffic and sensory experiences are as short as possible (Gehl 1996. *Life between Buildings*. P.P.93.)” Pedestrian environments should be dimensioned in proportion to the number of prospective users, so that pedestrians move in an intimate, clearly defined space and do not “drift about” in a large, half empty areas. In appropriately dimensioned areas, the meetings become truly interesting and relevant in the social context.

Traditional Chinese commercial streets normally have a width of 6-8 meters. These narrow streets, with small spaces are perceived as intimate, warm and personal. (Figure2.1).

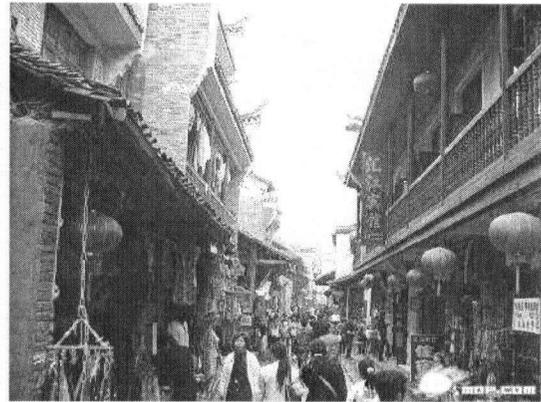


Figure2.1: A traditional commercial street, at Fenghuang city, China

(Source:<http://upload.mop.com/user/2005/04/21/a69af1b5.jpg>)

However, Chinese contemporary commercial centers have been designed differently, as the small-scale space of traditional commercial streets was no longer seen to accommodate pedestrian traffic due to increased levels of urban population and vehicular use (Wu1999). Contemporary Chinese downtown districts require unique dimensional standards due to pedestrian density distributions. Wu (1999) recommended a suitable width of 10-20 meters for the pedestrian streets in urban centers of Chinese metropolitan cities.

Table2.1: The list of the four focused factors and their corresponding researchers

| Influencing Factors | Corresponding Researchers |
|--|--|
| Pedestrian density | Schumacher(1978); Whyte(1980); Gehl(1996) |
| Quantity and quality of seating spaces | Whyte(1980); Gehl(1996); Marcus(1998)□ Carr(1992) |
| Attractiveness and entertainment | Whyte(1980); Robertson(1994); Gehl(1996); Carr(1992) |
| Dimensions of pedestrian environments | Jacob(1969);Whyte(1980); Gehl(1996) |

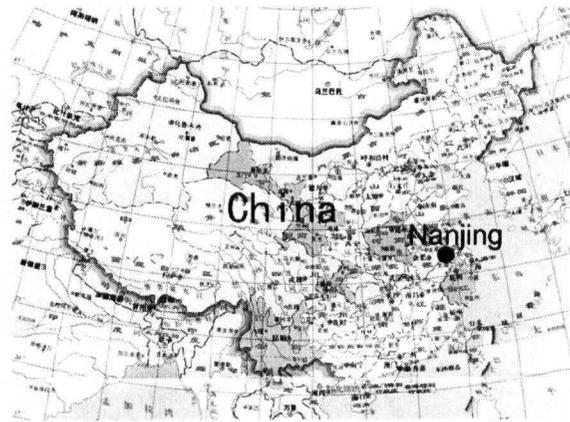
CHAPTER THREE: Study Area Background

3.1 Background Introduction

The study area is in Nanjing, a city with a two thousand years history, and the present capital city of Jiangsu province in China. Nanjing is located in the lower reaches of Yangtze river. The total population of Nanjing is 6,238,000, with the population of its urban area at about 4,435,000 (2000 National Population Census). Nanjing has four distinct seasons. Winter (December to February) is cold, with an average temperature in January of about 1.9c, lower temperatures in the winter go down to about -7c. Summer (June to September), is extremely hot, with the average temperature in July reaching about 28.2c. The highest temperatures in summer reach to about 37c.

Figure3.1: Nanjing’s location in China

(Source of the base map: <http://www.9654.com/m/china.htm>)



The study area in question is called Xinjiekou, and is the central business district of Nanjing. The core area of Xinjiekou is about 1.2 sq.km. The average population density is 42,000/sq.km. Xinjiekou has been Nanjing’s political, financial and commercial center since the Chinese Kuomintang government was founded in Nanjing in 1927. It develops along the intersection of the four main roads of the city, East-Zhongshan road, Zhongshan road, South-Zhongshang road and Hanzhong road. The oldest department store in Xinjiekou, Zhongyang department store, was founded in 1937.

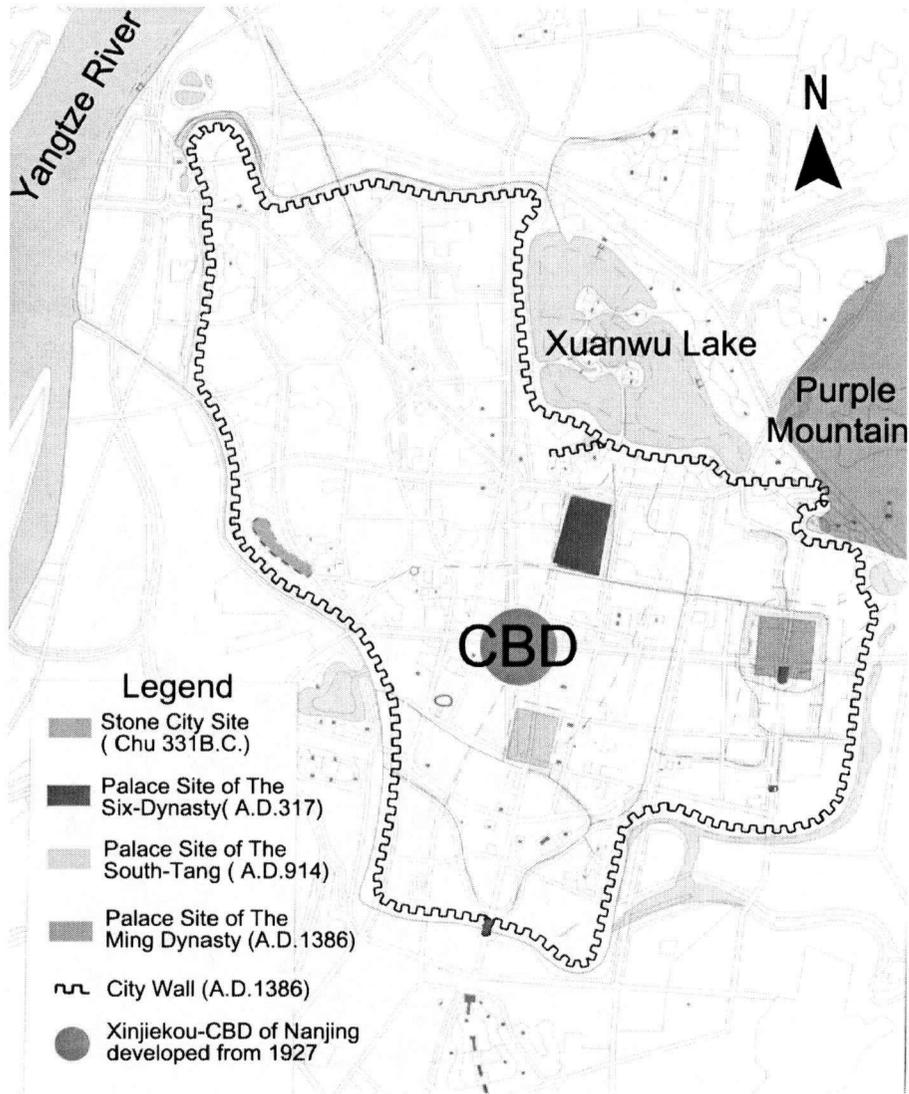
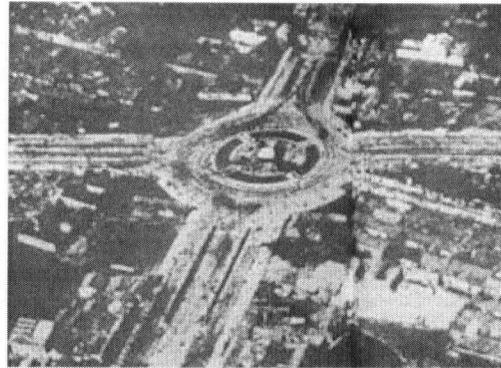


Figure 3.2: The location of Xinjiekou and some other historical remains in the city

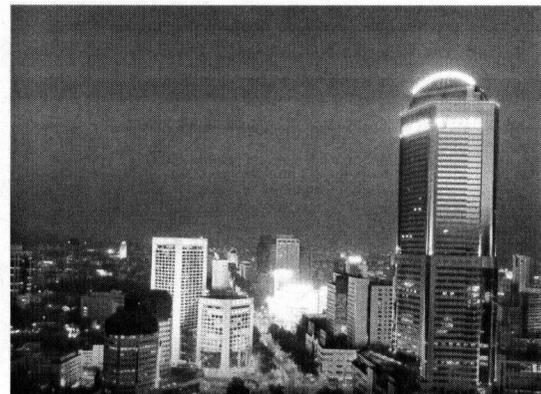
Figure3.3:Xinjiekou in early1930s
(Source: *Republic of China Meridian*.
Jiangsu Fine Arts Press. 2003.)



After the implementation of economic reform and open-door policy in 1980's, there has been a sharp increase of land use for retail, commerce, business, finance, catering and recreation in Xinjiekou. Xinjiekou has become the central business district of Nanjing. In 1984, the total commercial area in Xinjiekou was only 100,900 square meters. By 1996, the commercial area included an area of up to 2,740,000 square meters. From 1984 to the present, the number of large-scale department stores increased from 2 to 14. According to 2004 government statistics, during weekdays, the one-day pedestrian volume in Xinjiekou district is between 300,000 and 400,000. During special festival times such as during Spring Festival, National Day and Labour Day, the one day pedestrian volume rises to 1,000,000. Quite a number of pedestrians who come to Xinjiekou for shopping come from the nearby towns and cities such as Pukou, Liuhe, Lishui, Ma'anshan, Chuzhou, etc. Almost 30% of the total retail sales volume per year in Xinjiekou were achieved by people from nearby towns. Xinjiekou commercial district ranks third from among the top ten Chinese famous commercial streets because of its extremely high yearly retail sales volumes.

Figure3.4: Overlook Xinjiekou
district

Source:
[http://www.njtv.com.cn/njguide/
pic_intro.htm](http://www.njtv.com.cn/njguide/pic_intro.htm)



Open spaces in the study area include all the pedestrian environments on commercial streets. There are two main reasons for the lack of open spaces in

the study area. For one thing, the planning of parks and plazas has been restricted by the extremely compacted urban center of Nanjing, which was developed from the old urban district. Another reason for the lack of open spaces is that no scientific planning for public spaces was done in the past two decades during the early stages of urban renewal.

Pedestrian's general complaints about the study area involve three main aspects: pedestrians have difficulty in finding vacant seating places during peak hours and have to bear their fatigue and go on walking; lack of recreation facilities sometimes makes people feel bored and does not provide them with anything to do in their pedestrian environments; pedestrian activities are constrained in some pedestrian spaces due to congestion during peak hours. According to an interviews that were conducted with residents of Nanjing (Wu 1999), 64.6% of respondents thought that the most important aspect was the urgent need to increase rest areas for pedestrians in Xinjiekou.

3.2 Introduction of the Sub-areas within the Study Area

The study area includes Zhenghong pedestrian street and five street corner plazas: Xinbai, Zhongyang, Dongfang, Leifulai and Jinying.

Zhenghong pedestrian street, totally closed to auto-traffic, was built in 1993. It has four entrances, situated respectively in the north, south, west, and east directions. Zhenghong pedestrian street carries much of the pedestrian volume of Xinjiekou due to high density and a variety of commercial services around it and its pedestrian-oriented shopping environment.

The five street corner plazas, Xinbai, Zhongyang, Dongfang, Jinyin and Leifulai are also important pedestrian environments in the CBD of Nanjing. They have similar adjacent land use types, and the first several floors of their adjacent buildings are all department stores. Busy street corners were mentioned by many researchers (Whyte 1980) as spaces having a brisk social life of their own; they function not only as the pedestrian routeways, but also as the spaces for street life and activities. The five street corner plazas have different dimensions and design configurations, therefore, we can explore their various influences on life and activities through observing pedestrians' use of those street corners.

In short, Zhenghong pedestrian street and the other nearby five street corners were selected for study because they carry the main pedestrian flows in the CBD of Nanjing, and they are the only outdoor public open spaces in the compact city center.

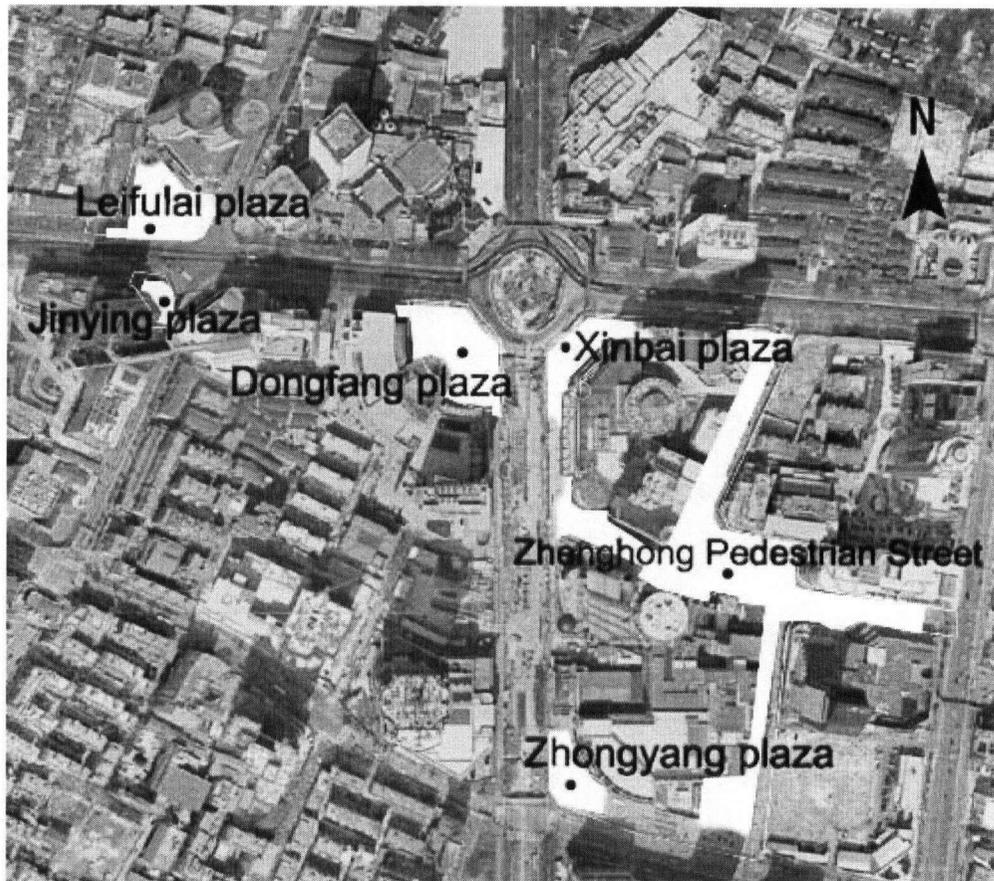


Figure 3.5: Open space distribution map

(Source of base map: *Nanjing Planning Bureau. Nanjing city 1:5000 Aerial Photo. 2003.*)



Figure 3.6: Land use map

Red color: commercial land use. Yellow color: residential land use

(Source of the base map: *Nanjing Planning Bureau. Nanjing city 1:5000 Aerial Photo. 2003.*)

From the map, we can see that the study area is totally surrounded by commercial land use. In the past of two decades, many residents were relocated out of the city center to new urban districts due to the commercial developments.

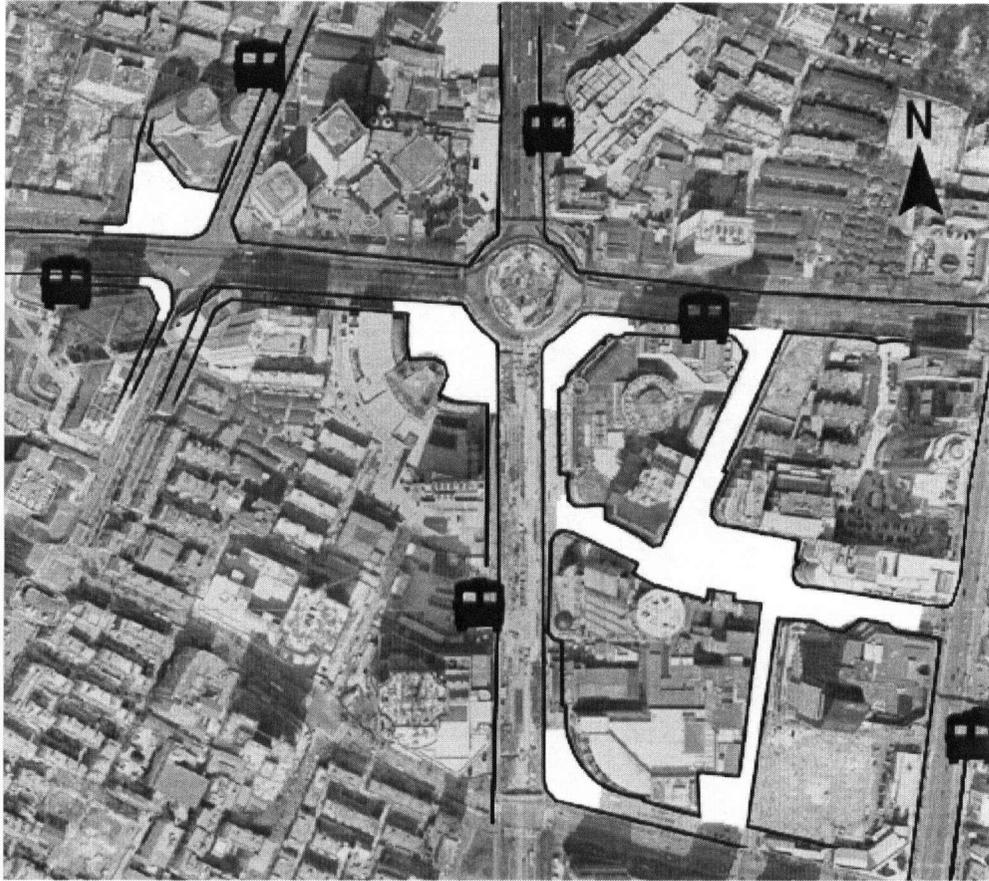


Figure 3.7: Public transit map
icons show the location of bus stops in the study area
(Source of base map: *Nanjing Planning Bureau. Nanjing city 1:5000 Aerial Photo. 2003.*)

Many of people travel to the CBD of Nanjing by subway, bus or bicycle. There are now more and more people going there by car due to the sharp growth in car ownership of recent years.

3.3 General Introduction of Pedestrian Activities in Study Area

Outdoor pedestrian activities in commercial environments can be classified into two broad categories: consumption activity and non-consumption activity (Wu 1999). Consumption activity refers to purchasing activity, such as retail activity. Pedestrians' non-consumption activity can be generalized as the combination of various activities such as walking, standing, talking, sitting, playing, with these activities sometimes done in combination.

The following is a general introduction to the non-consumption activities in which pedestrians are involved within the study area:

1) Walking

Walking can be broadly divided into two types: walking intentionally and walking randomly. Walking intentionally includes walking for the purposes of going to or from work, going to stores with the intent of buying something, going to restaurants or cinemas, etc. Walking randomly is a kind of slow and incoherent walking activity, where pedestrians usually walk for a while, then stop to watch something, then walk on. Walking randomly has no clear intention, it is like “strolling”.

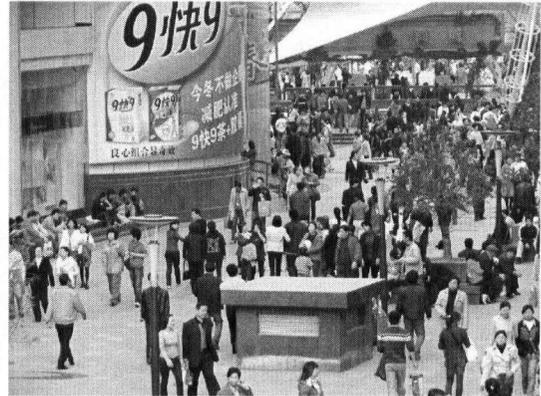


Figure3.8: Pedestrian walking on Zhenghong pedestrian street

2) Standing

Standing activity occurs in many situations such as when waiting for someone, happening to meet some acquaintances and exchanging of conventional greetings, or standing still to read something such as a demonstration board, to watch a movie screen, or to watch outdoor commercial shows and sales promotion usually presented around entrances of departments stores, etc.



Figure3.9: People standing around the commercial show at the center of Zhenghong pedestrian street



Figure3.10: People standing around the commercial show at the entrance of Zhongyang department store

Figure3.11: People standing at the entrance of a restaurant on Zhenghong pedestrian street



3) Sitting

In commercial environments, most pedestrians eventually need to sit for a rest. Sitting is a common and frequent pedestrian activity type. People like to sit to read newspapers, or have a drink, talk with friends, to play card games, or just sit to watch passersby, etc.

Figure 3.12: People sitting on a shrub planter at Zhenghong pedestrian street



4) Playing

Playing includes children playing in the fountain, playing on skateboards, or older people playing card games, etc.

Figure3.13: Children playing in the fountain at Zhongyang street corner



In the study, I define “social activities” in the broadest possible sense. This includes most of the common recreational and leisure pursuits one can carry out in urban centers, alone or in company.

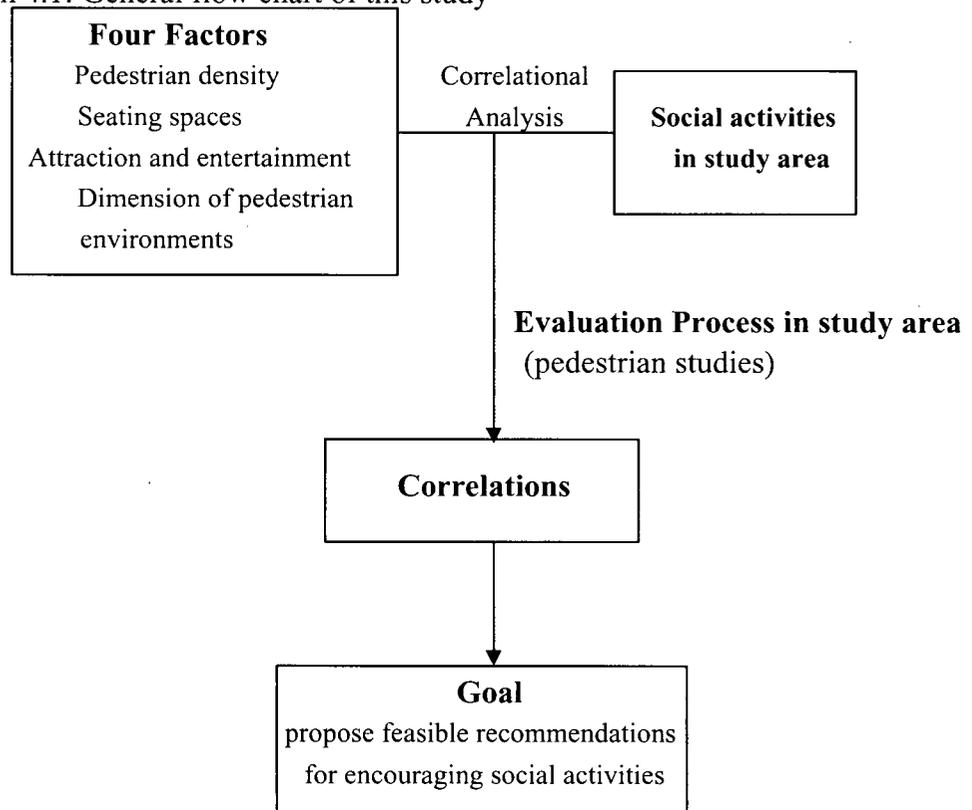
CHAPTER FOUR: Methodology

4.1 General Introduction of the Study Process

The final goal of the study is to propose feasible recommendations for solving some concrete problems related to the four focused factors in order to encourage pedestrians' social activities.

To achieve this goal, the method used is to evaluate the four factors examined in the study area in order to discover how they interact with pedestrians' social activities. Pedestrian studies were applied as the basic methodology in the evaluation process.

Diagram 4.1: General flow chart of this study



4.2 Review of Pedestrian Studies

Pedestrian studies were applied in the evaluation process in this study in order to explore the interactions between the four factors and pedestrians' social activities. Pedestrian studies, as they were applied in this study include both quantitative and qualitative aspects. Quantitative aspects focus on pedestrian density and capacity. Qualitative aspects focus on pedestrian behavior patterns. Pedestrian studies is often the best research method through which to understand the activities of pedestrians.

To begin, a brief review of the work done by authors who have applied pedestrian studies in their research was undertaken. The method, as a tool for recording some aspects of human behavior patterns has been used by many researchers. Lynch(1959)

recorded responses from pedestrians, in the city of Boston for the search for order in the environment. Whyte (1980) observed the social life of small urban spaces to study the possible reasons why some city spaces work for people, and some do not. Hass-Klau, Dowland and Nold (1994) studied street life in ten town centers in Britain, Germany and Italy, to explore the principles of creating livable urban spaces. Gehl (1996) applied pedestrian studies as a method of evaluation of the quality of city life in order to show the significant changes in pedestrian usage after the pedestrianization of Copenhagen's city center.

Table 4.1: Pedestrian studies used in this research and researchers of relevance

| Category | Detailed Pedestrian Studies in the study | Researchers and Publications |
|-----------------------------|--|--|
| Quantitative Aspects | 1) Pedestrian volumes at different time of a day (hourly pedestrian volume from morning to night on a day) | Gehl, J. <i>Public spaces, Public life</i> . 1996. |
| | 2) Pedestrian flow rate (highest two-way pedestrians per minute per meter of street width) | Gehl, J. <i>Life between buildings</i> . 1996 |
| | 3) The number of stationary activities (the total number of people sitting, standing, playing at a specific time in each sub-area) | Gehl, J. <i>Public spaces, Public life</i> . 1996. |
| | 4) The proportion of pedestrians involved in stationary activities including sitting, standing, children playing, etc. (calculate the total number of people involved in stationary activities as compared to the total number of people at a specific time in each sub-area) | Gehl, J. <i>Public spaces, Public life</i> . 1996. Hass-Klau, C., Dowland, C., and Nold, I. <i>Streets as living space: A Town Centre Study of European Pedestrian Behavior</i> . 1994. |
| Qualitative Aspects | 1) Behavior mapping of pedestrian's stationary activities (different icons were drawn on the plan of each subarea to represent different activity types) | Hass-Klau, C., Dowland, C., and Nold, I. <i>Streets as living space: A Town Centre Study of European Pedestrian Behavior</i> . 1994. |
| | 2) Mapping of pedestrian's walking flows (Use dotted lines to reflect pedestrian flow distributions in | Hass-Klau, C., Dowland, C and Nold, I. <i>Streets as living space: A Town Centre Study of European Pedestrian Behavior</i> . 1994. |

| | | |
|--|---|--|
| | each sub-area) | |
| | 3) Direct observation of pedestrian's activities (walking, standing, sitting, etc.) | Gehl, J. <i>Life Between Buildings</i> . 1996. Whyte, W. <i>The social life of small urban spaces</i> . 1980. Marcus, Clare.C. <i>People places: design guidelines for urban open spaces</i> . 1998. |

4.3 Detailed Methods Applied in the Evaluation Process

4.3.1 Other Influencing Factors

Other factors such as microclimate, demographics, quality of spaces, and programming effects actually influence pedestrians' use of street to a certain extent. However, I deem that they are not the vital factors through the analysis of the conditions of the study area. To explore the four focused factors (pedestrian density, quantity and quality of seating spaces, attractions and entertainment, and dimensions of pedestrian environments) in a more rational way, I choose April as the observation month. April in Nanjing is a comparably comfortable season during a year, there is no hot sun or cold wind, pedestrian's choice of seating and walking is not mainly influenced by the weather protection purpose. The aesthetic quality of a pedestrian environment also influences people's choice of seating or public facilities, however, this kind of influence is minor in the study area. In the whole study area, the design style of every pedestrian environment is very similar, furthermore, the high pedestrian density and the lack of seating and public facilities make people no more opportunities to select especially during on-peak hours. Commercial shows or sale promotions in the study area usually attracted a huge number of people to watch, the pedestrian density is extremely high at the space around such events, so I choose a normal day without special events to do the observation, thus the data collected in each sub-area will accurately reflect the true condition if there are no programming effects.

4.3.2 Introduction

The observation data and its subsequent analysis will be organized as a research report in Chapter Five.

The whole study area was divided into ten sub-areas for the purpose of recording the observation data: north part (N), south part (S), west part (W), east part (E) and central part (C) of Zhenghong pedestrian street; Zhongyang (Z), Xinbai (X), Dongfang (D), Jinying (J) and Leifulai (L) street corner plazas.

In order to make the comparisons between each sub-area more coherent, some data, such as pedestrian volume, was collected on the same day; the number of stationary activities and the proportion of pedestrians involved in social activities in each

sub-area were collected at the same time on one day. In order to achieve this, the author trained nine other students to help record the observational data.

Tables, diagrams and mapping were applied in order to clearly record some observation data. All the original hand-written drafts were changed into computer generated tables, diagrams and mappings.

Two kinds of pedestrian mapping were applied in the study: mapping of pedestrian behavior and mapping of pedestrian flows.

Mapping of pedestrian behavior and pedestrian flows can clearly show the relationship between activity and the surrounding environment.

Pedestrian behavior mappings (Appendix 1-10):

The position of street furniture, landscape elements and adjacent ground-floor land use types were shown on all sub-area plans, with different icons drawn to represent different types of activity.

From pedestrian behavior mappings, we can discover:

- 1) pedestrians' preferences for the locations of some social activities;
- 2) types of attractions or entrainment that can attract pedestrians to linger

Pedestrian flow mappings (Appendix a-j):

Use dotted lines to reflect pedestrian flows in each sub-area.

From pedestrian flow mappings, we can discover:

- 1) pedestrians' general walking patterns;
- 2) position of major and minor pedestrian flows in each sub-area (pedestrian density distribution on a site scale)

4.3.3 Detailed Process of Recording Data

- Record pedestrian counts per minute and hourly pedestrian volume:

Date: Wednesday 6 April 2005,

Weather: clear, mild

Time: from 9:00 am to 11:00 pm,

One observer stood at one measuring station, four measuring stations are at the entrance of the north part, south part, west part and east part of Zhenghong pedestrian street, the other five are at the five street corners.

- Pedestrian counts per minute:

Each observer used a stopwatch, counted the two-way pedestrians in one minute starting respectively from 9:00 am, 10:00am, 11:00 am ...to 11:00pm. The total number of observation times in each sub-area is 15. They wrote down the data. I put these data collected respectively from each sub-area into computer line charts. These line charts reflect the variation of pedestrians per minute during a day. The highest two-way pedestrians will be used to calculate the highest flow rate later.

- Hourly pedestrian volume:

The calculation of hourly pedestrian volume is based on the estimation of average two-way pedestrians per minute in an hour. For example, 10 people were counted in one minute starting from 9:00 am, 18 people were counted in one minute starting from 10 :00 am, I presumed that the average number of pedestrians per minute during 9:00 am to 10:00 am is the mean value of 10 and 18, which equals $14\{(10+18)/2=14\}$, so the hourly pedestrian volume during 9:00 am to 10:00 am at

this measuring station is about 840(14 pedestrians per minute x 60 minutes). The data of hourly pedestrian volume may not be very accurate, but they won't influence any other data and results because the purpose for estimating hourly pedestrian volumes is just to draw a column chart to reflect the variation of pedestrian volumes during a day.

- Record the variation of social activities during a day

Date: April 11 2005

Time: from 7:00 am to 23:00 pm

The number of social activities is measured by the number of stationary activities including sitting and standing.

Use one sub-area(north part of Zhenghong pedestrian street) as a sample to record the number of people sitting and standing at 17 observation times during a day. Every observation time started at 7:00 am, 8:00 am, 9:00am ...23:00 pm, total number of observation times is 17. For example, there were total 10 people sitting and 15 people standing at 9:00 am, so 10 people sitting and 15 people standing were wrote down. Then I put these data into a computer line chart to reflect the variation of social activities during a day.

- Record the number of stationary activities in each sub-area at the same observation time, draw the pedestrian behavior mapping and pedestrian flow mapping of each sub-area

Date: Saturday April 30, 2005

Weather: mild

Time: begin at 5:30 pm

Each observer stood respectively at each sub-area, counted the number of stationary activities including people sitting, standing and children playing at 5:30 pm on April 30, and wrote down these numbers. Then they immediately counted the total number pedestrians (the total number of people who were sitting, standing and walking) in each sub-area. I used two data (total number of stationary activities and total number people) to calculate the proportion of people involved in social activities. For example, 10 people sitting, 18 people standing, and 2 children playing were recorded as the number of stationary activities at 5:30 pm in one sub-area, and 80 people were counted as the total number of people at the same time in that sub-area, thus, the proportion of people involved in social activities is 37.5% $\{(10+18+2)/80\}$.

-Draw pedestrian behavior mappings of each sub-area

I first drew a detailed plan draft for each sub-area including building contour lines, seating spaces, public facilities and landscape elements, and I also labeled adjacent commercial service types. Every observer had such a draft in hand at their measuring stations. I let them draw some sample icons on the plan to represent activity types including single people standing, group people standing,

people sitting and children playing. When they observed those activities, they drew the corresponding icons on the plan draft. These pedestrian behavior mappings clearly showed the locations of activities.

- Draw pedestrian flow mappings of each sub-area

Observation of pedestrian's walking flows started immediately after finishing the record of pedestrians' stationary activities mentioned above. The time around 5:30 is a good time for observing pedestrians' walking patterns because during peak hours, there were many passer-by pedestrians, which easily formed pedestrians' walking flows, and thus those walking patterns were easily observed.

Each observer had another copy of the above mentioned plan draft of the corresponding sub-area in hand. They drew dotted lines on the draft, to show the major and minor pedestrian flows they observed. This observation process lasted for several to ten minutes, after finishing drawing, every observer spent a few more minutes to re-examine the walking patterns they already drew through observing pedestrian flows once again.

4.3.4 Rationale of the Evaluation Process

The four measurements will be evaluated in the study area to find their correlations with pedestrians' social activities. Pedestrians' social activities in the study area will first be evaluated.

(S)Social activity:

Social activity in the study area is evaluated through the following:

S1) The intensity of social activities during a day

Use of one sub-area as an example to record the number of social activities (sitting and standing), from morning to night on one specific day (Diagram 5.1);

Purpose: to reflect the variation in the intensity of social activities at different times during a day

S2) The intensity of social activities in each sub-area

The intensity of social activities in each sub-area is evaluated in the following three ways;

S2-1) Number of stationary activities (sitting, standing, children playing) within each sub-area at a certain time of day (Diagram 5.2)

S2-2) Proportion of people involved in social activities within each sub-area at a certain time of day (Diagram 5.3)

Not all the people in any one place are involved in social activities; some are involved in necessary activities, and some are involved in social activities. To calculate the proportion of people involved in social activities, one needs to calculate the total number of people involved in stationary activities (eg: sitting, standing, playing, etc) as compared to the total number of people at a specific time in each sub-area.

S2-3) Social activities types

Purpose of S2-1), S2-2) and S2-3): to compare the intensity of social activity between each sub-area

The following are the detailed evaluation methods for the four influencing factors:

A: Pedestrian Density:

Pedestrian density is evaluated in the following three ways:

A1) Hourly pedestrian volume from morning to night on a specific day in each sub-area (Diagram5.5-Diagram5.13);

Purpose: to reflect the variations of pedestrian density at different times of a specific day

Correlational analysis between A1) and S1):

Purpose: to discover if there is a correlation between pedestrian density and the intensity of social activities on a specific day

A2) Pedestrian flow rate (two-way pedestrians per minute per meter width) of each sub-area (Table 5.1 and Diagram 5.14);

Purpose: to reflect the general pedestrian density distribution in the study area and compare the pedestrian densities between each sub-area

Correlational analysis between A2) and S2-1):

Purpose: to discover if there is correlation between pedestrian density and the number of social activities

Correlational analysis between a2) and S2-2):

Purpose: to discover if there is correlation between pedestrian density and the proportion of pedestrians involved in social activities

A3) Pedestrian flow distribution of each sub-area (Appendix a-j)

Purpose: to discover major and minor pedestrian flows at the site scale (pedestrian density distribution at the site scale);

to discover some areas of pedestrian congestion;

to discover the relationship between social activities and the distribution of pedestrian flows (based on the analysis between Pedestrian Behavior Mappings for each sub-area and Pedestrian Flow Mappings for each sub-area)

B: Quantity and Quality of Seating Spaces

Quantity of seating spaces is evaluated in the following two ways:

B1) On-peak observation (observation of the conditions of use of seating spaces during peak hours);

Purpose: to discover if the quantity of seating spaces is favorable for pedestrian use

B2) Calculation of seating quantity(Table5.2)

Purpose: to compare the existing seating quantities within each sub-area with conventional requirements [Marcus (1998) proposed that optimal seating would equal one linear foot of seating for each thirty square feet of urban open space.].

Quality of seating spaces is evaluated in the following two ways:

B i) General evaluation according to the conventional requirements for quality seating clarified in Chapter Two

B i i) Off-peak observation (observation of the conditions of the use of seating spaces during off-peak hours)

Whyte considered that off-peak use provided the best clues regarding people's seating preferences. During off-peak hours, when people have more choice with regard to seating spaces, they normally begin by taking what they consider to be good quality seating spaces. Therefore, we can gain insight about what are considered to be good or bad quality seating spaces through observing people's preferences during off-peak hours.

C: Attractions and entertainment

Attractions and entertainment in the study area is evaluated by on-site observation of the existing attractiveness and entertainment in the study area (Table 5.3).

Purpose: to discover pedestrians' preference for attractions and entertainment within the study area

D: Dimension of the pedestrian environment

The dimension of the pedestrian environment is evaluated in the following two ways:

D1) Street capacity of each sub-area

Calculate highest two-way pedestrians per minute per meter of street width (Table 5.4)

Purpose: to compare the street capacity of each sub-area with the upper limits for pedestrian flow rates [Gehl (1996) proposed that 10-15 people per minute per meter of street width is the upper limit] to discover whether or not the existing street spaces can accommodate the highest pedestrian flows.

D2) The intensity of social activities at the five street corner plazas

Each of the five street corners in the study area have distinct dimensions (large dimension: over 40m, medium dimension: 20-25m, small dimension: under 15m). The condition of pedestrians' use of street space was observed respectively at all five street corners (Table 5.5).

Purpose: to discover the correlation between the dimensions of street space and the intensity of social activities

4.3.5 Summary

According to the evaluation process of the four factors in the study area and their correlational analysis with pedestrians' social activities, we can discover the interrelationship between each factor and pedestrians' social activities. The results of these interrelationships are summarized in Chapter five. Findings and recommendations will be proposed in Chapter Six.

CHAPTER FIVE: Research Report

Chapter Five summarizes the evaluation process of the four factors under assessment in the study area, and examines their correlation with pedestrians' social activities.

There are ten measuring stations within the study area. Zhenghong pedestrian street is divided into five parts which are recorded in the observation: north part (N), south part (S), west part (W), east part (E) and central part (C). The other five street corner plazas are as follows: Xinbai (X), Zhongyang (Z), Dongfang (D), Jinying (J) and Leifulai (L).

Figure5.1: Overview photo of each sub-area



5.1 Social Activity

5.1.1 The Intensity of Social Activities at Different Times of a Day

In the early morning, few people were on the streets and most seating spaces were vacant. As noon approached, more and more people began to walk on streets, sit on benches, or stand singly or in group at the entrances of stores. In the afternoon, between 3:00 pm and 5:00 pm, the number of people decreased and the intensity levels of social activities being carried out were modest. At nightfall, between 6:00 pm and 8:00 pm, another peak time occurred when the intensity of social activities reached their peak levels for the day. In the evening, the number of pedestrians decreased rapidly. A record of the number of people sitting and standing at the north part of Zhenghong pedestrian street from 7:00 am to 12:00 pm on Monday, April 11, 2005 (Diagram 5.1) shows the variation of intensity of social activities during a day.

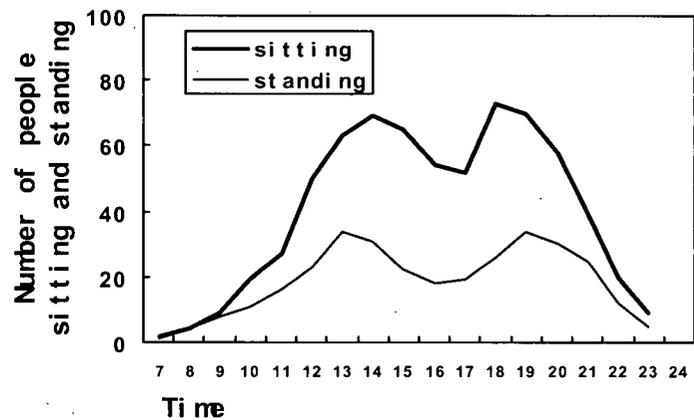


Diagram5.1: The number of people sitting and standing from 7:00 am-12:00pm (Monday, April 11, 2005), at the north part of Zhenghong pedestrian street

5.1.2 The Intensity of Social Activities in Each Sub-area

The intensity of social activities is evaluated in three ways:

- An examination of the number of people involved in most frequent stationary activities including sitting, standing, children playing;
- The proportion of people involved in social activities
- Social activities types

The observation took place on Saturday, April 30, 2005 at 5:30 pm. No special events such as commercial shows or sales promotions were in evidence at the time.

Number of stationary activities

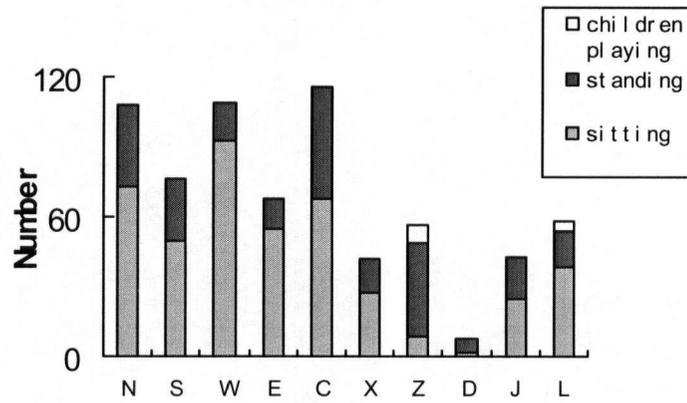


Diagram5.2: The number of stationary activities on Saturday, April 30 at 5:30 pm.

Proportion of people involved in social activities



Diagram5.3: The proportion of pedestrians involved in stationary activities at 5:30 pm on Saturday, April 30.



Diagram 5.4: The number of stationary activities in each sub-area at 5:30 pm on Saturday April 30, shows on base map of study area.

5.1.3 Brief Summary

There are two periods of time in a day that the intensity of social activities is the highest: at noon and nightfall.

According to the comparison of different sub-areas in the study area, we can find that Zhenghong pedestrian street normally has the highest number of people involved in sitting (366) and standing (153). Leifulai street corner has the highest proportion of people involved in social activities (51.5%), and Zhongyang street corner has the second highest proportion (48.7%). The activity of children playing was only found at Leifulai and Zhongyang street corners. Dongfang street corner plaza recorded the lowest number of stationary activities (2 people sitting and 6 people standing) and the lowest proportion of people involved in social activities (9.5%).

5.2. Pedestrian Density

Pedestrian density is evaluated in three ways: the pedestrian volume at different times of a day, pedestrian flow rates (two-way pedestrians per minute per meter width), and pedestrian flow distribution. The purpose of recording the pedestrian volume per hour from morning to night in a day is to reflect the variation of pedestrian densities at different times of a day; the purpose of recording the pedestrian flow rate is to compare the pedestrian densities between each sub-area; the purpose of recording pedestrian flow distribution is to discover major and minor pedestrian flows at the site scale.

5.2.1. Pedestrian Densities at Different Times of a Day

Recording was done of two-way pedestrians per hour, and pedestrians per minute, at nine observation points.

Four in Zhenghong pedestrian street:

west entrance (Diagram5.5), north entrance (Diagram5.6),
east entrance (Diagram5.7), and south entrance(Diagram5.8).

Five street corner plazas:

Dongfang (Diagram5.9), Xinbai (Diagram5.10),

Zhongyang (Diagram5.11), Jinying (Diagram5.12) and Leifulai (Diagram5.13)

Observation time: 9 am to 11 pm, Wednesday April 6th, 2005.

Weather: sunny, temperature: 20c- 25c

Diagram 5.5-Diagram5.13: Two way pedestrian counts per hour and per minute at the nine observation points

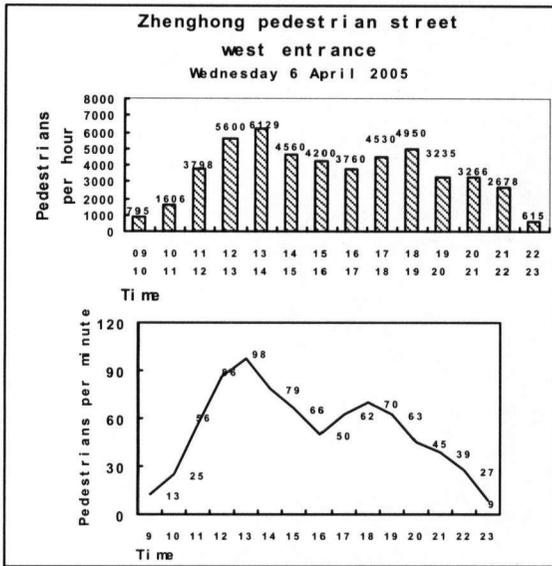


Diagram 5.5

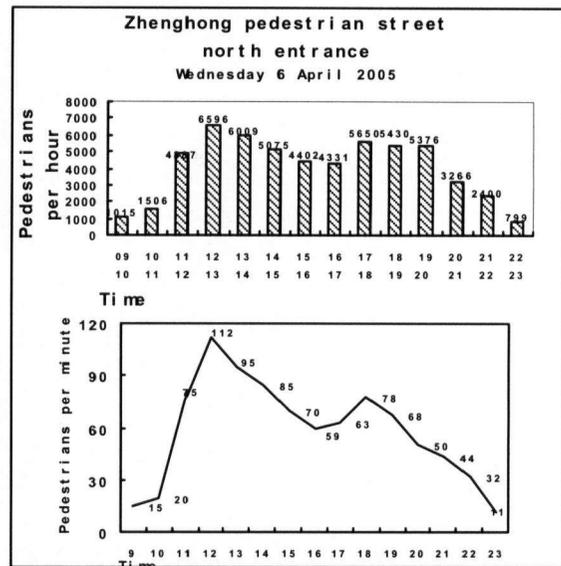


Diagram 5.6

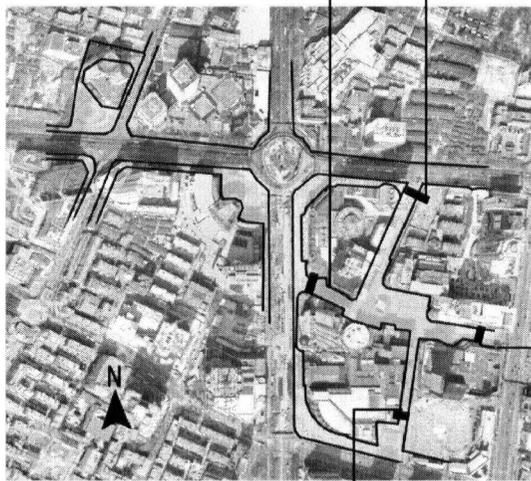


Diagram 5.8

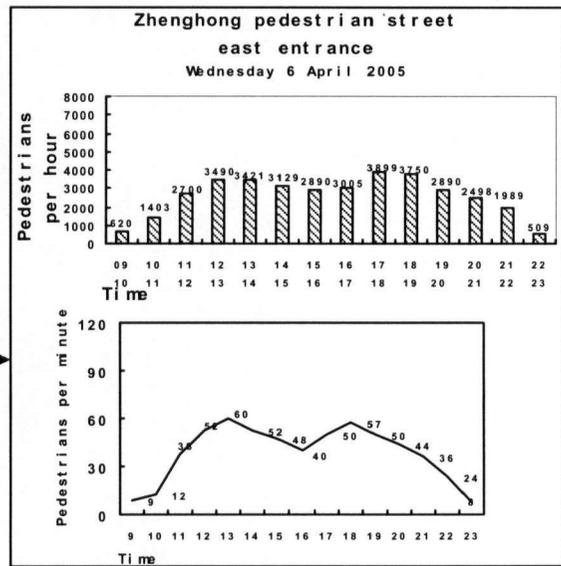
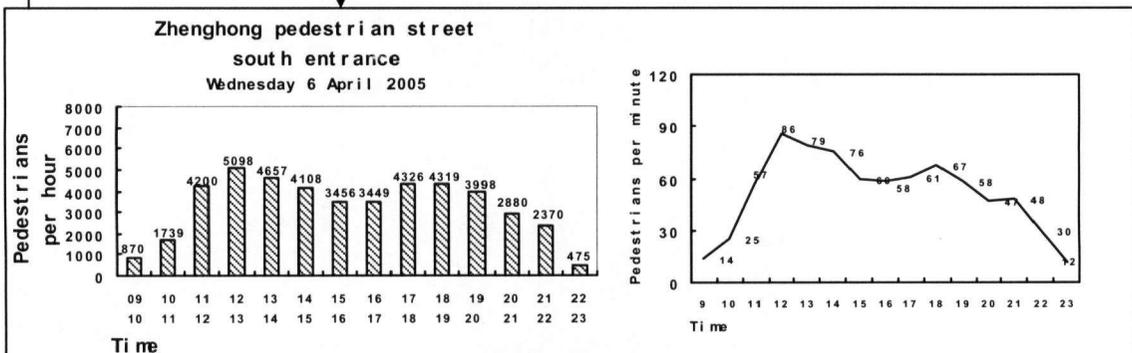


Diagram 5.7



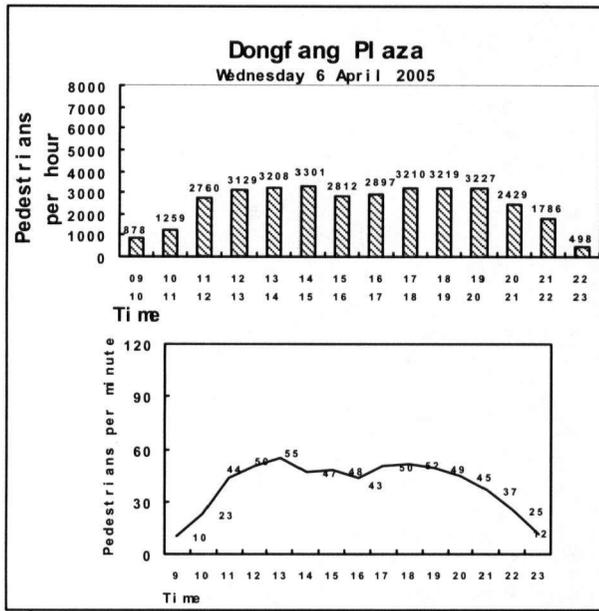


Diagram 5.10

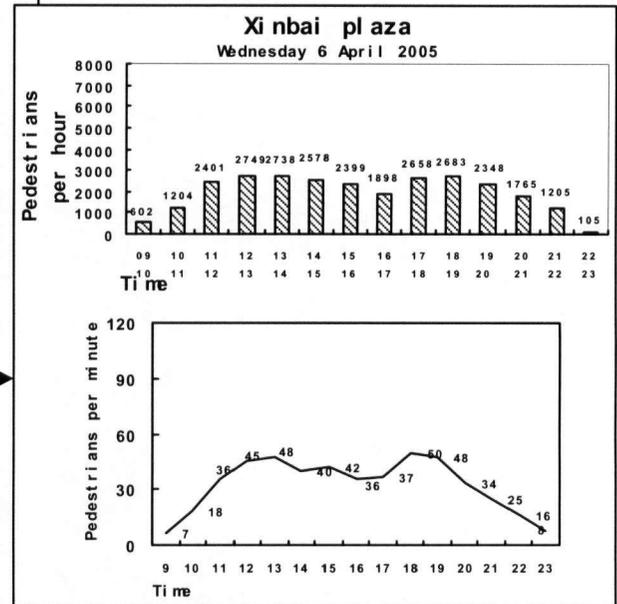


Diagram 5.9

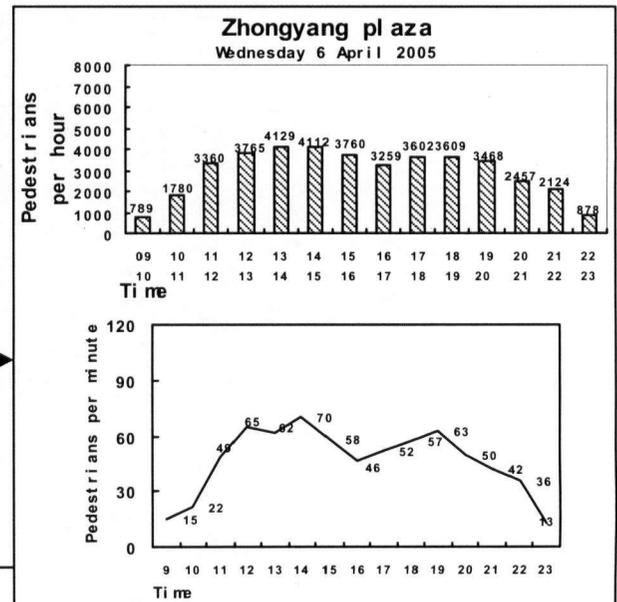
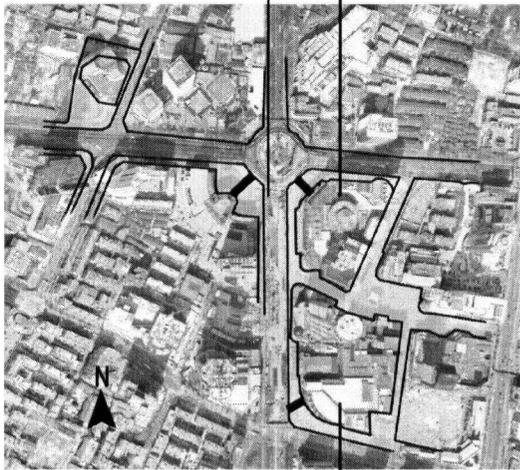


Diagram 5.11

Diagram 5.12

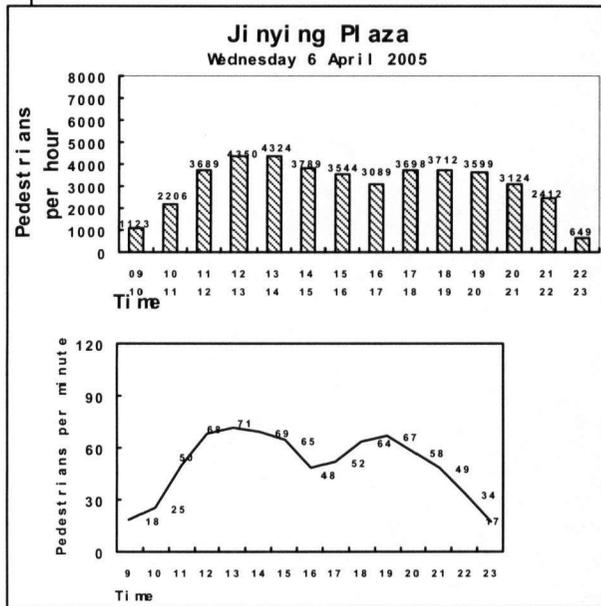
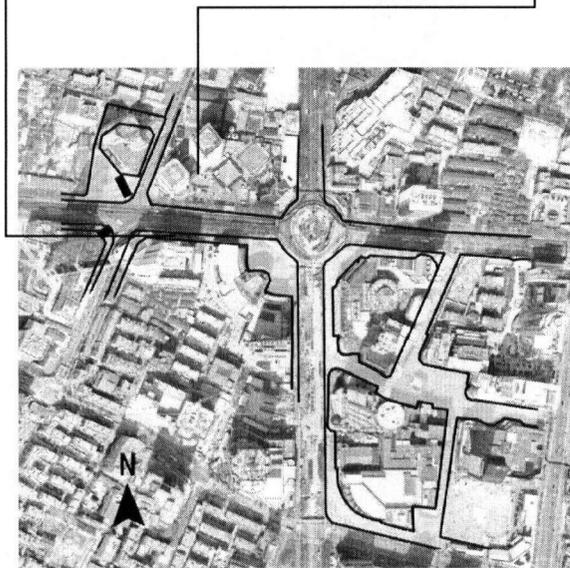
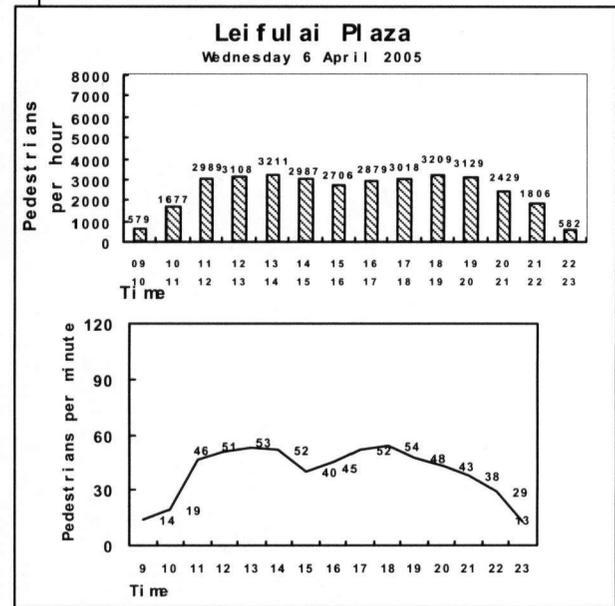


Diagram 5.13



5.2.2 Pedestrian Density in Each Sub-area

The pedestrian density in each sub-area is evaluated by the pedestrian flow rate (two-way pedestrians per minute per meter of street width). The highest flow rate in the nine observation points will be calculated based on two sets of data: average pedestrians per minute in peak hours, and the walkable street width.

Table 5.1: Pedestrian density of each sub-area

| | Walkable Width | Highest Pedestrians Per minute | Two-way Per | Flow rate □ pedestrians per minute per meter street width□ |
|--|----------------|--------------------------------|-------------|---|
| Zhenghong pedestrian street - north part (N) | 14.3m | 121 | | 8.4 |
| Zhenghong pedestrian street - south part(S) | 12.2m | 86 | | 7 |
| Zhenghong pedestrian street - west part(W) | 14.9m | 98 | | 6.5 |
| Jinying street corner (J) | 12m | 71 | | 6 |
| Zhongyang street corner (Z) | 16m | 70 | | 4.3 |
| Zhenghong pedestrian street- east part (E) | 18.8m | 60 | | 3.19 |
| Leifulai street corner(L) | 28 | 56 | | 2 |
| Xinbai street corner (X) | 25m | 48 | | 1.92 |
| Dongfang street corner (D) | 52m | 52 | | 1 |

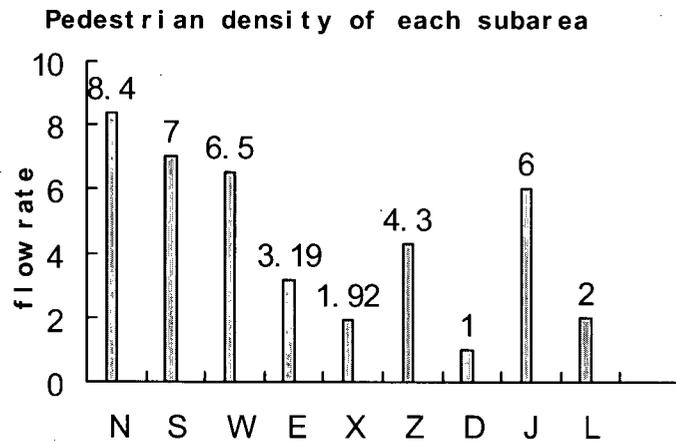


Diagram 5.14: Pedestrian density of each subarea

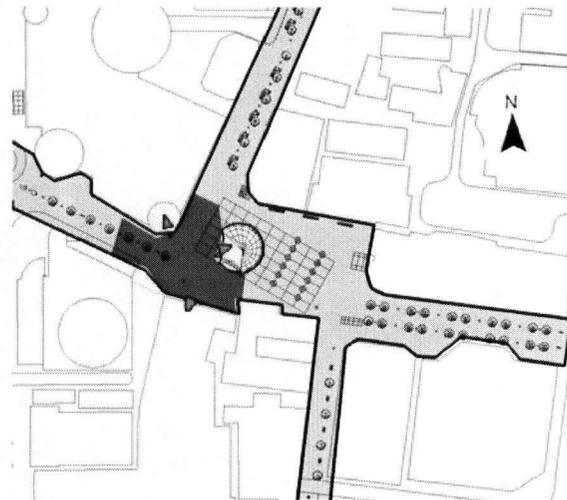
5.2.3 Pedestrian Flow Distributions at the Site Scale

According to pedestrian flow mappings of Zhenghong pedestrian street (Appendix a-e), we can see that the spaces near the entrances of large-scale commercial services (eg: department stores, shopping malls) have comparably much denser pedestrian flows than other places. Most pedestrians prefer to shop in department stores and shopping malls. Spaces in the vicinity of jewelry and men's wear stores, tea bars and cafés, usually experience lower rates of pedestrian flows (Appendix a, Appendix e). If

the attractive commercial services (eg: department stores, shopping malls, clothing stores, etc.) are densely arranged along one side of a pedestrian street, while the other side is occupied by less attractive commercial services (eg: man's wear, tea bars, cafés, jewelry stores, etc.), this kind of unbalanced distribution of commercial services normally results in an unbalanced distribution of pedestrian flow. Pedestrian flows along the more attractive side are much denser than pedestrian flows along the less attractive side (Appendix a).

The area with densest levels of pedestrian flow (Figure5.2) on Zhenghong pedestrian street was found in the area of the highest concentration of entrances to large-scale commercial services. There are three entrances of large-scale commercial services (two department stores, one underground shopping mall) directly facing this small space. This space is usually crowded with pedestrians due to a large volume of people entering and exiting the buildings.

Figure5.2: The area with densest levels of pedestrian flow on Zhenghong pedestrian street. The shade area: the area with densest levels of pedestrian flows
Red arrow: entrances of department stores or a shopping malls.



Based on the analysis of the pedestrian behavior mapping of Zhenghong pedestrian street (Appendix 1-5) and pedestrian flow mapping of Zhenghong pedestrian street (Appendix a-w), we see that the spaces with denser pedestrian flows have comparably more social activities occurring on them, especially the activity of standing.

5.2.4 Pedestrian Density and Social activity

1) Pedestrian density and its effect on social activity at different times of a day

According to Diagram 5.1 (The number of social activities at different times of a day), and Diagrams 5.5-5.13 (Pedestrian volume at different times of a day), we see that the number of social activities engaged in increased with increasing levels of pedestrian volumes. There are two periods of peak time for pedestrians and social activities: noon and nightfall.

2) Pedestrian density of each sub-area and their effect on social activities

Zhenghong pedestrian street recorded the highest number of people involved in social activities (Diagram 5.4), as well as the average highest pedestrian density

(Diagram 5.14); Xinbai street corner (X) and Dongfang street corner (D) had the lowest number of people involved in social activities, and their pedestrian density was the lowest.

3) Pedestrian density on a local scale and its effect on social activities

On a local scale, the places with dense pedestrian flows recorded a comparably greater number of social activities than the places which were distant from major pedestrian flows (Appendix 1-10, Appendix a-j).

Based on the above analysis, we can conclude that there is a strong correlation between pedestrian density and the number of people involved in social activities. Normally, the higher the pedestrian density, the higher the number of people involved in social activities.

However, no correlation was found between pedestrian density and the proportion of people involved in social activities (Diagram 5.3, Diagram 5.14).

The pedestrian density of Leifulai plaza (L) is not high, but the proportion of people involved in social activities is the highest from among all the sub-areas.

High pedestrian density of a given place does not necessarily guarantee the presence of pedestrian engagement in various social activity types. Zhenghong pedestrian street recorded the highest average number of people sitting and standing, but children were seldom found playing there. The activity of children playing was only found at Zhongyang street corner plaza (Z) and Leifulai street corner plaza (L).

5.3 Quantity and Quality of Seating Spaces

5.3.1 Quantity Evaluation

The evaluation of the quantity of seating spaces is based on on-peak observation and the calculation of seating quantity (m/m^2). According to the on-peak observation of the intensity of the use of sittable spaces, we can determine whether the quantity of seating spaces is enough or not. According to the calculation of seating quantity, we can compare the existing quantity of seating spaces in each sub-area with the conventional requirement.

5.3.1.1 On-peak Observation

Except for the seating spaces located at east part of Zhenghong pedestrian street and Leifulai street corner, seating spaces in much of the study area were not able to accommodate the volumes of pedestrian use during peak hours. No matter whether seating spaces were formal, such as benches, chairs and ornamental planters or informal, such as steps at entrances, bollards, or building niches, all were found to be densely occupied.

5.3.1.2 Comparison with Conventional Quantity Requirements

Marcus (1998), in her book, *People Places: Design Guidelines for Urban Open Spaces* recommended one linear foot of seating (about 0.3m) for each thirty square feet (about $2.8 m^2$) of urban open space. That is to say, about 0.1 meters of seating length for each 1 square meter of open space. Based on this criterion,

quantity of seating places is measured by the length of areas suitable for sitting in 1 m² of open space. According to this calculation, the length of an area suitable for sitting in each sub-area is far from the conventional requirement.

Table 5.2: Quantity of seating in each sub-area

| | Area (m ²) | Total length of seating space (m) | Sittable length (m/ m ²) | The varieties and number of seating and their sittable length(m) |
|---|------------------------|-----------------------------------|--------------------------------------|--|
| Zhenghong Pedestrian Street | 14141 m ² | 374.4 m | 0.026 m/ m ² | wood benches and chairs, tree planters, shrub planters, granite benches |
| 1)Zhenghong Pedestrian Street: north part (N) | 3191 m ² | 62 m | 0.019 m/ m ² | 20 wood benches (36m), 10 tree planters(26m) |
| 2)Zhenghong Pedestrian Street: south part(S) | 2423 m ² | 57.6 m | 0.024 m/ m ² | 4wood benches(28.8m), 6concrete benches(28.8m) |
| 3)Zhenghong Pedestrian Street: west part(W) | 1524 m ² | 67.6 m | 0.044 m/ m ² | 7 tree planters(47.6m), steps and building niches(20m) |
| 4)Zhenghong Pedestrian Street: east part(E) | 2398 m ² | 136 m | 0.056 m/ m ² | 20tree planters(136m) |
| Zhenghong Pedestrian Street: central part(C) | 4605 m ² | 71.2 m | 0.015 m/ m ² | 8wood chairs(14.4m), 3shrub planters(42m), 1shrub planters(14.8m) |
| Lefulai Street corner(L) | 2707 m ² | 175.5 m | 0.065 m/ m ² | 5wood benches(8m), 20stone stools(8m), feature steps(137.5m) shrub planters(22m) |
| Jinying Street Corner(J) | 371 m ² | 9.6 m | 0.026 m/ m ² | 6wood benches(9.6m) |
| Xinbai Street Corner(X) | 1569 m ² | 26 m | 0.0165 m/ m ² | 20wood chairs(26m) |
| Zhongyang Street Corner(Z) | 799 m ² | 10 m | 0.0125 m/ m ² | 10round granite stones(4m) shrub planter(6m) |

| | | | | |
|--|--------------------|------|-------------------------|----------------------|
| Dongfang Street Corner(D) | 3577m ² | 24 m | 0.006 m/ m ² | 6shrub planters(24m) |
| Conventional requirement: one linear foot of seating for each thirty square feet of open space □(0.1 meter of seating for 1 square meter of open space (0.1m/m ²)□ | | | | |

Quantity of seating spaces

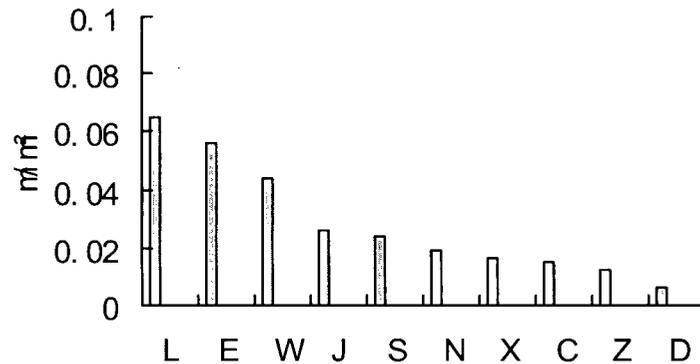


Diagram 5.15: The quantity of seating in each sub-area

5.3.2 Quality Evaluation

The evaluation of the quality of seating spaces within the study area is based on two aspects: a general evaluation according to the conventional requirements for quality seating, as clarified in Chapter 2, and off-peak observation.

5.3.2.1 General Evaluation

- Zhenghong pedestrian street:

- 1) Tree planters comprise of 71% of the total seating spaces. Tree planters are arranged in line on the north, south, west and east parts of Zhenghong pedestrian street (Figures 5.4-Figure 5.7).
- 2) Only a small amount of building frontages have niches where people can sit, and they are situated on the western part (Figure 5.3). Those spaces only became occupied when other formal seating spaces were full.
- 3) The seating space under the glass roof in the center part provides protection from rain, back protection, and has a clear view of surrounding pedestrian flows (Figure 5.9-Figure 5.11).

Figure5.3:Sittable niches in the west part



Figure5.4: Wood benches and tree planters in the north part



Figure5.5: Tree planters in the west part

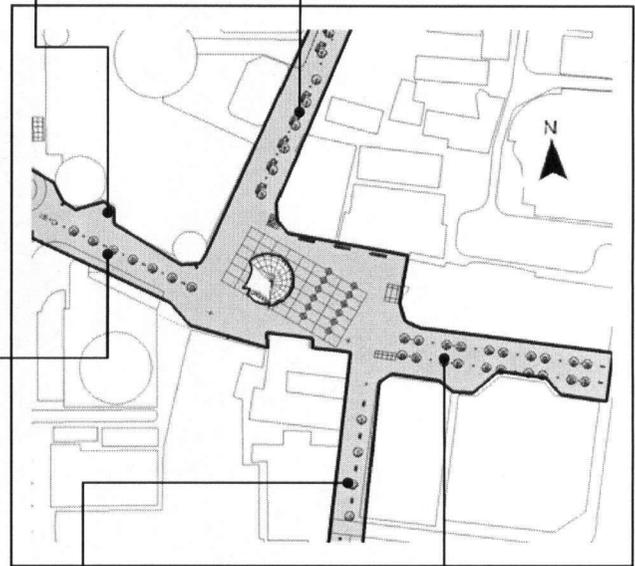


Figure5.6: Wood benches in the south part



Figure5.7: Tree planters in the east part

Figure5.8: Shrub planters



Figure5.9: The glass roof at the center of Zhenghong pedestrian street

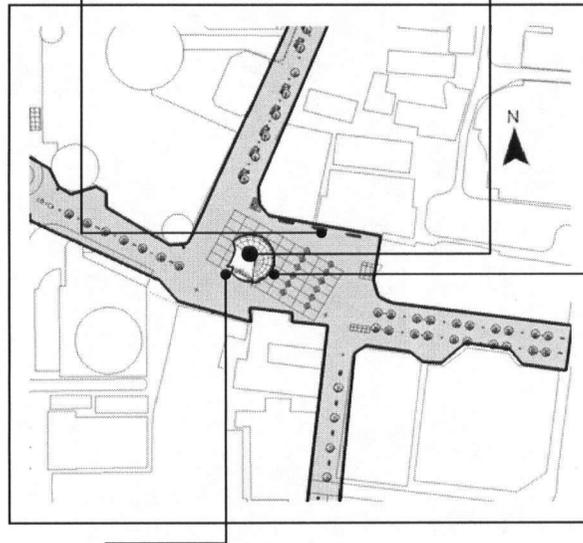
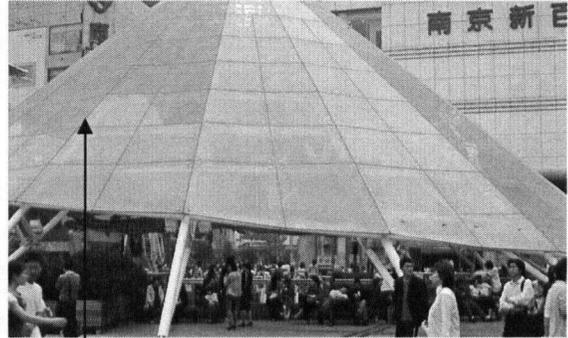


Figure5.10: Shrub planters under the glass roof

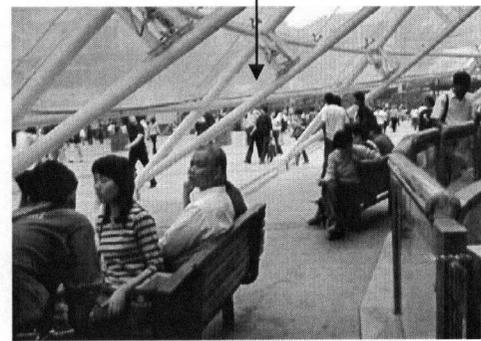


Figure5.11: Wood chairs under the glass roof

- Leifulai street corner plaza:

- 1) The huge canopy of a tree in the center of Leifulai plaza forms an

intimate and comfortable seating environment for pedestrians, and provides shade on hot summer days (Figure 5.12).

- 2) There are a variety of seating spaces: in sun and in shade, exposed and private, individual and in group.
- 3) There are various seating opportunities: movable stone stools, feature steps, shrub planters, and wood benches (Figure 5.13-Figure 5.15)

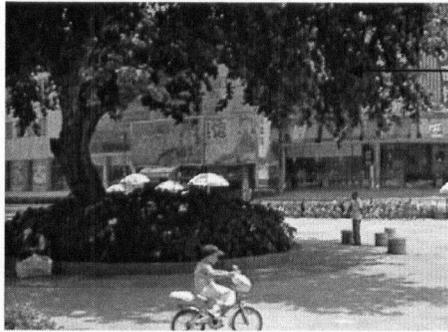


Figure5.12: The huge canopy tree at the center of Leifulai street corner plaza



Figure5.13: Movable stools under the canopy tree



Figure5.14: Feature steps along the edge of Leifulai street corner plaza

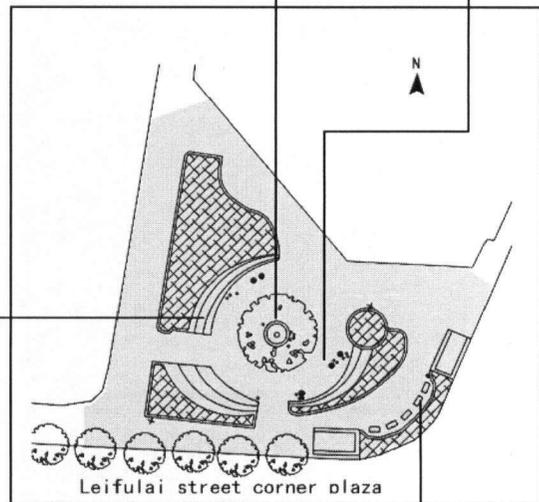
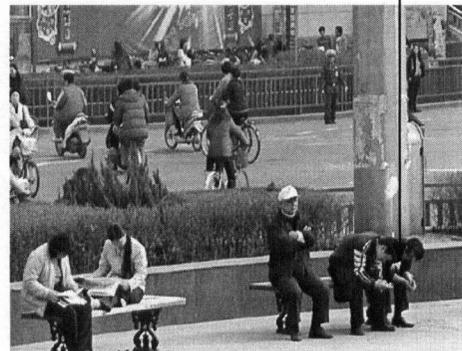


Figure5.15: Wood benches along the curb edge



- Zhongyang street corner plaza

The spaces suitable for sitting comfortably in Zhongyang street corner are the ten round stones around the fountains (Figure 5.16) and some curbs along the flower beds. The round stones that are situated around the fountains were frequently occupied by pedestrians, many of whom were parents who were watching their children playing around the fountain environment.

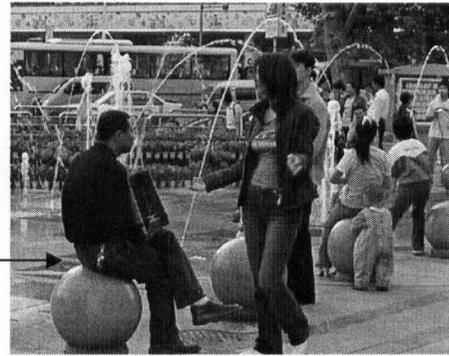
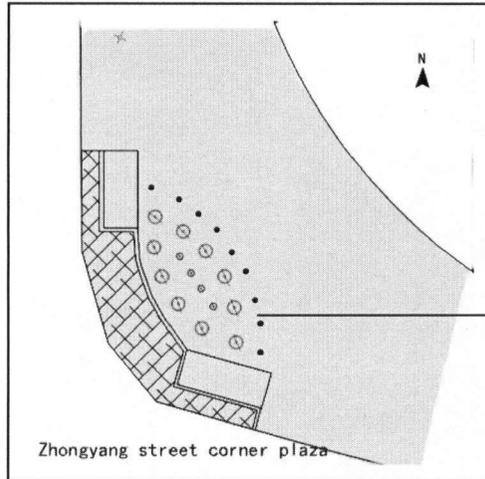


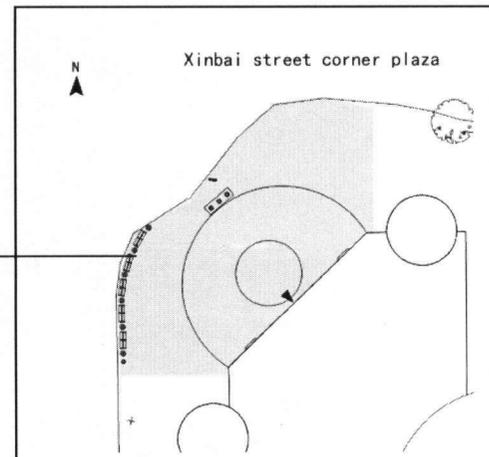
Figure5.16: Round stones distributed around the fountains at Zhongyang street corner

- Xinbai street corner plaza

Seating spaces include five groups of wooden chairs along the curb edge of Xinbai plaza. Each group is composed of four chairs with back and back orientation. The flower boxes between each group of chairs help to protect the privacy. The use of those chairs greatly is greatly reduced on hot summer days because they are fully exposed to the sun shine.



Figure5.17:Wood chairs along the curb edge of Xinbai plaza



- Jinying street corner

The seating spaces include six wood benches along the outer edge of Jinying street corner. There is nothing between each bench, and the distance between each bench is comparably short, at no more than 1 meter. These spaces were densely used during peak hours.

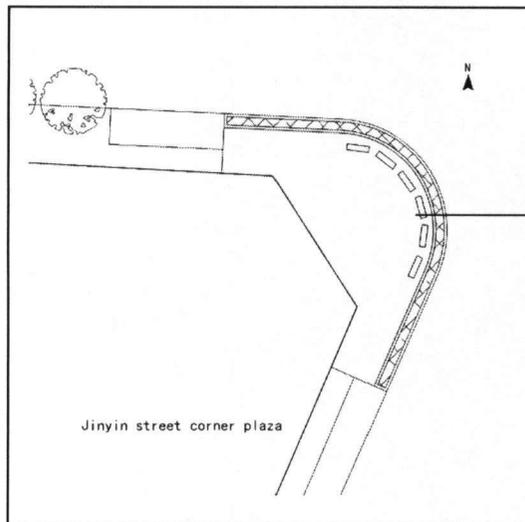


Figure5.18: Wood benches along the curb edge of Jinying street corner

- Dongfang street corner plaza

The total number of spaces suitable for sitting in Dongfang street corner plaza include six shrub planters (Figure 5.10). The height of the planters is less than the conventional sitting requirement (35-45 centimeters). The six planters are seldom used by pedestrians, even during peak hours (refer to Appendix 8: Behavior Mapping of Dongfang plaza).

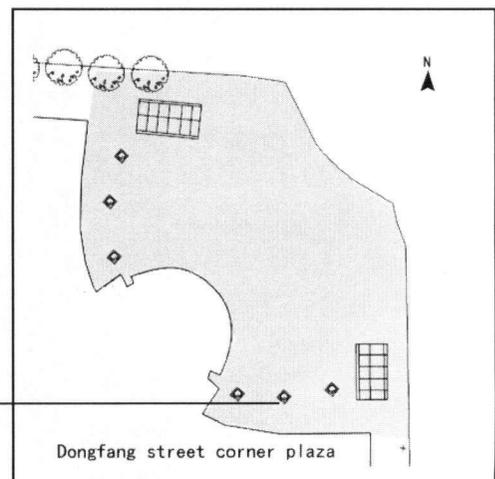


Figure5.19: Shrub planters at Dongfang plaza

5.3.2.2 Off-peak Observation

- The wooden chairs under the glass roof (Figure 5.11) were found to be the most preferable seating places for pedestrians at Zhenghong pedestrian street. They were the first to be occupied.
- The second most preferable seating spaces were the ornamental planters under the glass roof (Figure 5.10).
- When all the seating spaces under the roof were full, people were forced to choose the shrub planters nearby (Figure 5.8). They first occupied the front side of the planters, facing the main pedestrian flow, while the rear side of the planters remained vacant (Figure 5.20).



Figure 5.20: The sittable side facing main pedestrian flows was first occupied by pedestrians.

- Both wooden benches and stone planters are situated at the north part of Zhenhong pedestrian street (Figure 5.4). When given the choice, people chose the wood benches first.
 - Informal seatings (eg: steps, building niches, bollards, etc.) were seldom used during off-peak hours.
 - People don't choose to sit at exposed seating spaces. The seating spaces of Dongfang plaza (Figure 5.19) have some negative attributes: exposure onto the wide and empty plaza, no back protection, no tree canopies, furniture or anything else which can provide some level of intimacy for people. Comparably speaking, the seating along the edge of Xinbai street corner and Jinying street corner (Figure 5.17 and Figure 5.18) were more preferable to pedestrians.
- According to the off-peak observation of pedestrians' preference for seating spaces, we can conclude that the general characteristics of good quality seating include: good views of the surrounding people, events and environment; have back protection; are made of wooden material with a backrest; provides a sense of intimacy (people sitting are not disturbed by pedestrian flows).

5.3.3 Brief Summary

According to the quantity evaluation (Diagram 5.15), we can see that Leifulai street plaza has the highest quantity of seating (0.065m/m²), and Dongfang plaza has the lowest quantity of seating (0.006m/m²). Except for the seating spaces in Leifulai plaza and the eastern part of Zhenghong pedestrian street, all the other seating spaces are not adequate for pedestrian use due to the high volumes of pedestrian traffic and the lack of seating spaces available during to on-peak observation.

According to the quality evaluation, Leifulai plaza has the best quality of seating. Leifulai plaza has high quality seating according to the conditions of weather protection, good views, and various seating options (eg: formal and informal, backed and backless, private or exposed, individual or group). Dongfang plaza has the worst quality of seating (exposed onto the empty plaza and disturbed by the main pedestrian flows), the seating spaces in Dongfang plaza were seldom used by pedestrians, even during peak hours.

5.3.4 Quantity and Quality of Seating Spaces and Social Activities

Obviously, quantity and quality of seating spaces are directly related to the number of people sitting. During on-peak hours, the greater the quantity of seating available in a place, the higher the number of people sitting; during off-peak hours, people choose sit in the higher quality places.

5.4 Attractions and Entertainment

Attractions and entertainment in pedestrian environments are features that can improve the sensual pleasure gotten from walking, and can include physical objects (eg. outdoor exhibits, sculptures, food facilities, water features, attractive landscaping, sidewalk cafes, etc.), people and events(eg. street performances, entertainers, street bands, etc.), and anything else that results in the discovery of something new or vital in one's surroundings. Different cultural backgrounds and living habits influence preferences for entertainment; for example, street bands, street entertainers, and sidewalk cafes are common features of street environments and entertainment in western countries. These, however, are seldom seen in Chinese cities.

Table 5.3: Attractions and entertainment in pedestrian environments

▲: indicates that the study area has this kind of attractions; □: indicates that the study area doesn't have this kind of attractiveness

| Category | Attractiveness and Entertainment | |
|-------------------|-----------------------------------|---|
| People and events | commercial shows, sales promotion | ▲ |
| | propaganda procession | ▲ |
| | street bands, street entertainers | □ |
| | water feature | ▲ |
| | attractive floorscape | □ |

| | | |
|-------------------|---|---|
| Landscape element | sculpture | □ |
| | outdoor exhibits(eg: demonstration board) | ▲ |
| | film screen | ▲ |
| | outdoor café or outdoor tea bar | □ |

The most attractive landscape element in the study area are the jetting fountains in Zhongyang street corner plaza (Figure 3.13), where many children can be observed to play in the fountain environment. Lots of people stand around the fountains and watch the children playing (refer to Appendix 7: The behavioral mapping of Zhongyang street corner). The fountain environment in Zhongyang plaza is the only space in the study area that can attract so many children. The observation of pedestrians' gravitation towards water features in the study area was in accordance with western researchers' observation that water was the single most desired feature in public spaces (Whyte 1980 and Carr 1992).

The film screen in Leifulai plaza is also an entertainment attraction, and it did attract many people to sit or stand and watching video clips of such things as important news, football games, Olympic games etc.

The less attractive features are the demonstration boards. They sometimes attracted a single person or several pedestrians to linger.

The events that could attract a large number of pedestrians in the study area were commercial shows or sales promotions, usually presented at the main entrances of department stores (refer to Figures 3.9 and Figure 3.10). These events embody some attractive attributes: music, people, stage performances, and something new or interesting, that provide a communication platform for social interactions. Their shortcomings include the problems of crowding and noise, and when the number of people around commercial shows increased, and the street space got more and more crowded, pedestrians' ability to walk freely was to a certain extent adversely effected,. Generally speaking, the attractions and entertainment value found within the study area was very limited.

Many places in the study area were perceived by pedestrians as monotonous spaces, because there was nothing interesting to be found except for some basic seating spaces.

5.5 The Dimension of Pedestrian Environments

5.5.1 Street Capacity

In the urban centers of many large Chinese cities, street capacity and pedestrian traffic are unavoidable (Wu1999). Walking, standing, meeting, and playing all demand a need for space, and if pedestrian density is too high, the freedom of movement is restricted and social activities are less likely to occur. Therefore, before we explore the interactions between the dimensions of pedestrian environments and pedestrians' use of streets, we must first make sure whether or not the existing street capacity can afford the highest levels of pedestrian traffic. That is to say, the ability to accommodate the highest levels of pedestrian flow is a basic requirement for the dimensions of a pedestrian environment.

Based on his study of pedestrians in Copenhagen, Jan Gehl figured that a flow rate of between 10 to 15 people per minute per meter of street width is the upper limit for an acceptable density in streets and on sidewalks with two-way pedestrian traffic. According to the calculations of the highest pedestrian flow rates in every sub-area, we find that the pedestrian environment in each sub-area can fully accommodate the highest rates of pedestrian flow. It was found to be unnecessary to broaden the dimension of existing pedestrian environments in the study area. In Chinese metropolitan cities like Nanjing, a pedestrian street with a 15-20 meters width can completely fulfill the street capacity requirements.

Table 5.4: The width of pedestrian environments and highest pedestrian flow rate of each sub-area

| Sub-areas | Average width of pedestrian environment | Highest pedestrian flow rate (two-way pedestrians per minute per meter of street width) |
|---|---|---|
| Dongfang street corner (D) | 52m | 1 |
| Zhenghong pedestrian street - central part(C) | 48m | 3 |
| Leifulai street corner(L) | 42m | 2 |
| Xinbai street corner (X) | 25m | 1.92 |
| Zhongyang street corner (Z) | 21m | 4.3 |
| Zhenghong pedestrian street – east part (E) | 23m | 3.19 |
| Zhenghong pedestrian street- north part (N) | 19m | 8.4 |
| Zhenghong pedestrian street - west part(W) | 16m | 6.5 |
| Zhenghong pedestrian street - south part(S) | 13.5m | 7 |
| Jinying street corner (J) | 12m | 6 |
| | | Upper limit: 10-15 |

5.5.2 Observation of the Intensity of Social Activities at the Five Street Corners

Within a range of 20-25 meters, people can relatively clearly perceive the feelings and moods of others (Gehl1996). Based on this understanding, many researchers have argued that some pedestrian streets, with a width of more than twenty meters, or squares with a width more than forty meters are oversized, and not conducive to creating an atmosphere for promoting social interactions.

The five street corner plazas (Zhongyang, Xinbai, Dongfang, Jinyin, and Leifulai) in the study area were chosen to evaluate the interactions between the dimensions of pedestrian

environments and the condition of people's use of street spaces. Dongfang street corner (52 meter width) and Leifulai street corner (48 meter width) were considered to be wide pedestrian environments; Xinbai street corner (25 meter width) and Zhongyang street corner (21 meter width) were considered to be medium-sized pedestrian environments; and Jinyin street corner (12 meter width) was categorized as a small-sized pedestrian environment.

We can discover something from Pedestrian behavior mappings (Appendix6-10) and Pedestrian flow mappings of the five street corner plazas(Appendix f-j). The situations of street use were greatly varied. At the same time(at 5:30 pm on Saturday), there were only two people sitting, three people standing at Dongfang street corner plaza. Meanwhile at Jinying, Zhongyang, and Leifulai street corners, their number of people sitting and standing were much higher.

The intensity of social activities at Dongfang was the weakest among the five street corners. People just went passed it, seldom standing or lingering, and much of the street spaces were not used for social activities at anytime (Figure 5.21 and Figure 5.22).

The intensity of social activities in Xinbai was the second lowest. Except for the sitting spaces along the curb edge and the walking spaces for pedestrians along the building edge, other spaces were seldom used (Figure 5.23 and Figure 5.24).

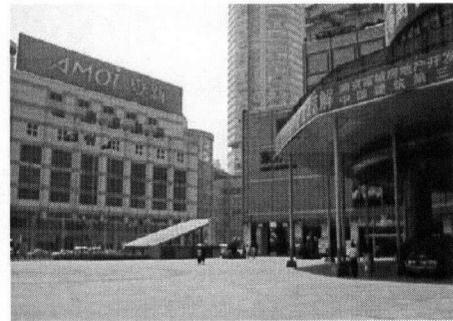


Figure 5.21 and Figure5.22 Wide and empty Dongfang plaza



Figure5.23 and Figure5.24: Empty Xinbai plaza

Leifulai street corner (refer to Appendix 10, Figure 5.12-Figure 5.15) has a width of 48 meters. However, the intensity of social activities was very strong. The huge canopy tree

at the center, the feature steps along the canopy tree, the ornamental planters, and the quality of seating all helped to create a sense definition and intimacy for the space as a whole. These specific design features have actually altered the perception of original broad dimensions of the street corner into a human scale. The warm, intimate small spaces created by the design features provide a suitable environment for pedestrians to sit, stand or play.

Table 5.5: The intensity of social activities at the five street corner plazas

| Dimension of pedestrian environments | | Design configurations landscape elements | Intensity of social activities |
|--------------------------------------|----------------------------------|---|--|
| large (more than 40m) | Dongfang street corner (52 m) | only six short shrub planters in the middle of the street space | very low(people seldom sitting and standing, much of the street spaces unused) |
| | Leifulai street corner (42 m) | huge canopy tree in the center, ornamental planters and feature steps along the edge, quality seating | strong(many people sitting, standing, children playing) |
| Medium (20-25m) | Xinbai street corner (25m) | five group of chairs along the outer edge | A bit low(only several people standing) |
| | Zhongyang street corner (21m) | feature fountains | strong(many people standing and children playing) |
| Small (less than 15m) | Jinyin street corner (12m) | benches and ornamental planters along the outer edge | relatively strong (many people sitting and standing) |

The two main reasons that the intensity of social activities is weak at wide and empty street corners like Dongfang and Xinbai are that:

- People usually take the shortest route. This implies that people normally won't choose the outer space of an over-dimensioned street corner for walking, because it involves a longer distance to walk. Therefore, pedestrian flows tend to only go through the inner side of the street corner. According to pedestrian behavior mappings (Appdendix 1-10) and pedestiran flow mappings (Appdendix a-j), we can see that the intensity of social activities is comparably weak at the places which are far from pedestrian flows. Just as Gehl (1996) said, "Nothing happens, because nothing happens". If there is nobody around, no social activities occur.

- No quality seating, attractiveness, or anything which can create a sense of definition, intimacy or enclosure (eg: trees, columns, ornamental planters, sculptures, etc.) exist in the pedestrian environment to encourage a vibrant life and activity for pedestrians.

5.5.3 Dimension of Pedestrian Environments, and Social Activities

Generally speaking, empty spaces of large dimensions are not conducive to social life and activities. Small, intimate spaces encourage activities because they provide a sense of warmth, definition and enclosure which are important for socially attractive spaces. Suitable design configurations and landscape elements can help create an outdoor environment which correlates well with the human sensory apparatus, as we have seen is the case on Leifulai street corner. Overly large spaces can be transformed into sociable spaces by adding elements that increase their attractiveness, quality seating or some vertical elements which can create a sense of intimacy and definition (eg: canopy trees, ornamental planters, columns, sculptures, etc.).

5.6 Noted Observations Regarding Pedestrians’ Walking, Sitting, and Standing Behaviors

The following are observations regarding pedestrians’ walking, sitting, and standing behaviors in the study area according to on-site observations.

Table5.6: General characteristics of pedestrian’s walking, standing and sitting

| | Characteristics |
|-----------------|---|
| Walking | Pedestrians usually take the shortest routes |
| | Pedestrians tends to congregate where other people are assembled |
| | Pedestrians like to walk on ground level |
| Standing | Pedestrians’ preferred standing in locations that included entrances of department stores or shopping malls, under cornices, along edges, under trees, near columns, etc. Pedestrians especially liked to stand singly or in groups at or near entrances of department stores, waiting for friends. Private conversations between two or three standing people occurred more frequently in spaces that were not disturbed by pedestrian flows. |
| | The denser the pedestrian flow in a place, the more people tended to stand in the place. |
| Sitting | Preferred seating included wood material, seats with back protection, locations with a sense of intimacy (eg. under trees, under roofs, along building walls, etc.), locations with good views of the surrounding environment. |
| | Women preferred more intimate seating spaces than men. |

Some characteristics of children and old people's activities within the study area included:

Children: Children were much more curious with regard their surrounding environment than were adults. They displayed a strong desire for touching any objects or material that interested them, including, leaves, flowers, water, stones, and walls, etc.

Old people: Old people liked to play cards, chess and other social games, and they preferred to sit in intimate spaces.

5.7 Chapter Summary

Chapter Five consisted of an evaluation of the four factors (pedestrian density, quantity and quality of seating spaces, attractions and entertainment, and dimension) in the study area and explored some of the correlations between the four aspects and the existence of pedestrians' social activities.

People are the basic requirement for a sociable space. In a pedestrian environment, a sufficient pedestrian density is a prerequisite for generating social life and activities. A sufficient pedestrian density does not, however, necessarily guarantee the quality of social activities. Quality seating, attractions and entertainment, and a suitably dimensioned pedestrian environment are some important design features related to public open spaces which play an important role in influencing both the quantity and quality of social activities. The CBD of Nanjing City attracts a high volume of pedestrians due to its highly concentrated and multi-functional commercial services. The level of high pedestrian density in the study area provides a great potential for generating activities. In the meantime, it has also resulted in some problems: 1) the overcrowded pedestrian flows at some particular locations impede certain pedestrian social activities; 2) existing outdoor seating and recreation facilities are insufficient with regard to pedestrian demands for rest and amenities, especially during weekends or holidays. Understanding the correlations between the four factors and social activities clarified in this chapter help us propose practical and feasible recommendations for increasing both the quantity and quality of social activities. As a result, it is hoped that the existing situation in study area can be improved.

Chapter Six: Findings and Recommendations

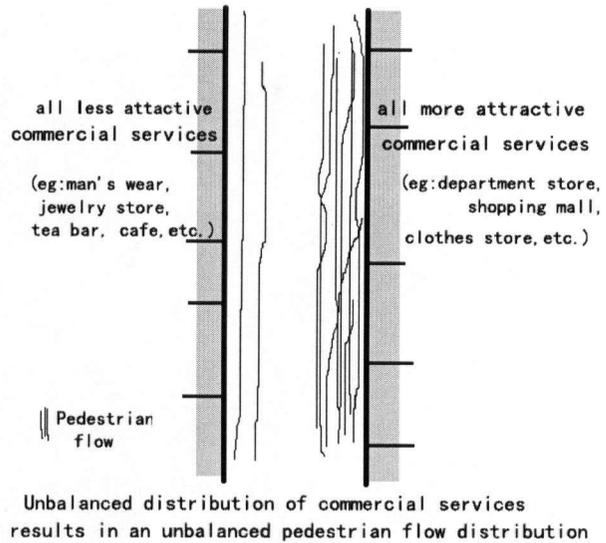
Chapter Five explore the correlations between the four influencing factors and pedestrian's social activities. From the study, we have gained insight about how people act in commercial pedestrian environments; which kind of seating spaces and entertainment are preferred by pedestrians; what the preferable seating or standing locations are; how social activities correlate with pedestrian flow distributions; and how the dimension of pedestrian environments influence the use of streets, etc. We can thus get an indication as to how to solve some of the problems that were noted in the studied commercial pedestrian environments, and can extrapolate these to some Chinese city centers with similar situations to the study area. These problems are also reflected in the research questions of the study - how to arrange the movement spaces and rest spaces in a congested linear pedestrian environment; how to create sociable spaces in an overly large dimensioned pedestrian environment; how to arrange locations and physical configurations of seating spaces to provide for more sitting opportunities; how to facilitate attractive landscape elements, etc. In short, we can learn how to create a functional, recreational, and sociable commercial pedestrian environment.

6.1 Summaries of the Findings from the Study

- 1) There is a strong correlation between pedestrian density and the number of occurring social activities. Normally, the higher the pedestrian density in a place, the greater the volume of social activities.
- 2) The peak times of social activities on a day occur at noon and nightfall.
- 3) Spaces with denser pedestrian flows have comparably more social activities.
- 4) Department stores or shopping mall entries are more attractive to pedestrians for standing, talking and walking than other kinds of commercial services. There are much denser pedestrian flows around the entrances to department stores and shopping malls.
- 5) An unbalanced distribution of commercial services results in an unbalanced pedestrian flow distribution. This is a main reason that pedestrian crowding problems occurred at particular locations.

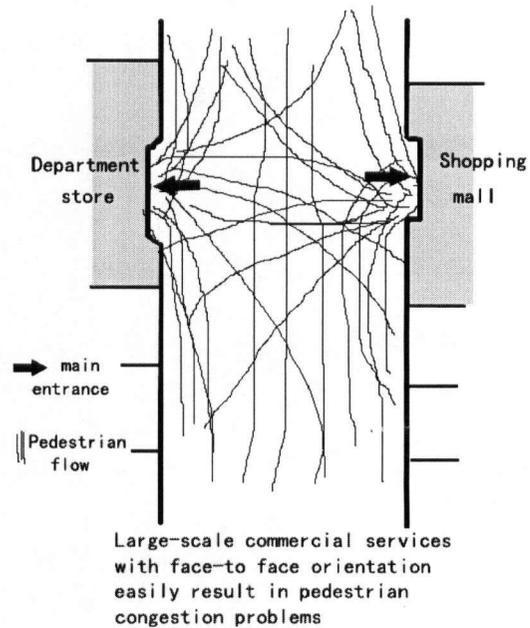
If the attractive commercial services (eg: department stores, shopping malls, clothes stores, etc.) are densely arranged along one side of a pedestrian street, while the other side is arranged with less attractive commercial services (eg: men's wear stores, tea bars, cafés, jewelry stores, etc.), pedestrian flows along the more attractive side are much denser than pedestrian flows along the less attractive side (Figure 6.1). This appears from this study to be the main reason for the phenomenon that one side of a pedestrian street was crowded with pedestrians while the other side had much fewer pedestrians.

Figure6.1:
A type of unbalanced
distribution of commercial
services



If the entrances of department stores or shopping malls are arranged in a face-to-face orientation, this kind of distribution easily results in pedestrian congestion problems due to large volumes of people passing in and out (Figure6.2).

Figure6.2:
Large-scale commercial
services with face to face
orientation



- 6) Pedestrians' seating preference:
Sense of intimacy, not disturbed by pedestrian flows, good views of surrounding environments, back protection, wood materials
- 7) Water features are the most attractive landscape elements especially to children.
- 8) Children like interactive activities.
- 9) The intensity of social activities is extremely weak at wide and empty street corners. They usually discourage pedestrians' social activities and are also a waste of urban space.
- 10) In Nanjing's urban center, the highest pedestrian flow rate figured out in the research report is about 7-8 people per minute per meter of street width, it is below the upper limit for an acceptable pedestrian density (Gehl proposed that 10-15 people per minute per meter of street width is the upper limit). Thus, from the point of street capacity, it was found to be unnecessary to broaden the dimension of existing pedestrian environments in the study area.

Here I use North part of Zhenghong pedestrian street as an example to explain how to apply the value of upper limit for an acceptable pedestrian density proposed by Gehl to examine the suitability of the dimension of a pedestrian street. North part of Zhenghong pedestrian street has the highest pedestrian flow rate among all sub-areas during peak hours, the highest two-way pedestrians per minute at north part of Zhenghong pedestrian street is 121. Based on the value of upper limit for an acceptable pedestrian density (10-15 people per minute per meter of street width), we can figure out the lower limit for the width of the walkable street space, which is about 8-12 meters, thus if the street width of north part of Zhenghong pedestrian street is below 8-12 meters, the highest pedestrian flow rate will exceed the upper limit. That is to say, normally, a commercial pedestrian street in the urban center of Nanjing with 15-20 meter width can totally fulfill street capacity requirements. This finding also implies that a width of 15-20 meters may be enough for the dimension of pedestrian streets in urban centers of some other Chinese cities which have a pedestrian density and situations similar to Nanjing city.

6.2 Recommendations for commercial pedestrian environments

6.2.1 Introduction

The following recommendations and strategies may not be the only solution to the problems identified, these designs should be further evaluated much like this study did if they can be put into effect.

6.2.2 Recommendations and Strategies

A: Avoid planning an unbalanced commercial service distribution around a commercial pedestrian street

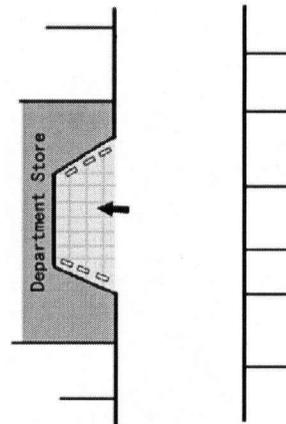
Architects, city planners or urban designers should avoid planning an unbalanced distribution of commercial services. Unbalanced distribution of commercial services easily results in pedestrian crowding problems. Particularly, more attention should be paid to the positions of the main entrances of large-scale commercial services such as

department stores and shopping malls. Entrances of large-scale commercial services with face-to-face orientation should be avoided. On a commercial pedestrian street, more attractive commercial services and less attractive commercial services should be facilitated in a balanced way in order to prevent the unbalanced pedestrian flow distributions.

B: Design a large setback at the entrance of large-scale commercial services on a pedestrian street

There are comparably much denser pedestrian flows and a great number of social activities at the entrances of large-scale commercial services, especially department stores or shopping malls. Therefore, entrance setbacks help to mitigate the pressure of pedestrian flows, and create free spaces for pedestrians' activities like standing, sitting, etc. The setback can be designed as an entry plaza with some seating facilities.

Figure6.3: Design a large entrance setback for large-scale commercial services



Entrance setbacks of large-scale commercial services help to mitigate the pressure of pedestrian flows and create some free spaces for pedestrian's activities

C: The design of pedestrian environments should be based on the distribution of pedestrian flows

(C1) Arrange more rest and recreation facilities at places with higher pedestrian densities.

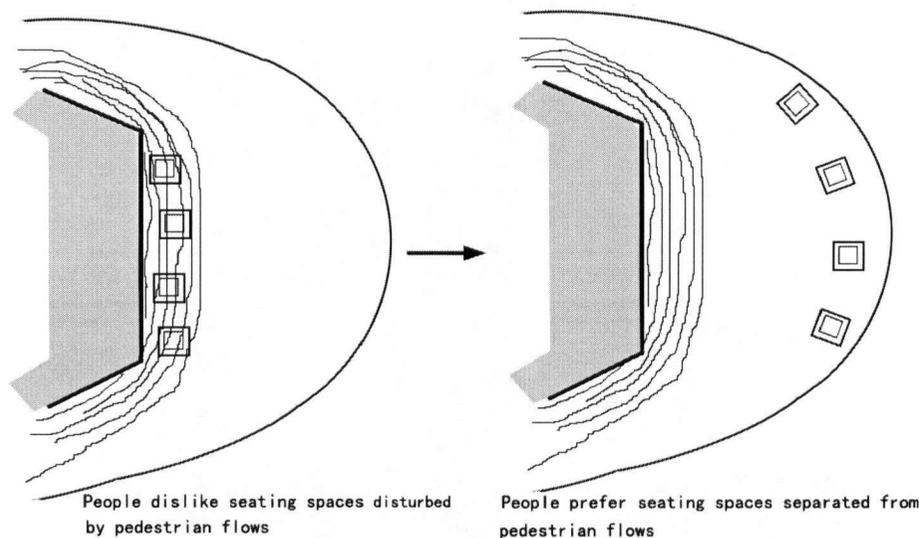
The higher the pedestrian density (the denser the pedestrian flows) of a place, the more need for rest spaces and recreation facilities. This is a basic consideration for setting the quantity of seating spaces or recreation facilities. There is no need to arrange too many public facilities in places with a very low pedestrian density. Arranging public facilities on the basis of actual need is an efficient way to increase the use of seating or recreation facilities, and reduce unnecessary costs involved with building public facilities. For example, regarding the north, south, west and east parts of Zhenghong pedestrian street, the quantity requirement for public facilities of each part differs due to their various

pedestrian densities. The north part has the highest pedestrian density (highest flow rate: 8.4 people per minute per meter street width), the south part (highest flow rate: 7), the west part (highest flow rate: 6.5), and the east part has the least pedestrian density (highest flow rate: 3.19). Thus, more seating spaces should be arranged on the north, rather than on the east part of Zhenghong pedestrian street, as this side experiences much lower levels of pedestrian density.

(C2) Rest spaces should not be arranged right in the middle of main pedestrian flows.

Pedestrians dislike seating spaces disturbed by pedestrian flows. For example, the seating spaces exposed on Dongfang street corner are located right in the middle of main pedestrian flows, seldom people were observed to use those seating spaces. When people use this seating, they are disturbed by pedestrian traffic, and the seating arrangements do not provide a sense of security and intimacy for people. Rest spaces which are separated from pedestrian flow disturbance are given preference (Figure 6.4). Seating spaces along the edge of a space are usually welcomed by pedestrians because they are not easily disturbed by main pedestrian flows, and moreover, they provide a good view of surrounding environments

Figure6.4: Positioning seating spaces at places without being disturbed by pedestrian flows



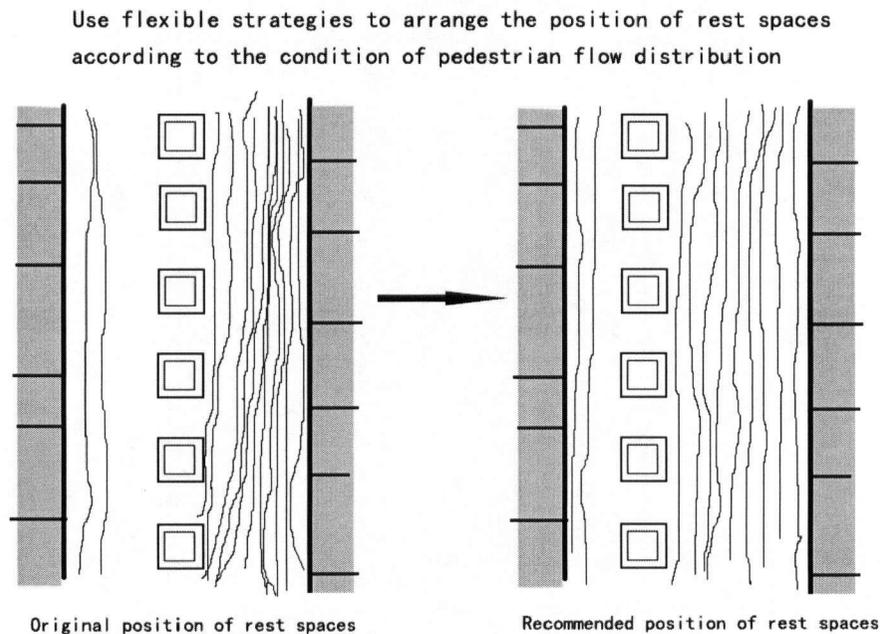
(C3) Use flexible strategies to arrange the position of rest spaces on pedestrian streets based on the analysis of pedestrian flow distributions

Rest spaces and walking spaces on a pedestrian street are equally important. On a pedestrian street with a high volume of pedestrian traffic, rest spaces should not occupy too much of the walking spaces. We can use a flexible strategy to arrange the positions of rest spaces according to the conditions of the pedestrian flow distribution on a pedestrian

street. The pedestrian flow density differs from place to place on a pedestrian street due to different adjacent commercial service types. Before positioning a rest space, we could first estimate the pedestrian flow distribution on the site, and based on this, find a suitable position for rest spaces. It is most efficient to arrange these in spaces with comparably lower levels of pedestrian flows.

For example, at the north part of Zhenghong pedestrian street, the west side of the street space has much denser pedestrian flows than the east side. This is mainly because the commercial services (shopping mall, department store, and clothing stores) along the west side are much more attractive to pedestrians than those (jewelry store, men's wear, blank wall) along the east side. Thus, the west side of the street space is usually crowded with pedestrians. Under these conditions, it would be better to move the original rest spaces from the middle of the walkway to a position close to the east side, because the east side of the street space has lower levels of pedestrian flows (Figure 6.5). This is a strategy that would be satisfactory for both sides. For one thing, it would create more space for walking on the west side of the street, and mitigate the pressure of pedestrian flows. Also positioning rest spaces away from dense pedestrian flows can reduce the disturbance of pedestrian traffic, and thus create an increased sense of intimacy for people who are resting.

Figure 6.5: A flexible strategy to arrange the position of rest spaces



D: Strategies to increase the quantity and quality of seating

(D1) Create multi-purpose types of seatings

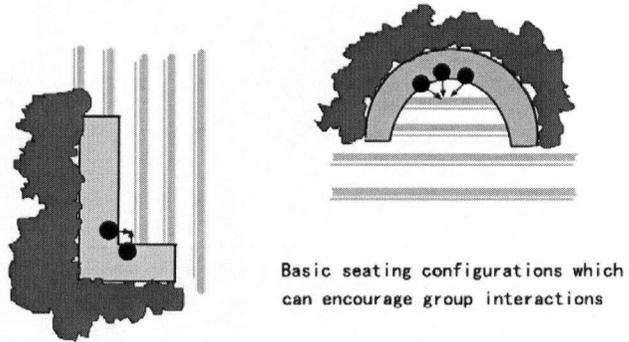
Flag poles, bollards, flower boxes, concave spaces of buildings should be designed to provide seating opportunities. These are effective ways to increase the quantity of seating spaces.

(D2) Create seating configurations with face to face orientation

If the conditions permit, seating spaces can be arranged in a variety of configurations, providing opportunities for group conversations.

Seating spaces with concave edges help to encourage group interactions because they provide opportunities for face to face orientation (Figure 6.6).

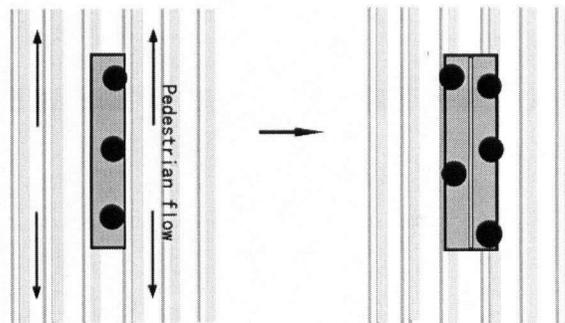
Figure 6.6: Basic seating configurations that encourage group interactions



(D3) Create benches that are two backsides deep in order to provide more seating edges

In a pedestrian environment that is extremely short of rest spaces, benches with two backsides deep should be greatly encouraged, because seating choice is greatly enlarged and more people can sit without feeling crowded (Figure 6.7).

Figure 6.7: Benches with two backsides deep provide more seating opportunities



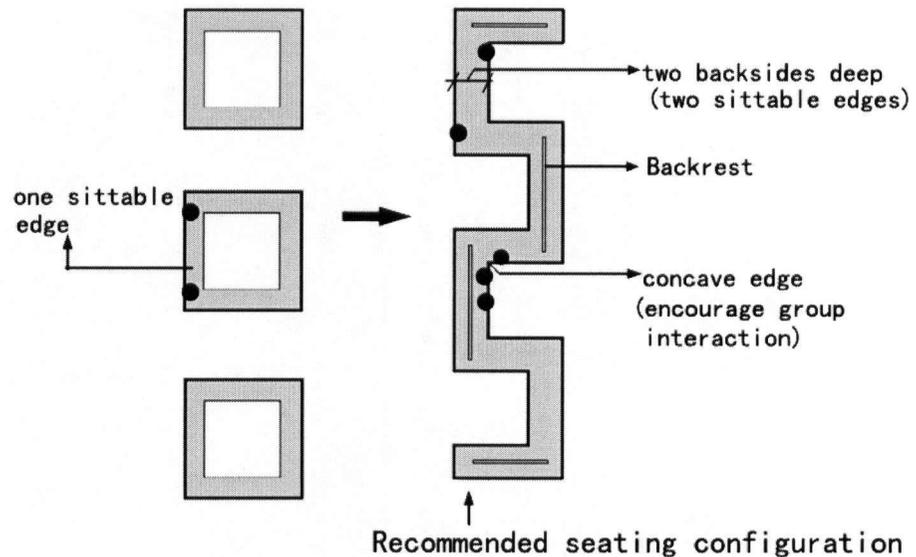
Benches with two backsides deep have much more seating opportunities

(D4) Apply a combination of seating configurations in order to greatly enlarge the area of seating edges and create opportunities for group interactions

Very often, one row of seating space is arranged in the middle of a commercial pedestrian street, such as in Zhenghong pedestrian street. Often, these rows are in the

form of a row of tree planters, benches or chairs. It would be more efficient to apply a kind of seating configuration which could allow more people to sit without occupying an increased area of the walking space (Figure 6.8). Figure 6.8 illustrates a kind of seating configuration which possesses some good qualities: many more edges that can be used for seating, more seating choices, and encouraging group interaction.

Figure 6.8: Recommended seating configuration in the middle of a pedestrian street



E: Strategies to change a pedestrian environment of overly large dimensions into a human-scaled space

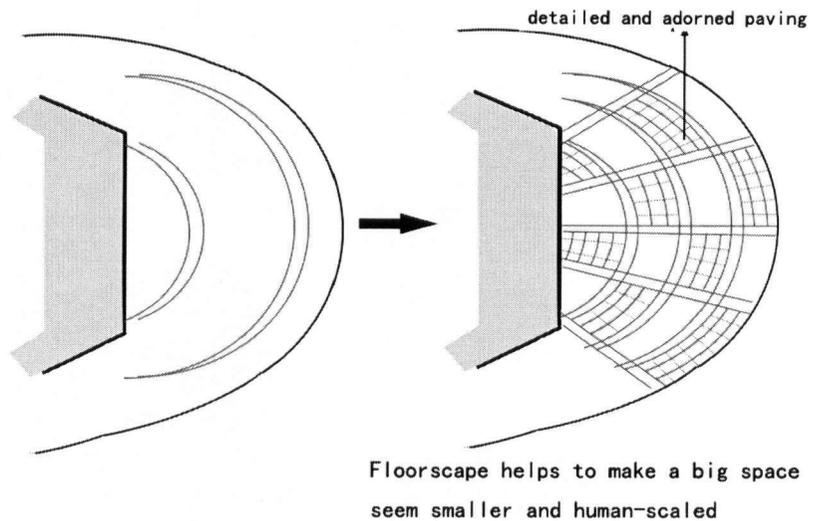
Extremely wide and empty pedestrian environments do not correlate well with the human sensory apparatus, and thus impede social interaction. However, a suitable design configuration and appropriate landscape elements can help to improve these conditions. The key points are to reinforce or create a sense of scale, a sense of spatial containment, and create the feeling of a 'space within a space'.

(E1) Apply floorscape to introduce scale to a space

Floorscape here mainly refers to the 'hard' pavement. Floorscape can not only enhance the aesthetic character of a space, but can also introduce scale and divide space.

Floorscape patterns often perform the important aesthetic function of breaking down the scale of large, hard surfaces into more manageable human proportions. The detail and modulation paving patterns tend to make a big space seem smaller and human-scaled (Figure 6.9), while a simple and unadorned treatment has the reverse effect.

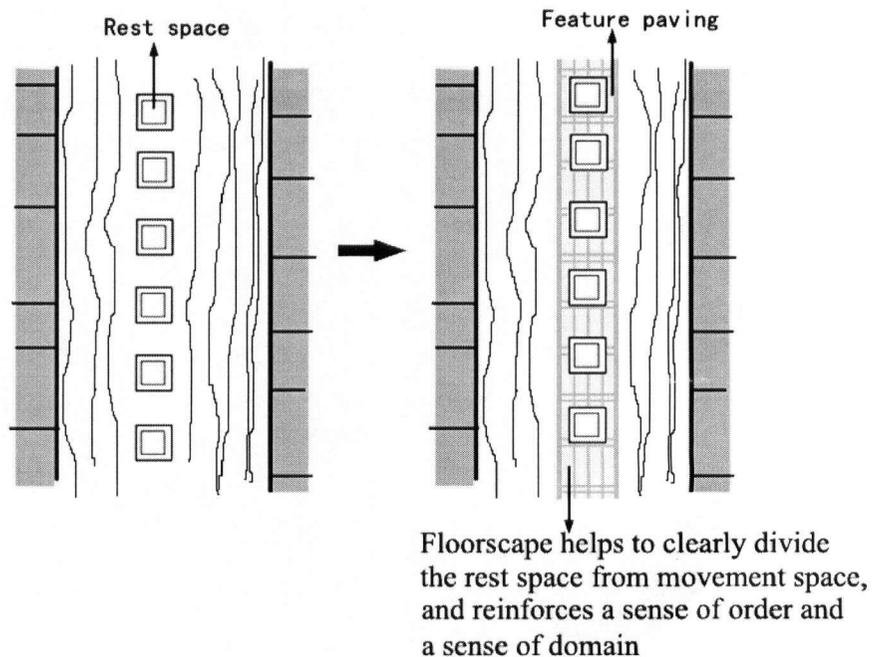
Figure 6.9:
Apply detailed
paving to introduce
scale to a place



(E2) Apply floorscape to divide the rest space from the movement space in a pedestrian environment

Floorscape can be applied to divide the rest space from the movement space of a pedestrian environment. Figure 6.10 illustrates an example of how the feature paving arranged at the seating space helps to reinforce its separation from the walking space, creates a sense of order for the whole, provides a sense of domain, as well as a sense of spatial containment for the people who are resting.

Figure 6.10: Apply the floorscape to divide the rest space from the movement space

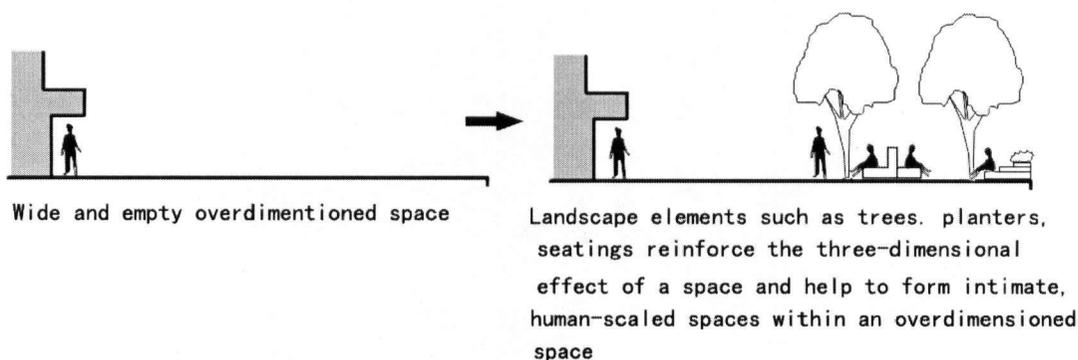


(E3) Apply vertical elements to create definition and human scale to an over-dimensioned pedestrian environment

A pedestrian environment is deemed as an over-dimensioned space when it is seen to have lost its three-dimensional effect. According to the former research report, we find that some street corners, like Dongfang and Xinbai street corners, are too wide and empty to encourage engagement in social activities. Unlike those pedestrian streets with buildings along both sides of the street space, street corners like Dongfang and Xinbai only have one building façade to create definition to the space. Thus, if the width of those street corners is too wide, they easily lose their three-dimensional effect.

The three-dimensional effect of a space can be enhanced by vertical elements such as trees, columns, sculptures, walls, etc. These vertical elements, combined with landscape elements (such as seating, shrub planters, flower boxes, feature steps, water features, etc.) all help to form small, interesting spaces within a big space (Figure 6.11). The small, intimate spaces correlate well with the human scale, providing niches for people, and thus encouraging active use of the street.

Figure 6.11: Apply vertical landscape elements to reinforce the three-dimensional effect



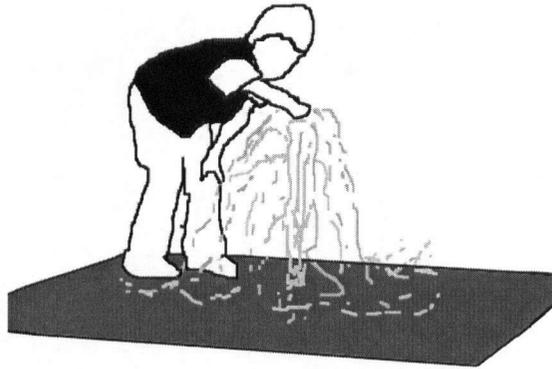
F: Create interactive landscape attractions in pedestrian environments

Fountains were found to be very attractive to pedestrians in the study area. The jets of water give pedestrian environments a playful feeling irresistible to children. Many different types of attractions and entertainment can pull people in. The most effective are those that possess an interactive function which greatly helps to build a playful interrelationship between people and the attraction, and thus help to encourage the use of the pedestrian environment. The following are some examples of how to create an interactive relationship between pedestrians and landscape attractions.

(F1) Create interactive sonic fountains:

When people come closer to a sonic fountain, the fountain begins to spray and a music feature is activated.

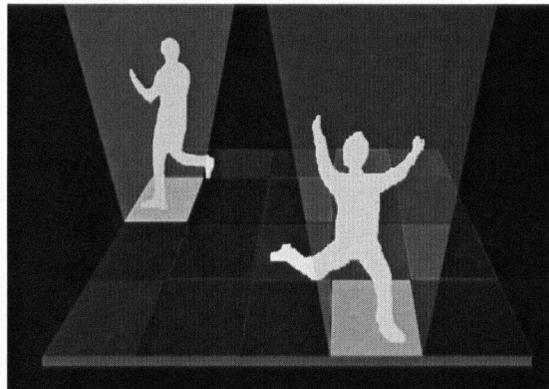
Figure6.12:
Interactive sonic fountain



(F2) Create activated floorscape lighting:

The lighting system under the glass paving is activated by step pressure; when it is stepped on, the light starts to reflect through the glass paving.

Figure6.13:
Activated floorscape
lighting



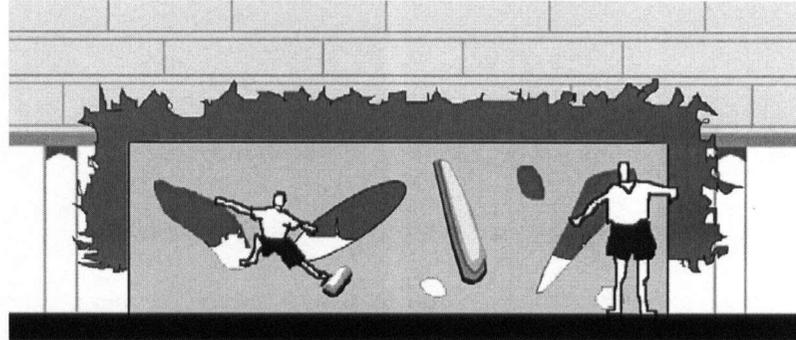
These interactive devices do not need to maintain a working status all through the day for the purpose of economizing energy. According to the research report, pedestrian peak hours occur at noon (11:00 am-2:00 pm) and nightfall (6:00 pm-8:00 pm). The intensity of social activities during peak hours is also at its highest. Thus, the interactive devices can be turned on only during the peak hours. During peak hours, they can greatly and effectively encourage social activities. The floorscape lighting can be turned on for a longer time, until 9 pm, because after 9 am there is a sharp decrease in pedestrian volumes.

(F3) Create textured art walls that encourage children to touch and play

Textured art walls can be introduced as a kind of attraction in pedestrian environments to replace the existing dull and blank walls in the study area. The on-site observation revealed that children demonstrated a strong desire to touch any object such as water,

leaves, stones and walls, etc., that caught their attention. The art wall with both hollowed-out and protruding surfaces can encourage children's touch and play.

Figure 6.14: The art wall with both hollowed-out and protruding surfaces



6.3 Conclusion

6.3.1 Summaries of the Study

This study applied pedestrian studies as the research method to explore some important relationships between pedestrians' social activities and the four influencing factors in the commercial pedestrian environment of Nanjing City. As a scientific research method, pedestrian studies helps us understand more about how people behave in urban spaces, and also helps us to discover some principles to encourage social life and activities. Most importantly, pedestrian studies helps us find practical and feasible ways to solve the problems. Finding and applying these solutions is vital to the success of a revitalization project.

The author hopes that the above pedestrian study report of Nanjing City can offer practical, positive and valuable information to architects, city planners or urban designers who are involved in doing revitalization projects for urban public spaces. The author also hopes the findings from the study will give some indications for further research.

6.3.2 Indications for Future Research

This study may provide some indications for doing a more in-depth, systematic study on people and commercial pedestrian environments.

Through this study, I found some seemingly regular patterns in the distribution of pedestrian flows in a commercial pedestrian environment. It is hoped that the patterns, and others that have yet to be identified, will be able to provide research value and guidance to professionals involved in the design of commercial pedestrian streets. We may also identify a practical method of estimating the general pedestrian flow distribution on a pedestrian street through analyzing the surrounding commercial service types and layout, the behavior characteristics of pedestrian's walking patterns, and the existing spatial configuration of the pedestrian environment. Understanding the

condition of the pedestrian flow distribution helps us solve some key problems such as finding optimal positions for rest spaces, landscape elements or entertainment facilities. Further research may be taken to determine a seating quantity standard for commercial pedestrian environments in the urban centers of Chinese metropolitan cities. Although North-American's seating quantity requirements are based on the total area of the open space, it is perhaps more reasonable for China's seating quantity standard for commercial pedestrian environments to be based on average pedestrian density. Of course, the suitability of this standard should be further examined.

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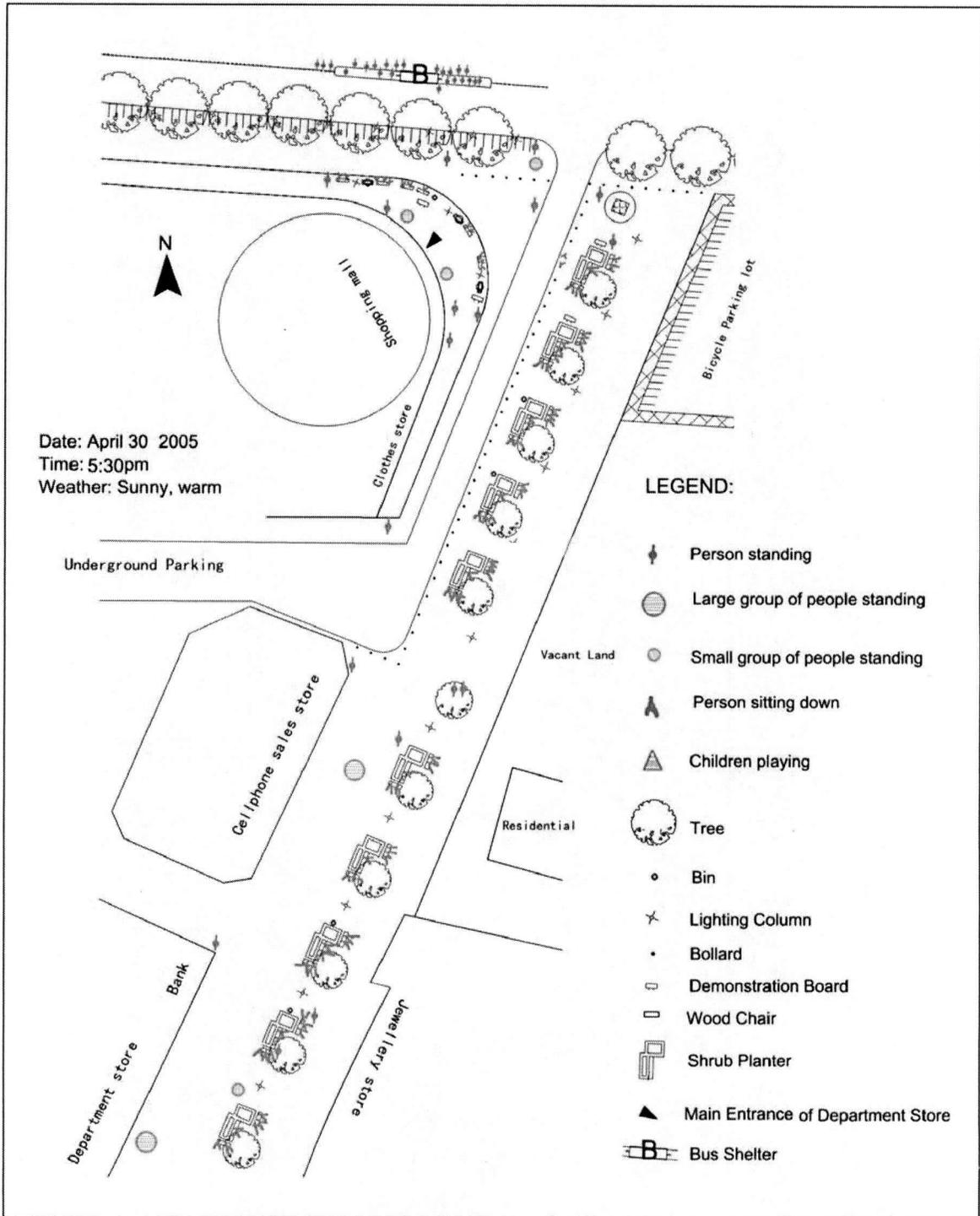
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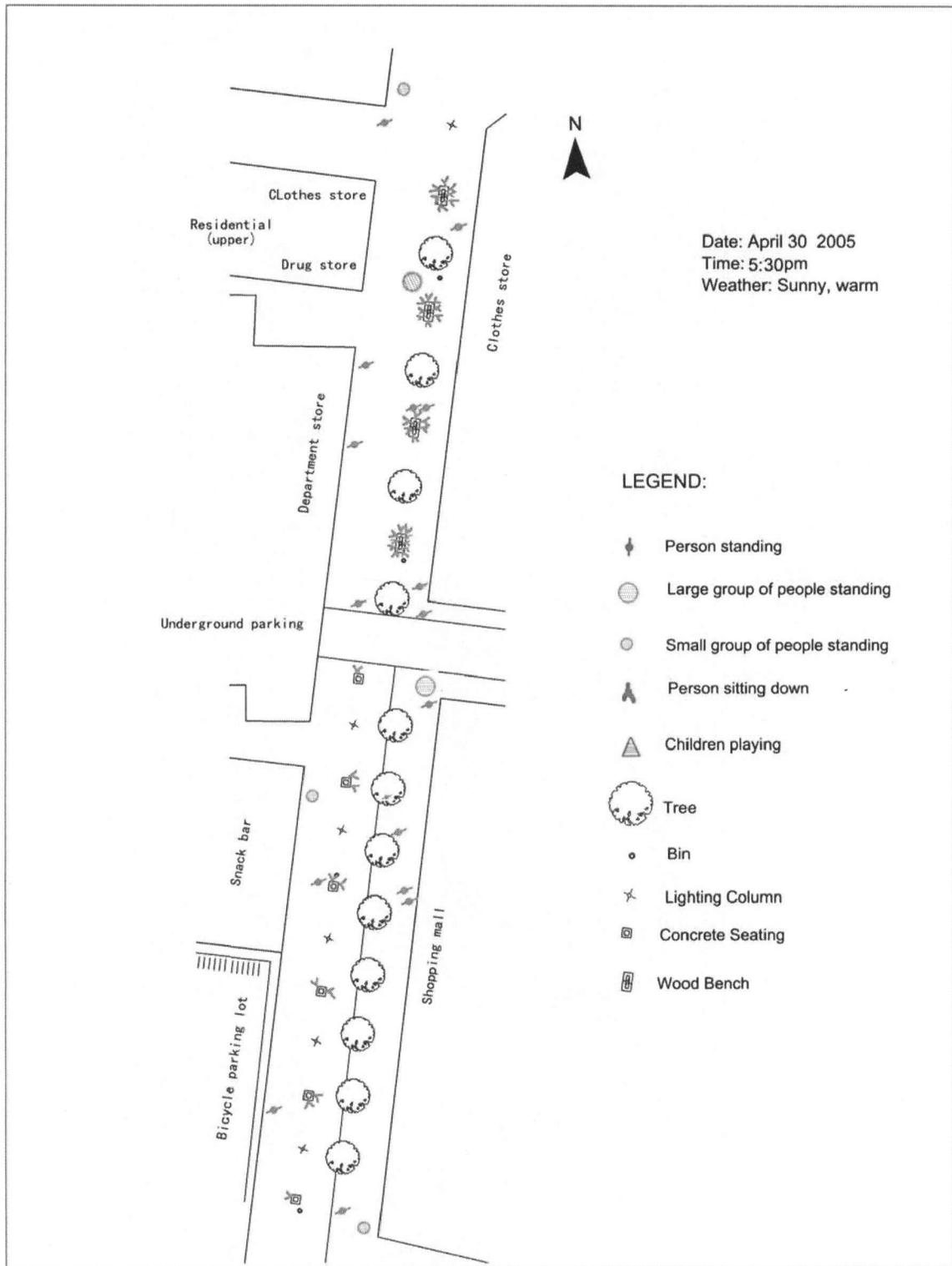
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Chapter Five:

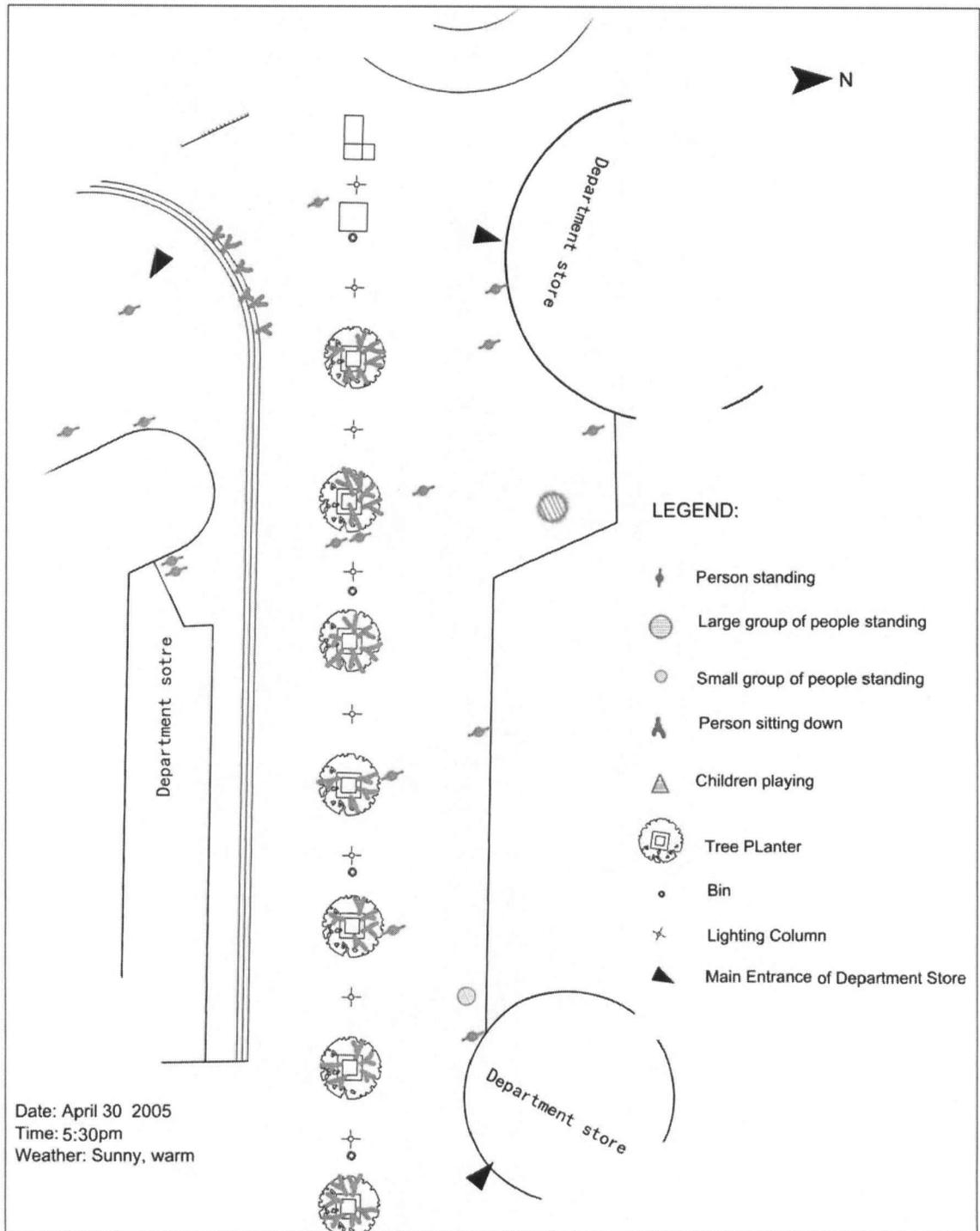
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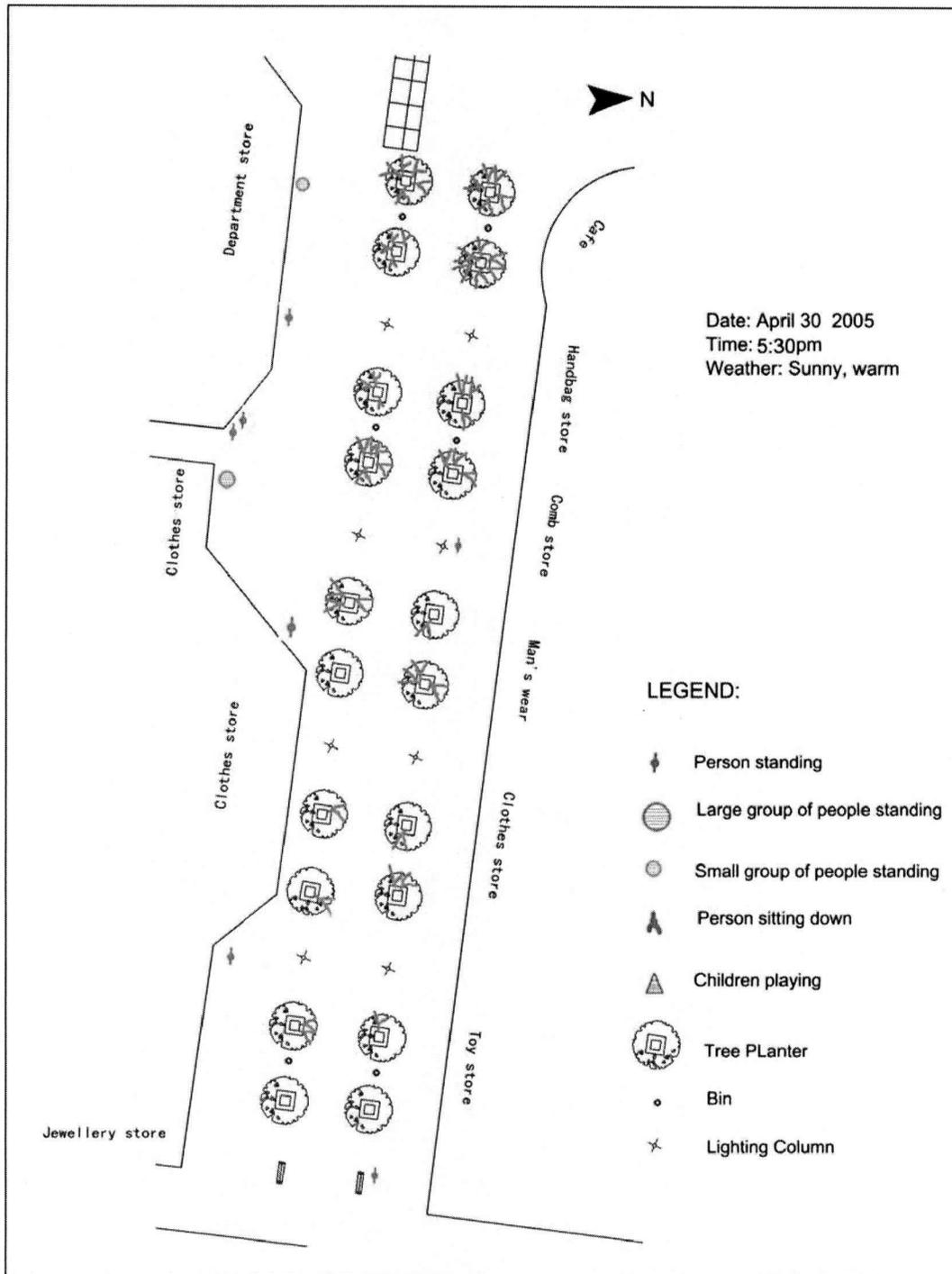
Appendix 1: Pedetrian Behavior Mapping - North Part of Zhenghong Pedestrian Street



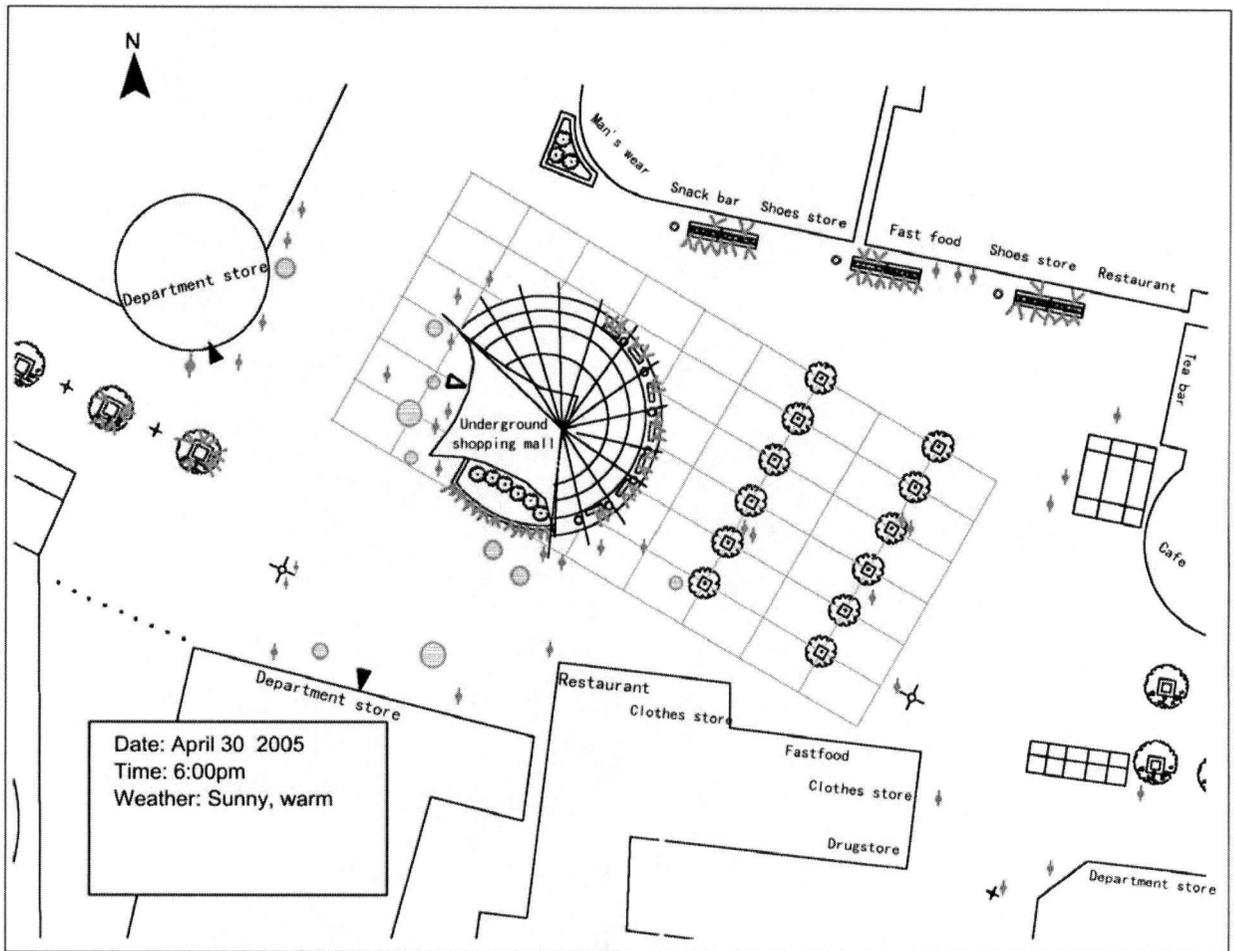
Appendix 2: Pedestrian Behavior Mapping - South Part of Zhenghong Pedestrian Street



Appendix 3: Pedestrian Behavior Mapping - West Part of Zhenghong Pedestrian Street



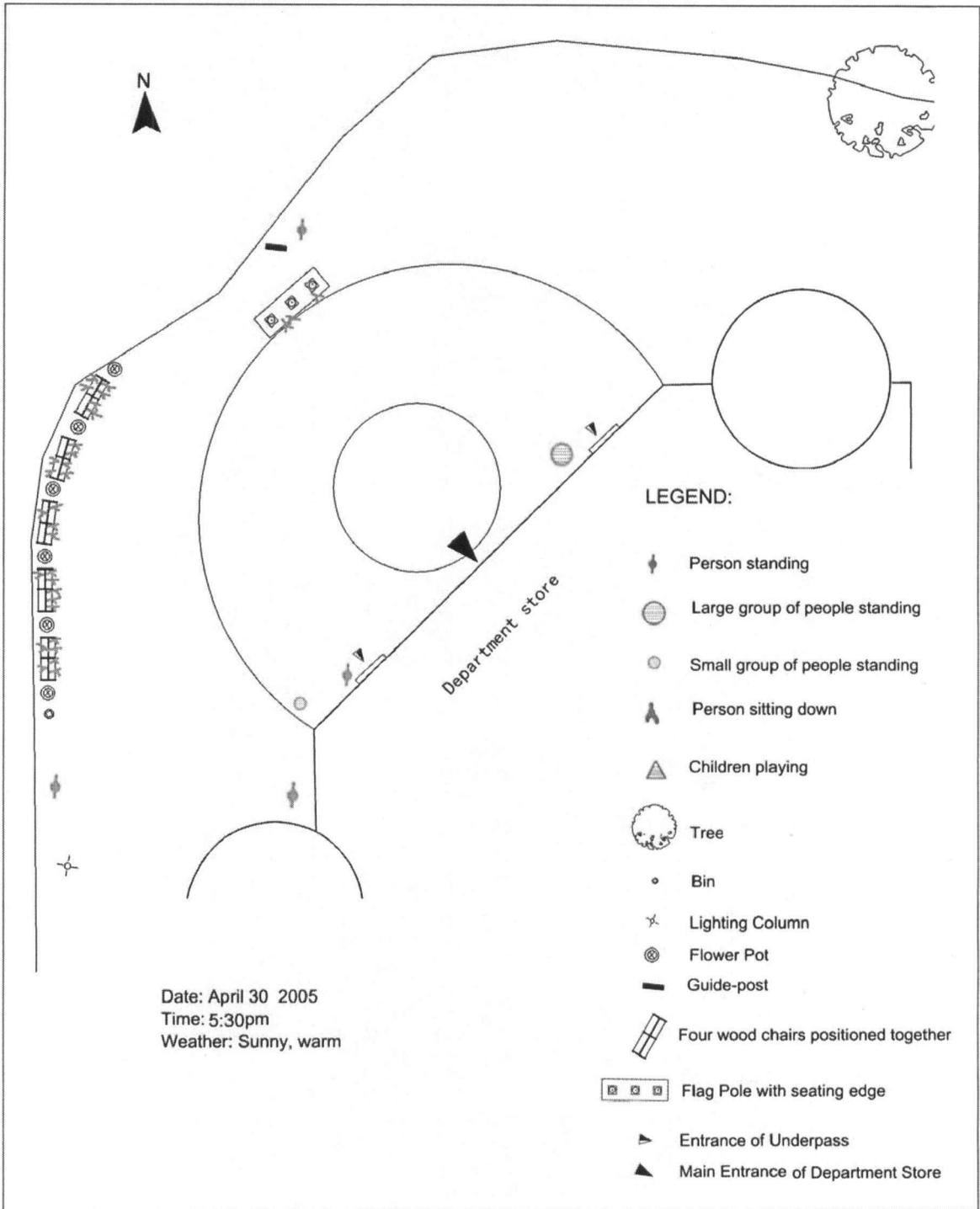
Appendix 4: Pedetrian Behavior Mapping - East Part of Zhenghong Pedestrian Street



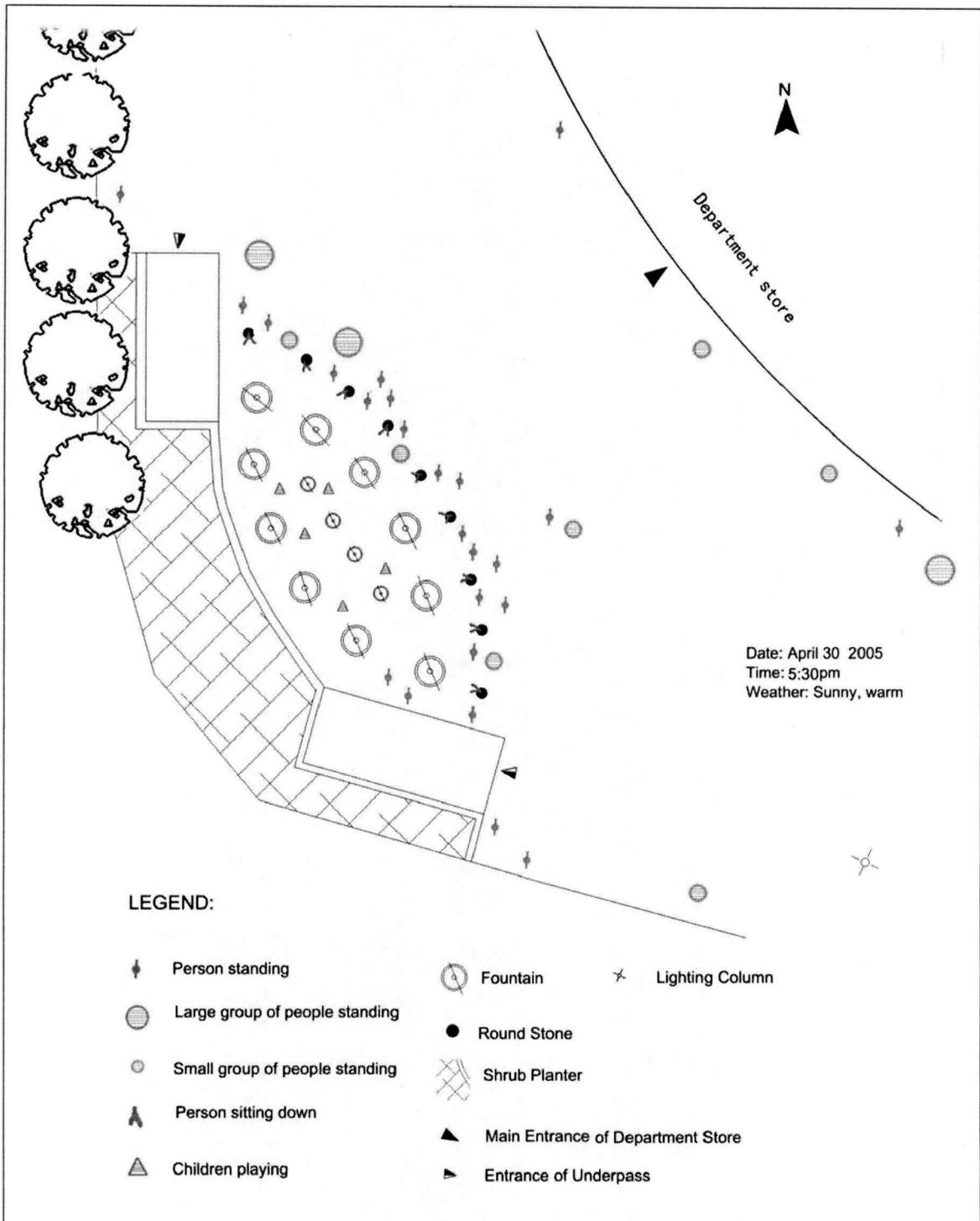
LEGEND:

- | | | | | | |
|---|--------------------------------|---|-----------------|---|--|
| ♣ | Person standing | 🌳 | Tree Planter | • | Bollard |
| ⊙ | Large group of people standing | ○ | Bin | 🌳 | Tree Box |
| ⊙ | Small group of people standing | ✖ | Lighting Column | □ | Chairs |
| ♣ | Person sitting down | 🌳 | Shrub Planter | ♣ | Main Entrance of Department Store |
| ♣ | Children playing | 🌳 | Shrub Planter | ♣ | Main Entrance of Underground Shopping Mall |

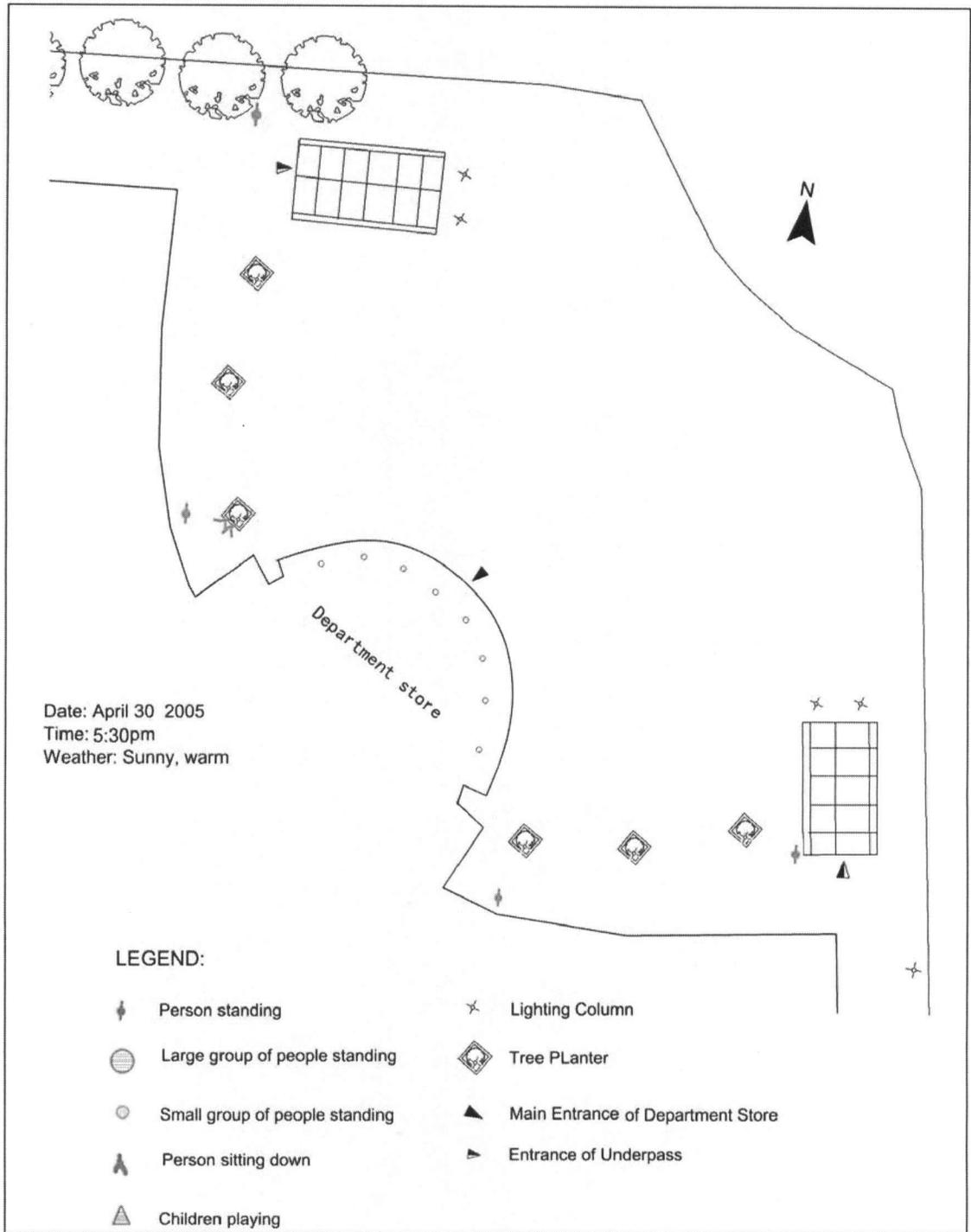
Appendix 5: Pedetrian Behavior Mapping - Central Part of Zhenghong Pedestrian Street



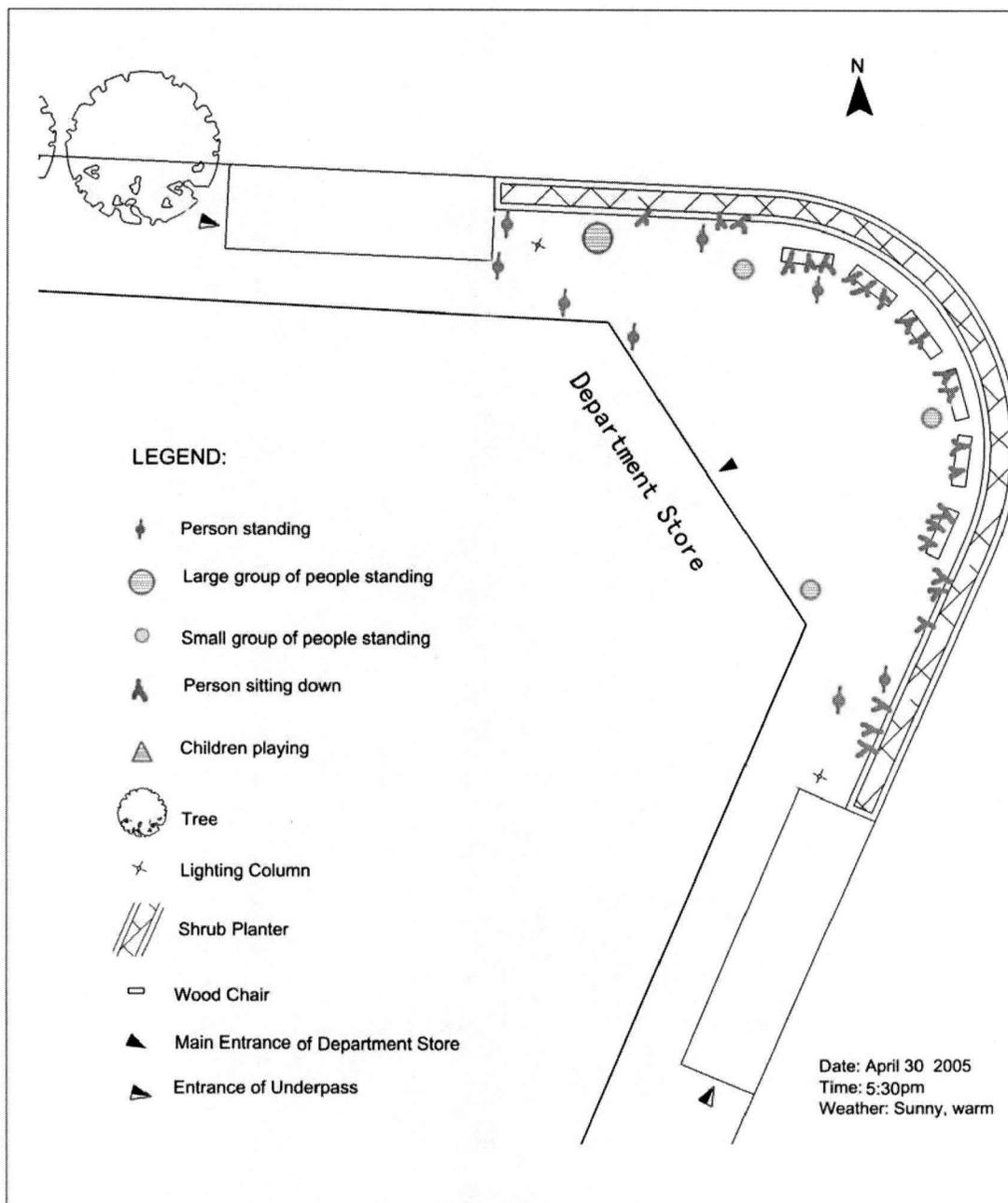
Appendix 6: Pedestrian Behavior Mapping - Xinbai Plaza



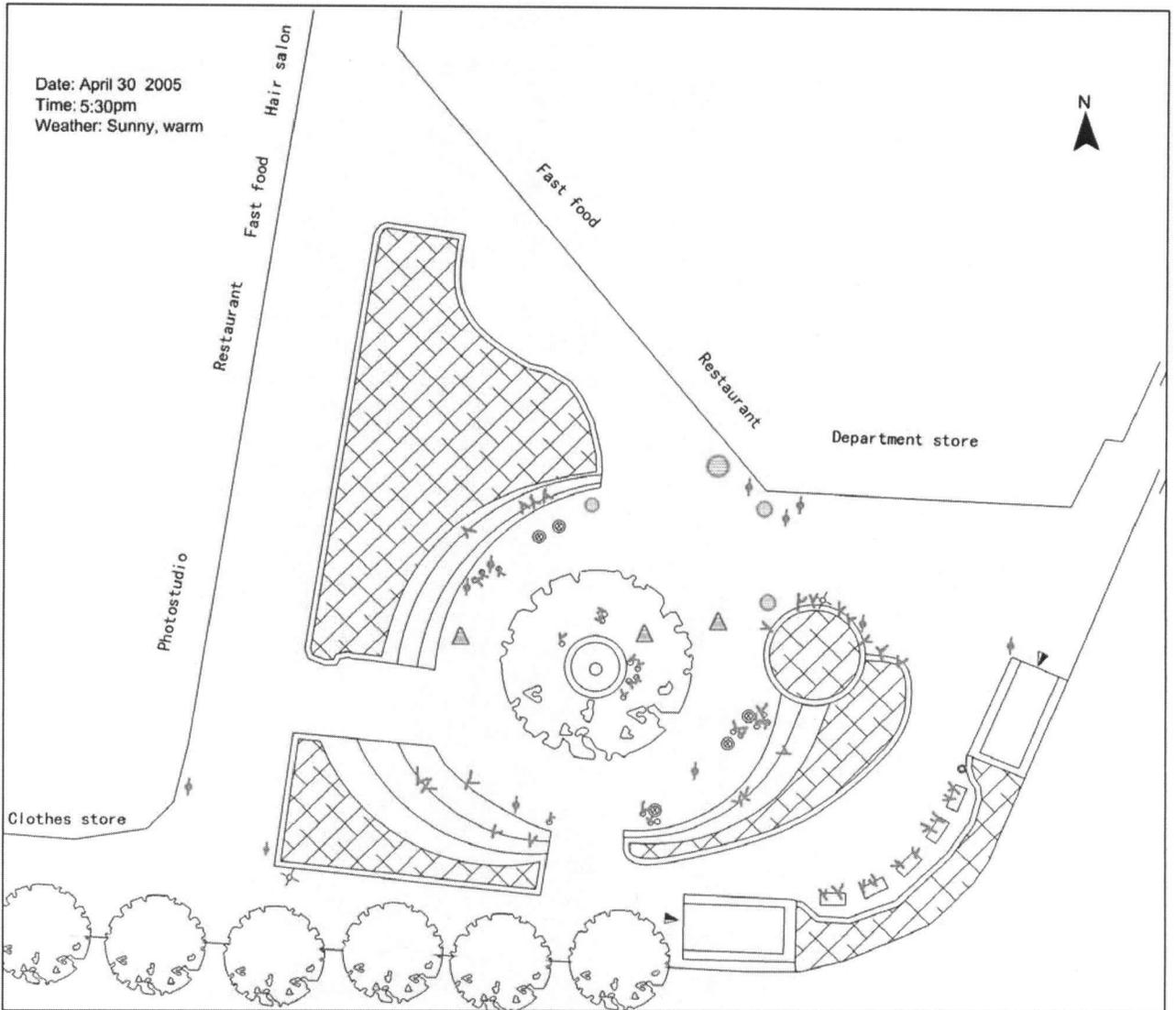
Appendix 7: Pedetrian Behavior Mapping - Zhongyang Street Corner



Appendix 8: Pedetrian Behavior Mapping - Dongfang Plaza



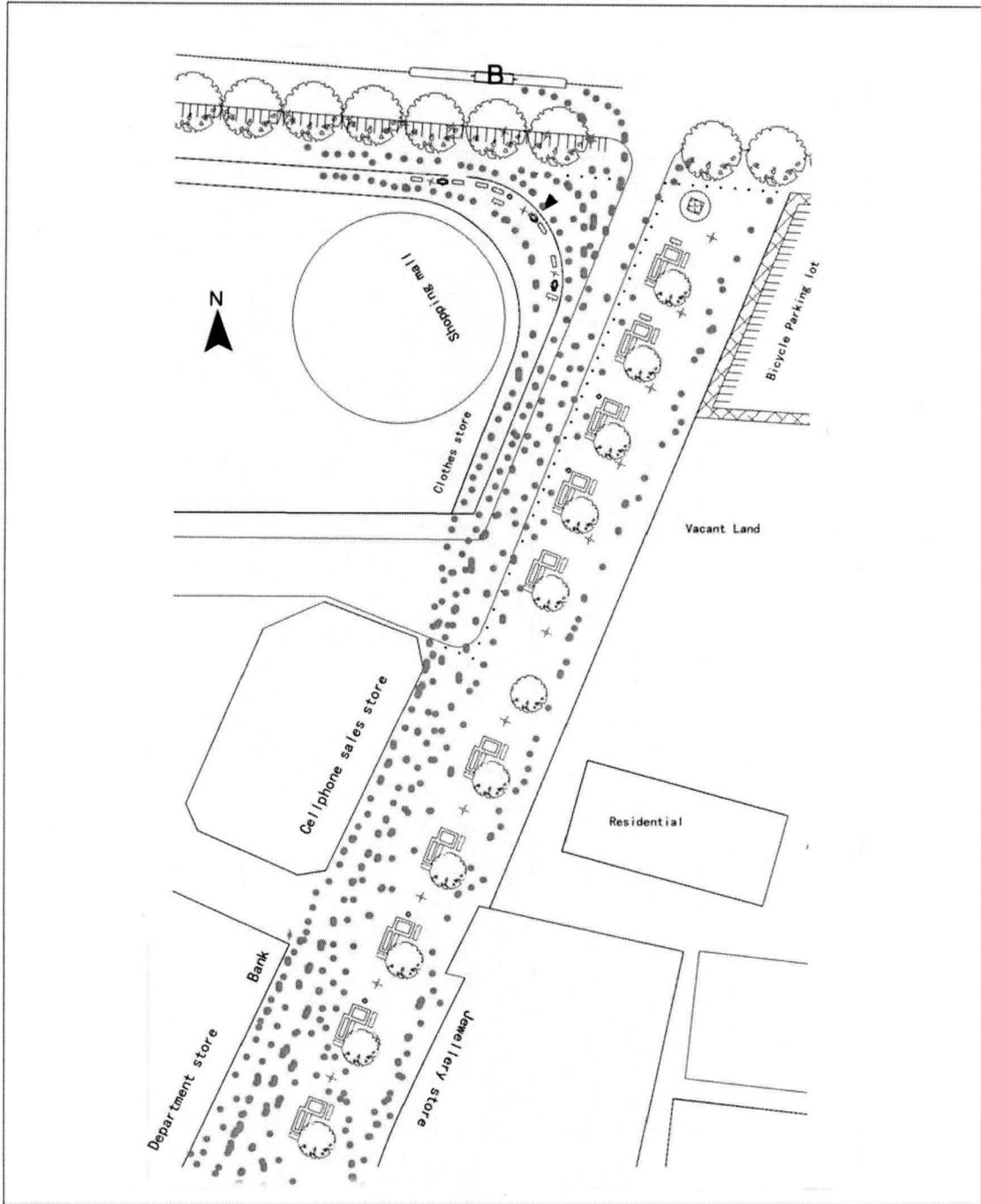
Appendix 9: Pedestrian Behavior Mapping - Jinying Street Corner



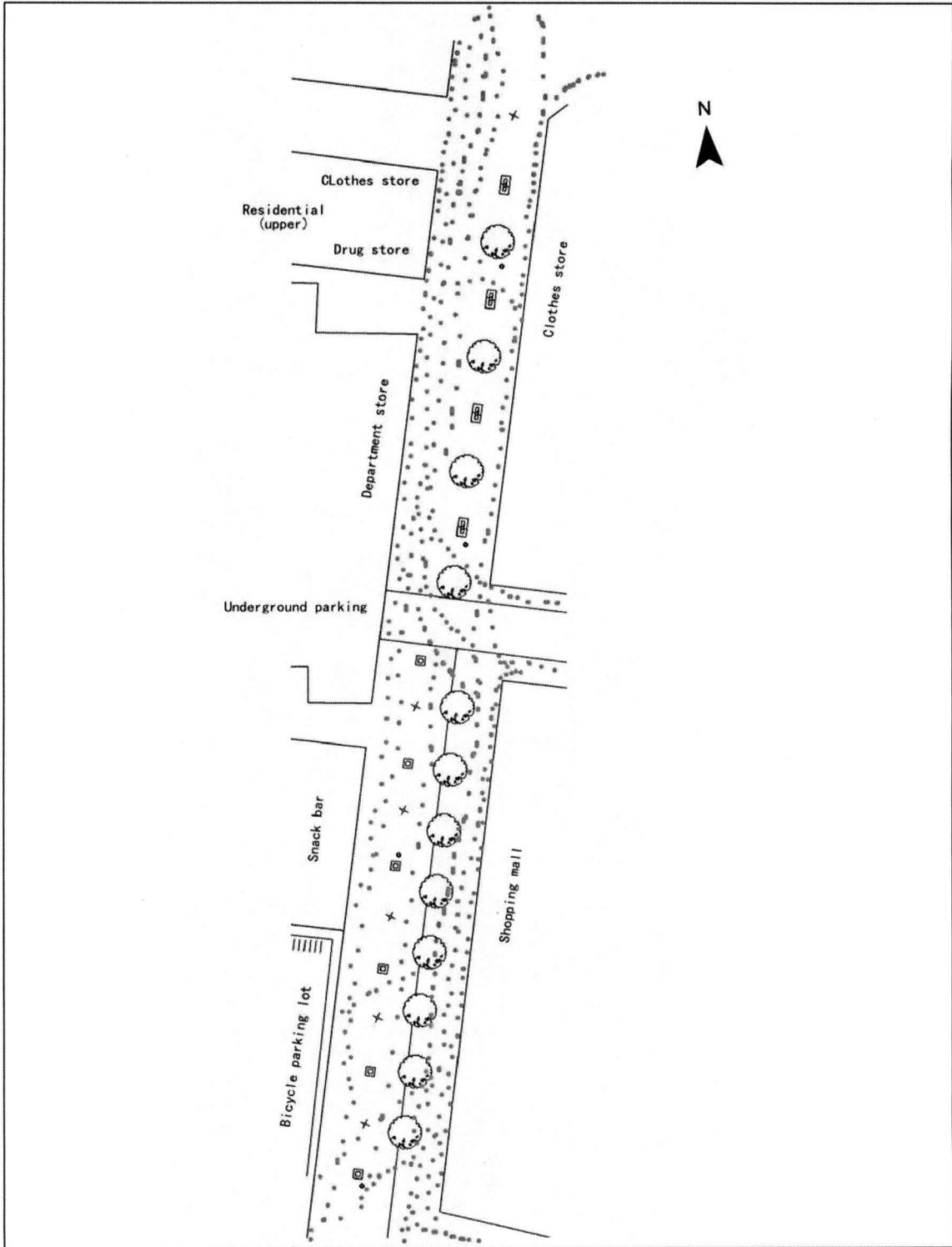
LEGEND:

- | | | | | | |
|---|--------------------------------|---|-----------------|---|-----------------------|
| ♣ | Person standing | ✱ | Lighting Column | ○ | Stone Stool |
| ⊙ | Large group of people standing | ⊗ | Flower Pot | ▶ | Entrance of Underpass |
| ⊙ | Small group of people standing | ⊘ | Shrub Planter | | |
| ♣ | Person sitting down | ○ | Bin | | |
| △ | Children playing | ▭ | Wood Bench | | |

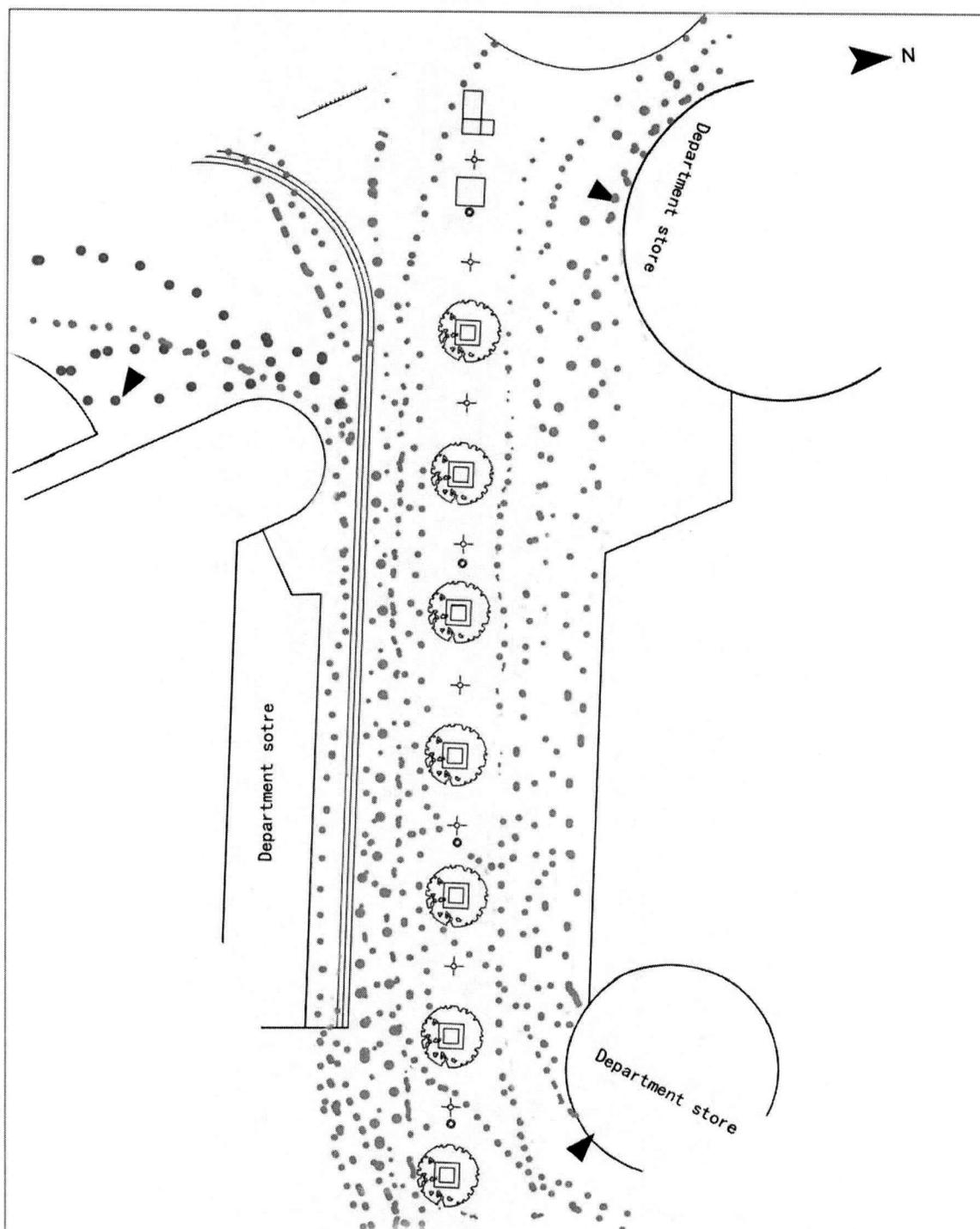
Appendix10: Pedetrian Behavior Mapping - Leifulai PLaza



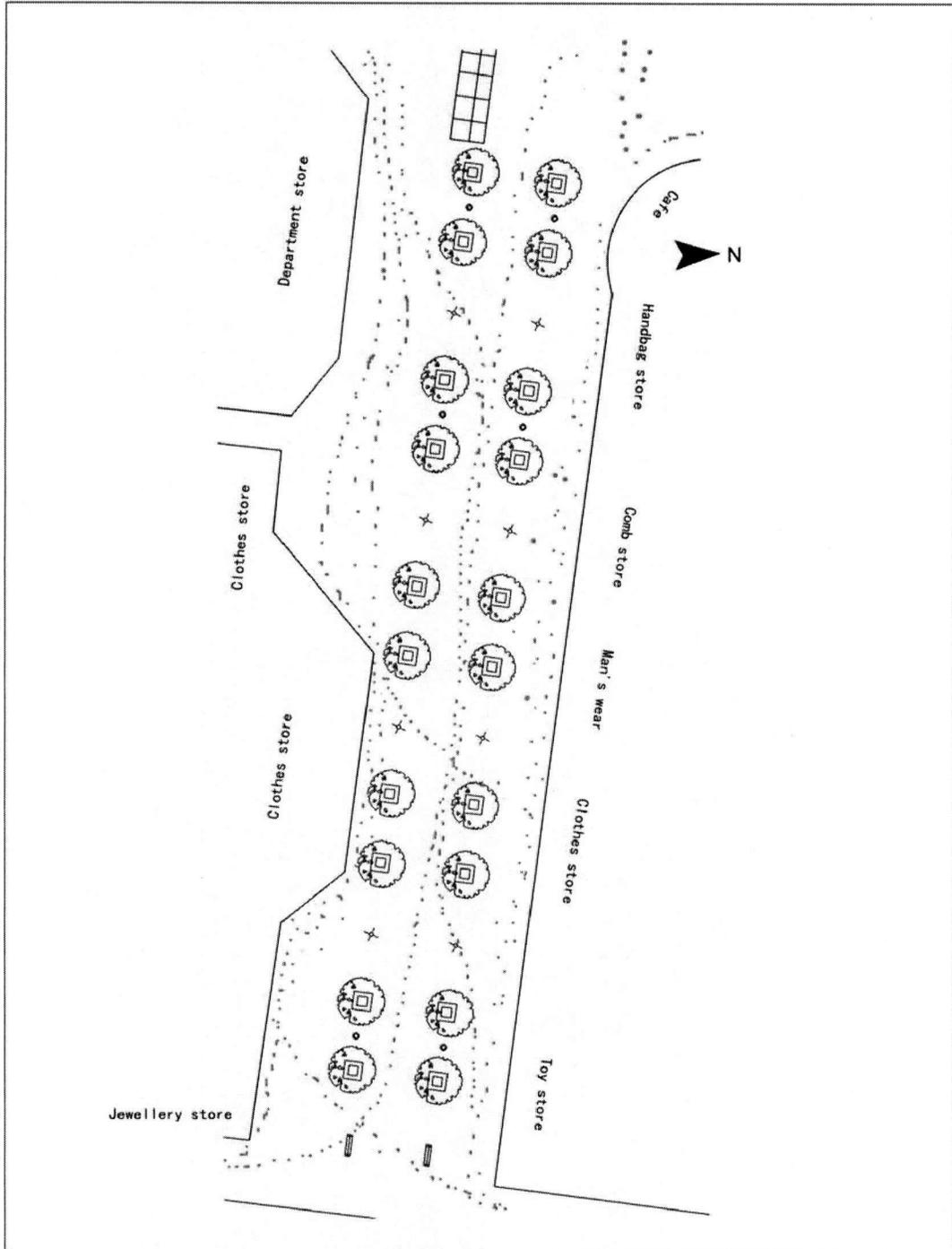
Appendix a: Pedestrian Flow Mapping - North Part of Zhenghong Pedestrian Street



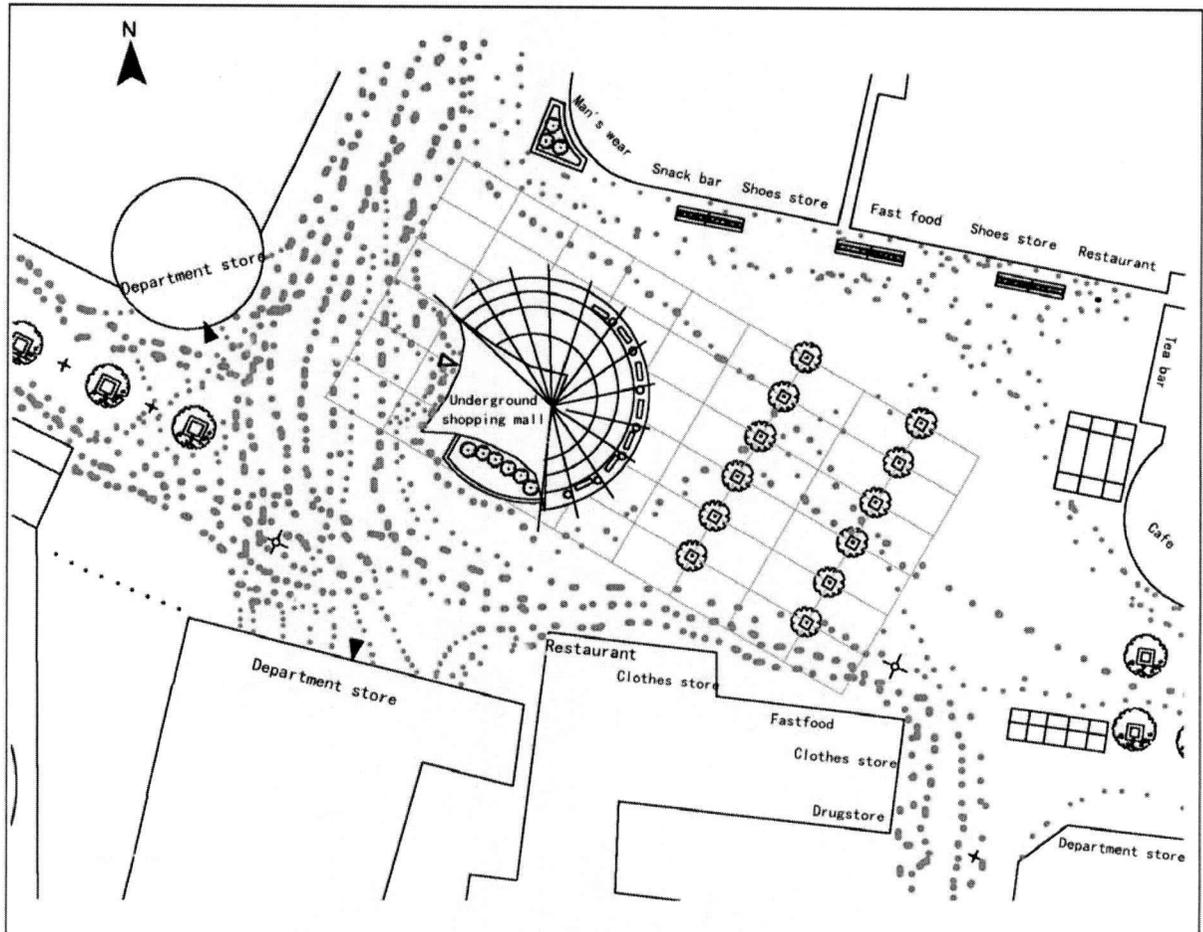
Appendix b: Pedestrian Flow Mapping - South Part of Zhenghong Pedestrian Street



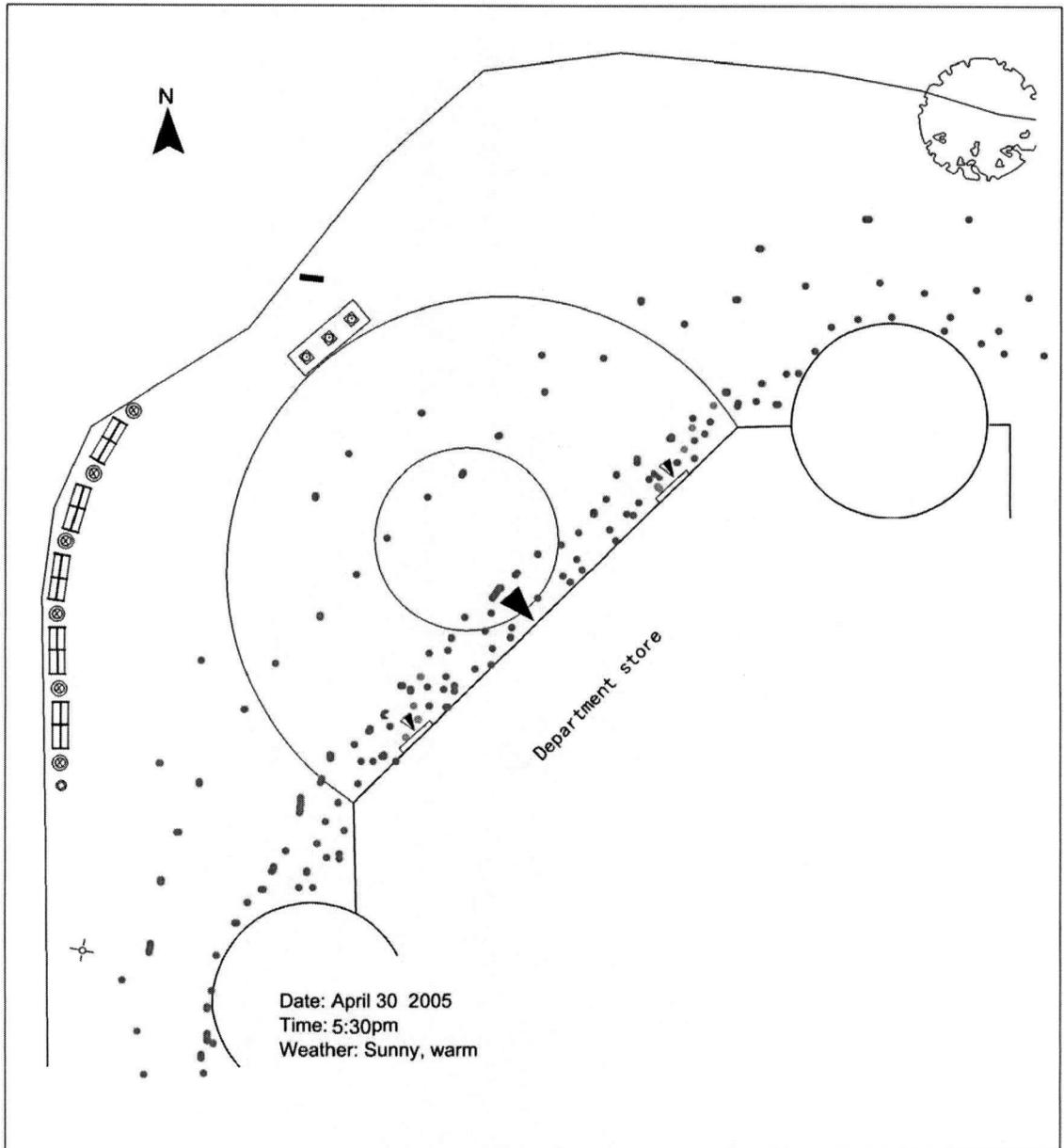
Appendix c: Pedestrian Flow Mapping - West Part of Zhenghong Pedestrian Street



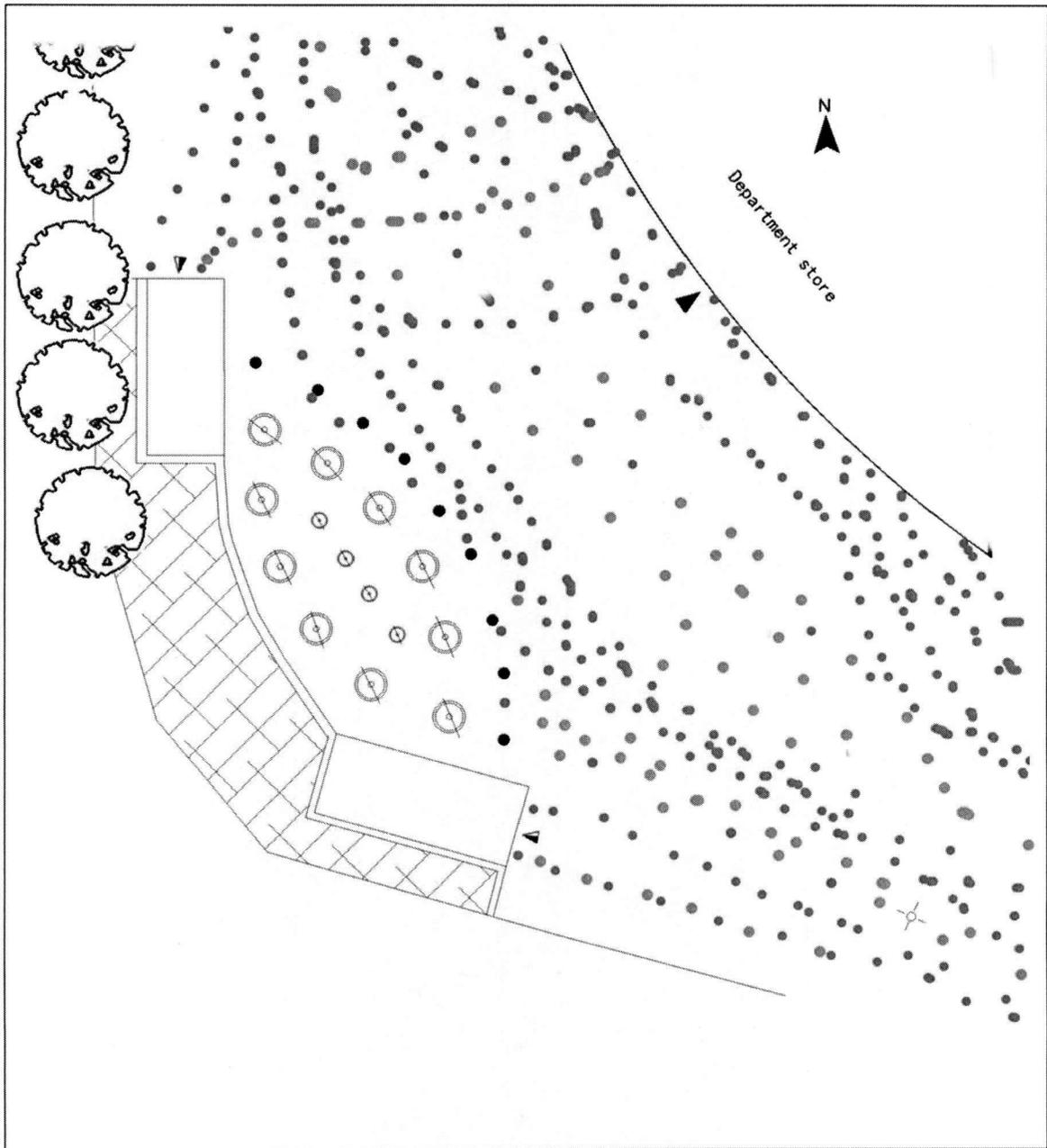
Appendix d: Pedestrian Flow Mapping - East Part of Zhenghong Pedestrian Street



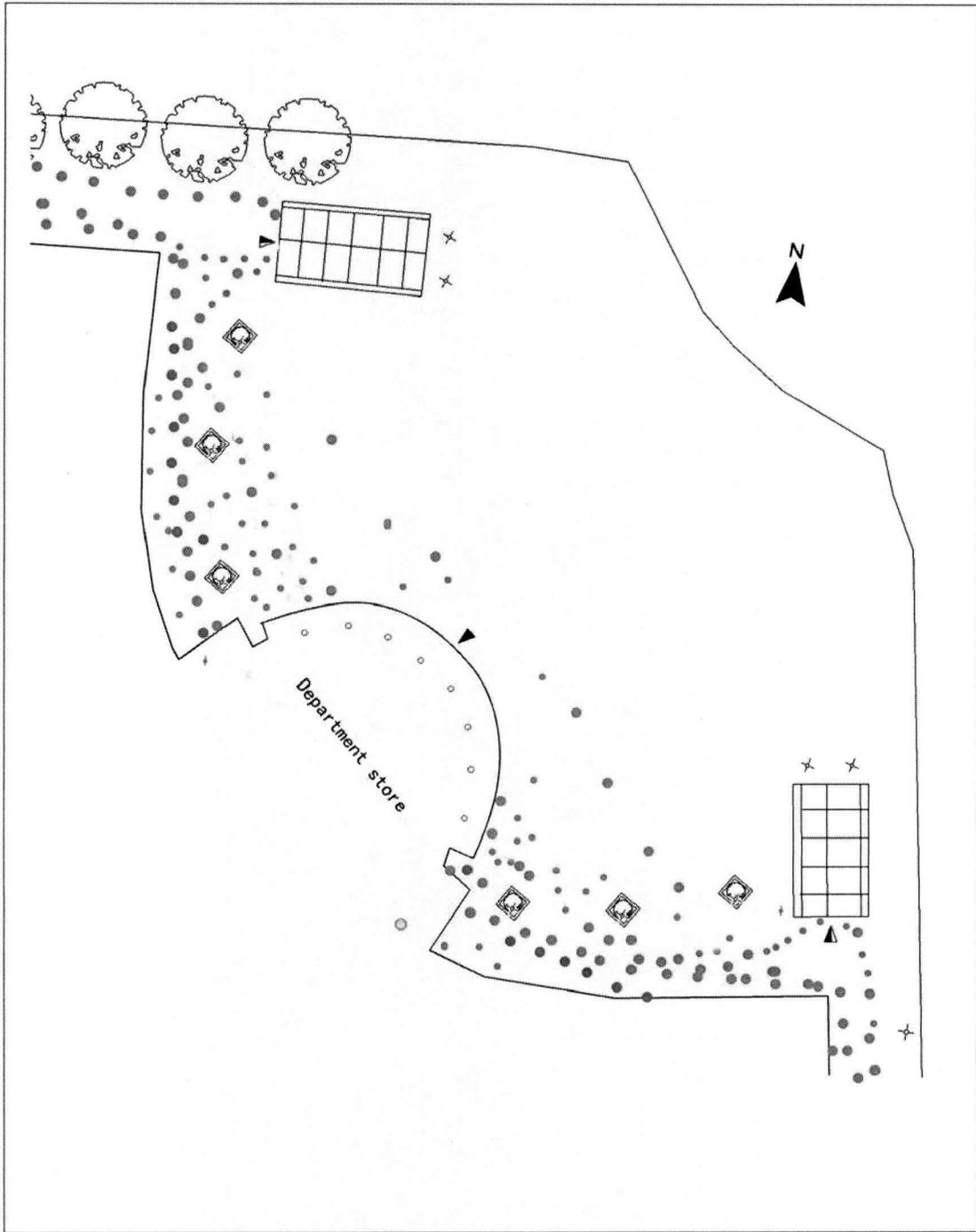
Appendix: Pedestrian Flow Mapping - Central Part of Zhengong Pedestrian Street



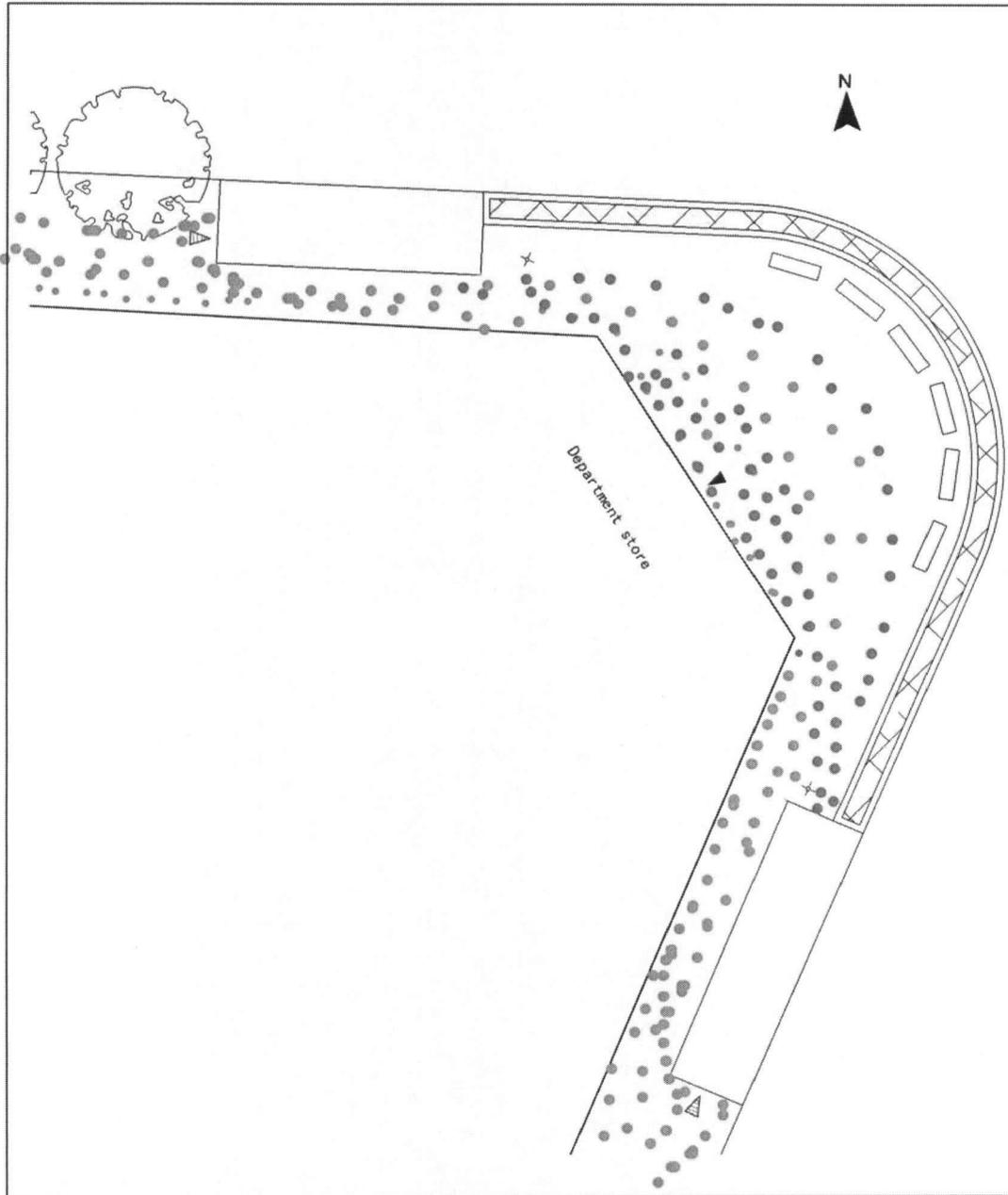
Appendix f: Pedestrian Flow Mapping - Xinbai Plaza



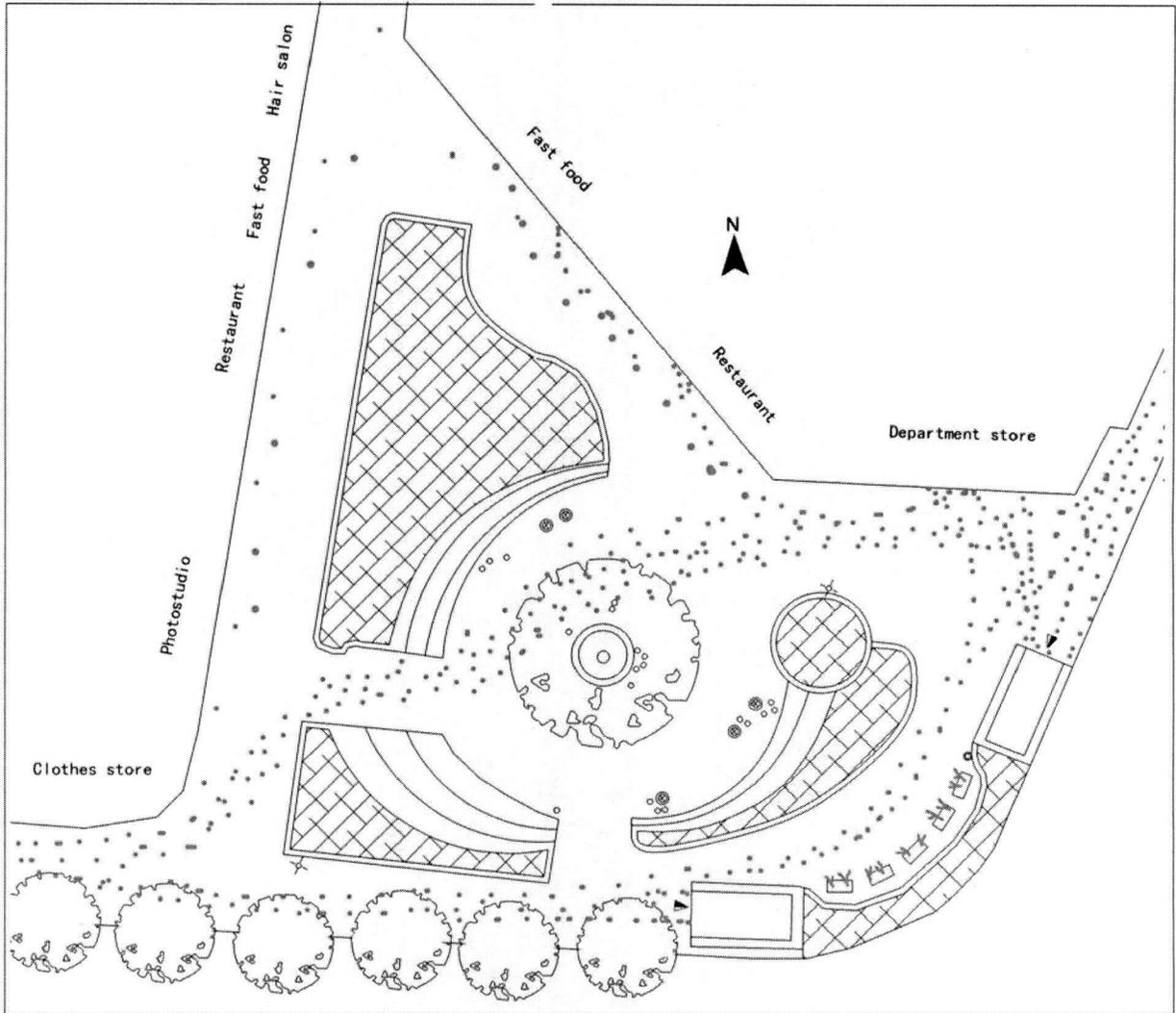
Appendix 9: Pedestrian Flow Mapping - Zhongyang Street Corner



Appendix h: Pedestrian Flow Mapping - Dongfang Plaza



Appendix i: Pedestrian Flow Mapping - Jinying Street Corner



Appendix J: Pedestrian Flow Mapping - Leifulai Plaza