

Public Space Analysis on Spontaneously Formed University Towns on the Basis of Students' Behaviors to Attend and Dismiss the Class

—A Case Study of Shigulu Block in Jimei District, Xiamen City

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Abstract. Jimei School Village is a university town with a history of nearly one hundred years. Its “spontaneous” formation is distinctly different from that of the prevailing “planning-construction” university towns. Under the turning point of public space optimization in Jimei District, this paper took the behaviors of students in the university town to attend and dismiss the class as the breakthrough point to analyze characteristics in the block, so as to understand the demands of students in this special university town for public space. The paper summarized possible shortcomings in Jimei School Village and regarded this as the basis for optimization and reconstruction of the school village. It provided a case for researches on “spontaneous” university towns.

History and Current Status of Jimei School Village and Shigulu Blocks

Jimei School Village

Jimei School Village is located in Jimei District, Xiamen City. It is the general term for all types of schools and cultural institutions in Jimei. The name of Jimei School Village originated in the 1920s. In order to avoid adverse impacts of warlords on students, schools in Jimei made a petition to the State Department to admit Jimei schools as “school villages with permanent peace”, so as to ensure a peaceful learning environment. As a result, “Jimei School Village” was proposed in *Convention to Admit Jimei School Village* in October 1923. It is still popular even today. Jimei School Village was founded by Chen Jiageng, the leader of patriotic overseas Chinese. After nearly one hundred years of development, Jimei School Village has more than ten thousand teachers and students at present. It possesses more than one hundred teaching buildings, with a total area of over 100,000 square meters. In the school village, there are navigation schools, sports schools, normal schools, financial and economic colleges, technical secondary schools, primary and middle schools, kindergartens and nursery schools. In addition to the schoolhouses, there are auditoriums, swimming pools, gymnasiums, cinemas, hospitals, sailing clubs and some other facilities. The school village is on a grand scale, with exquisite architectures. Its Jiageng-style architectures are unique in the country.

In China, such pattern which is founded by one person but sets all types and levels of educational facilities as a whole is particularly special. Meanwhile, since the school village is integrated with the city for common development, it is similar to the University Town of Oxford in the United Kingdom.

Shigulu Block

Shigulu Road



Figure 1 The Formation of Shigulu Road

Shigulu Road was opened in the 1960s. It is a main street throughout Jimei School Village. It reaches Jiyan Road in the north and arrives at Jiageng Road in the south, with a total length of about 2 km. The 20 colleges (the originally independent senior colleges and technical secondary schools merged into Jimei University) of Jimei University, Jimei middle schools, primary schools and kindergartens are distributed on both sides of the road.

The history of Shigulu Road can be traced back to the early days of liberation when Chen Jiageng opened a large number of roads to improve the school village. Shigulu Road is the second batch of road built after Dashe Road, Ao Road and Jiageng Road. Its formation is mainly due to the construction of various types of schools in the school village - the schoolhouse construction of Nanqiao College, Marine College and Jimei Primary School prompted the formation of the south segment of Shigulu Road. With the continuous development of the various schools and emergence of new schools, Shigulu continued to extend northward. It finally reached the Yindou campus of Jimei University (Figure 1)..

Because of the unique geographical position of Shigulu Road, administrative facilities, major public service facilities and commercial areas successively show up on both sides of the road with the continuous development of Jimei School Village. This makes Shigulu Road a multi-functional collection of commercial streets, campus roads and commute route. Accordingly, crowds in the Shigulu Block are complex.

Shigulu Block

(1) Shigulu Block defined in this paper refers to the block with Shigulu Road as the center and constituted by colleges of Jimei University and commercial zones on both

sides. Wherein, the block boundaries are mainly divided in accordance with land functions and adjacent municipal roads.



Figure 2. Scope of Shigulu Block

(2) The criteria to define the block is as follows: the research objects of “behaviors” are main bases for the definition of Shigulu Block. In the neighborhood, there are mainly three kinds of people: students, residents and foreign personnel (workers and shoppers). As for this paper, it aims to discover problems in the block via researches on daily behaviors of these three kinds of people. Therefore, according to possible activity places of them, Shigulu Block can be divided into three parts: school zones (Zone 1), landscape areas (Zone 2) and residential areas (Zone 3) (Figure 2).

Present Situation and Issues of Shigulu Block. (1) Surface: the business

model is single in functions; there is a lack of public facilities and street furniture; sidewalks are narrow; the shopping environment is crowded; the traffic is heavy; cars are parked disorderly.

(2) Below the surface: since the block gathers local residents, students and tourists and students of Jimei University need to shuttle in the block (mainly Shigulu Road), there are some differences between Shigulu Block and the general neighborhoods:

A. Among a day on weekdays, there are frequent rush hours in the block. The sudden increase in the flow of people will make the block overcrowded (Figure 3).

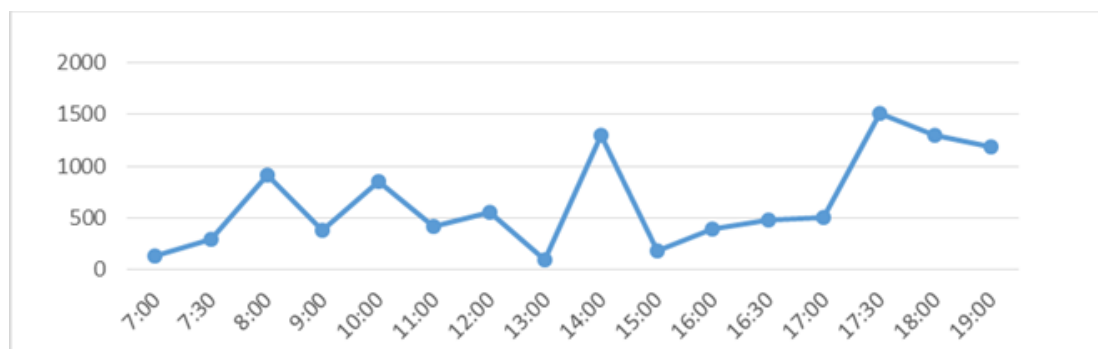


Figure 3. Investigation on the Population Flow at the Junction of Jimei Gymnasium in the Block

B. In winter and summer vacations (or major holidays), the population flow will decline dramatically and the block will become sluggish since students leave the school.

These problems reflect great fluctuation in the population flow in Shigulu Block. This characteristic brings a series of problems to the block, such as crowded streets, high volatility in commercial structures along the street, etc. In addition, there is a serious shortage of places for recreation. Moreover, the utilization of public recreational space is low. It is the focus of public space optimization in Shigulu Block to resolve the contradictions between “behaviors” of residents and the block space.

Analysis on Behaviors to Attend and Dismiss the Class in Shigulu Block

Public Space and Behaviors

People often explain space with the following words of Lao Zi (the founder of Taoism): “windows and doors are carved to build a house. It functions as a house since it is empty”. Space is regarded as the empty room in objective substances. However, this is only an explanation at the level of “logistic space”. It is the basis to recognize space [1]. Nevertheless, this is not the entirety of space. The significance of space, especially public space lies in the use of humans. In the words of Heidegger, “nothing can separate humans from space. Space is not an external entity. Nor is it the inner experience. Space does not exist anymore when humans are excluded. [2]”

People hold different views about the relationship between space and behaviors. However, it is generally accepted that interactivity exists between the two. On the one hand, space has an impact on human behaviors. The specific forms, locations and characteristics of urban space attract unique functions, uses and activities. The main function of space is to “support behaviors”[1] of humans. On the other hand, the space environment is constructed by humans. Moreover, its quality can be reflected by human behaviors. “According to the research on human behaviors in environments already created, the adaptability of environmental designs to the internal needs of humans can be inferred. Consequently, it is possible to evaluate the environment and

identify problems with the existing environment. [3]” In other words, human behaviors are important criteria for the detection of environmental quality in the neighborhood.

In terms of research methods, there are a variety of methods to research human behaviors. The selection of specific research method will have a great impact on the credibility and results of the research. Research methods in this field include “experimental method, natural observation, test method, evaluation and motivation research” [4]. As for this paper, it mainly adopted the observation method, supplemented by questionnaires. Natural observation is to “systematically observe the use of environment (how environments support or hinder behaviors occurring therein)”. Specifically, it includes the following methods: 1, Natural observation. Namely, base on the pre-prepared themes to carry out observations and records as a “complete observer”. This is to understand the overall situation of the observed areas. 2, Graphical record. This method mainly records behaviors occurring in the space and behavior trajectories of users in the space environment. 3, Quantitative analysis method. This method conducts quantitative analysis on the obtained information. It represents variation of the population flow with time and place changes in the form of charts in the statistics of the population flow [5].

Analysis on Behaviors of Students in the Block to Attend and Dismiss the Class

The behaviors of students to attend and dismiss the class belong to necessary activities (Jan Gehl, a Danish architectural theorist, divides activities in neighborhoods into three categories on the basis of human activities in outdoor public space: necessary activities, spontaneous activities and social activities). Necessary activities are those all people should participate in varying degrees, including daily works and life affairs. Since activities are necessities of life, they are rarely influenced by the surrounding environment. However, necessary activities are associated with the long-term living habits of people. Such habitual behaviors prompt the formation of specific places. In other words, they reflect public space, especially some problems with the public space, in the block. Besides, the environment of necessary activities provides conditions for the occurrence of social activities and spontaneous activities. This section aims to analyze problems and use of space in Shigulu Block via researches on the behaviors of students in the block.

In Shigulu Block, colleges of Jimei University account for 37.5% of the total area. Students of Jimei University occupy nearly 50% of all people in the streets in Jimei (Jimei School Village belongs to the streets of Jimei). Such a high proportion indicates: daily activities of students are important components of activities in the block.

In addition to students in Jimei University, those in the College of Chinese Language of Huaqiao University and Jimei Primary School also conduct the behaviors of attending and dismissing the class. However, both teaching buildings and dormitories of the College of Chinese Language are within the scope of the college. In addition, Jimei Primary School only has 1600 students. This is much fewer than those of Jimei University (35, 000). For these reasons, the research focused on students in Jimei University. Students in the College of Chinese Language and Jimei Primary School were not considered.

It is routine for students to attend and dismiss the class. According to the survey, students in Jimei University have five lessons everyday (except Saturday and Sunday) on the average. Most courses are concentrated in headquarter of Jimei University, the College of Finance and Economics and the College of Fisheries. As a result, the

students have to pass through the entire block to attend and dismiss the class most of the time. Therefore, behaviors of students in Jimei University to attend and dismiss the class are emphases to research necessary activities in the block.

Based on field researches, it can be seen that students in Jimei University mainly attend and dismiss the class in Shigulu Road and its surrounding streets. In this section, the author gave a detailed analysis on these behaviors from three aspects: time, ways of traveling and behavior trajectories.

Time - the population flow of these behaviors fluctuates wildly with time changes. Since there are vacations, the behaviors of students to attend and dismiss the class have different impacts on the block at different times. According to the general education systems in China, college students can enjoy winter and summer vacations. Generally, the winter vacation starts in mid-January and ends at the end of February. As for the summer vacation, it usually lasts from early July to late August. During these two periods, most of the students will leave for home. Consequently, the campuses are almost “vacant”. Based on this, the author analyzed the behaviors of students to attend and dismiss the class from two perspectives: in normal workdays and during the holidays.

a. In normal workdays

(1) Changes in behaviors of students to attend and dismiss the class within one week

Since students have no classes at weekends, their behaviors of attending and dismissing the class are significantly fewer than those during the weekdays. The author took the population flow of students at a junction of Jimei Gymnasium in Shigulu Block within one week (during the time period 9: 50 a.m. - 10: 00 a.m.) in April for data statistics (Figure 4). As can be seen from the chart, the student flow on weekdays was three times as that at weekends. Such high-volatility population flow in Shigulu Block is more significant than that in other streets in the city.

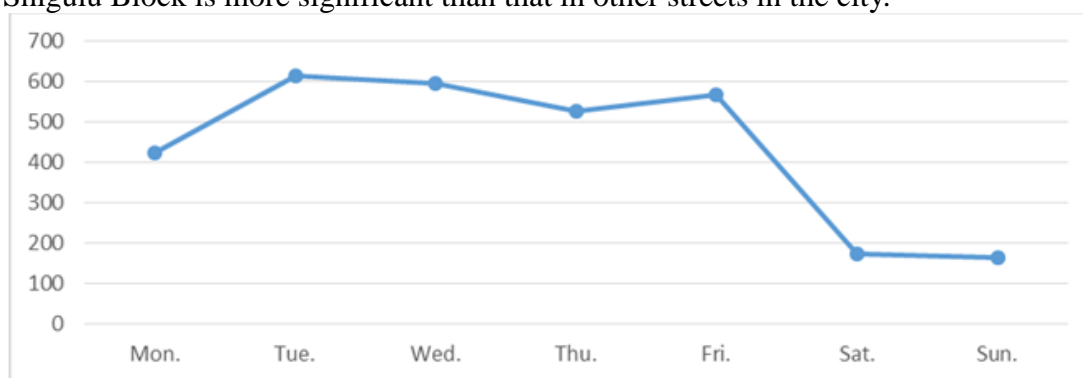


Figure 4. Investigation on the Population Flow at the Junction of Jimei Gymnasium in Shigulu Block within One Week ((from the ten minutes 9: 50 - 10: 00 for sampling at April 8 to April 14)

The author learned from interviews on students in Jimei University that they generally have no classes at weekends, except some scattered elective courses. Moreover, most students living in “block dormitories” (dormitories in Jimei University include those in colleges and those in blocks outside the colleges. The latter is referred to as “block dormitories”) will choose to stay at the dormitory because of inconvenience.

(2) Changes in behaviors of students to attend and dismiss the class within one day

This section researches changes in behaviors of students to attend and dismiss the

class within one workday. Since there are class schedules in Jimei University, students attend and dismiss the class at specific times. Via the investigation, the student flow reaches its maximum in the ten minutes before and those after the class. In order to intuitively reflect the changes in student flow, this paper kept data statistics for three nodes in the block, as shown in Figure 5.

Most of the students in Jimei University have classes from Monday to Friday. Based on the collection and collation of class schedules in Jimei University, the author obtained behavioral characteristics of the students to attend and dismiss the class during various parts of the day. According to the above analysis, population flows in Shigulu Block are more frequent than those in other blocks due to the involvement of students. In addition, the population flow may increase suddenly and dramatically. Moreover, the block is often crowded at rush hours. This is particularly serious in Shigulu Road and some narrow roads.

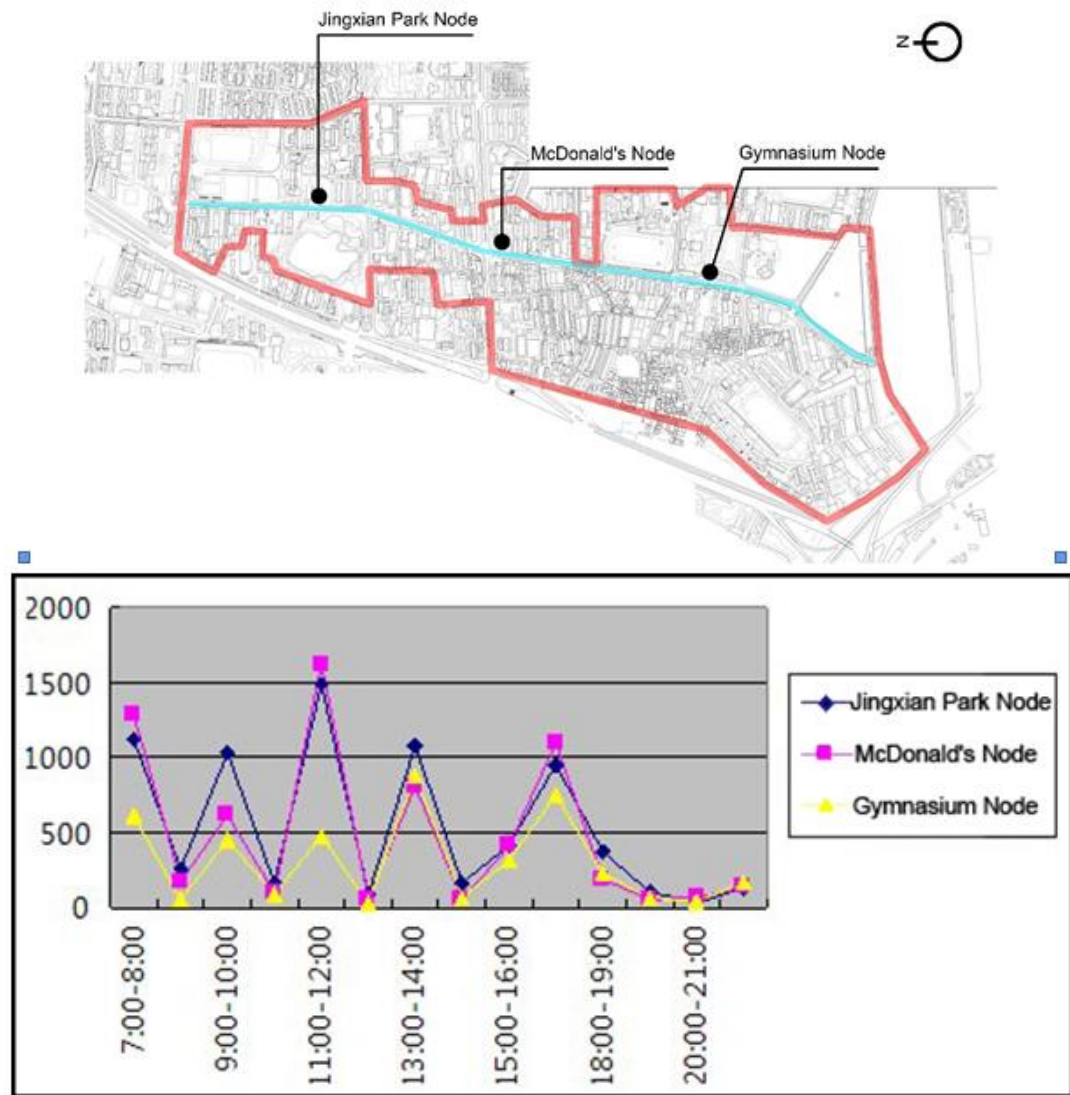


Figure 5 Investigation on the Population Flow of Students to Attend and Dismiss the Class within One Day in Shigulu Block

b. During Summer and Winter Vacations

In the summer and winter vacations, only a handful of students stay at school. Therefore, there is no large-scale student flow. The investigation showed that a lot of students staying at school would choose to live off campus. Although the university

will provide a small number of classrooms, students will go in and out of school more freely.

Ways of Traveling - by Bus and on Foot

Table 1 Survey on Typical Means of Traveling of Students in Shigulu to Attend or Dismiss the Class

Name	Start	Terminal	Travel Mode
Student A	Jimei University	Finance College	Bus
Student B	Marine College	Mechanical College	Bus
Student C	Marine College	Jimei University	Walk or Bike
Student D	Teachers College	Marine College	Bus
Student E	Teachers College	Finance College	Bus
Student F	Jimei University	Fisheries College	Walk or Bus
Student G	Navigation College	Finance College	Walk
Student H	Marine College	Teachers College	Walk

The biggest factors influencing the ways of traveling are convenience and efficiency. The investigation on students in Jimei University indicated: the selection of ways of traveling is closely associated with the distance between the starting point and the place to have classes. The author selected one workday to conduct follow-up surveys on the students in Jimei University. The general conditions were shown in Table 1. According to the survey, there are mainly three ways of traveling for students in the block: by bus, on foot and by bike (Figure 6). In addition, they have the following characteristics:

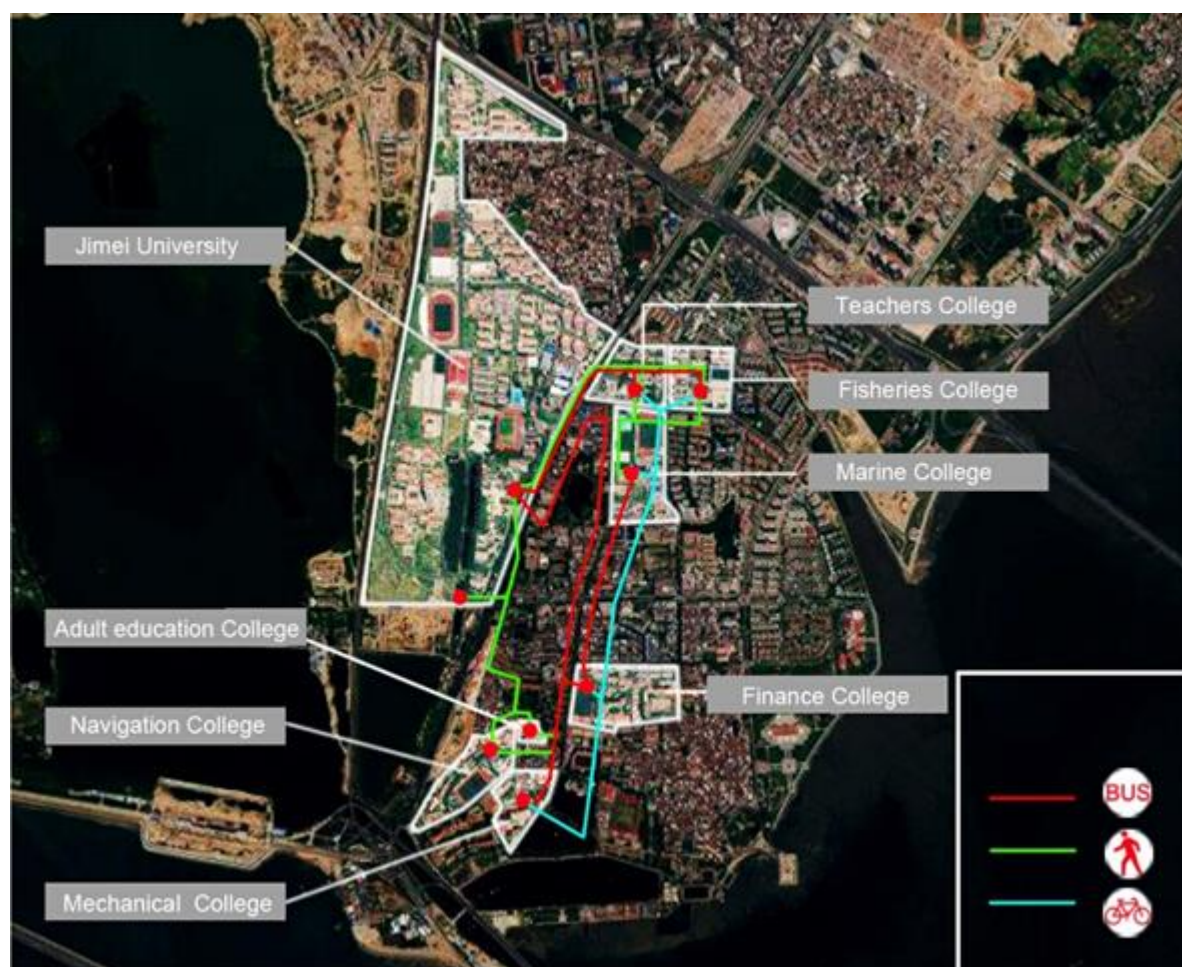


Figure 6 Main Means of Traveling of Students in Shigulu Block to Attend and Dismiss the Class

- a. Generally, students go to class in other colleges from headquarter of Jimei

University on foot.

b. Most students go to class in colleges along Shigulu Road by bus.

c. Students usually walk to colleges on neither side of the transportation-type road in the block.

Urban transportation-type roads herein refer to Cenxi Road and Shigulu Road. Colleges on neither side of the road mainly refer to Marine College and Adult Education College. Neither college is close to the urban trunk road. They are collected to the main road by other roads in the block (Figure 7). This paper divided these roads into two categories:

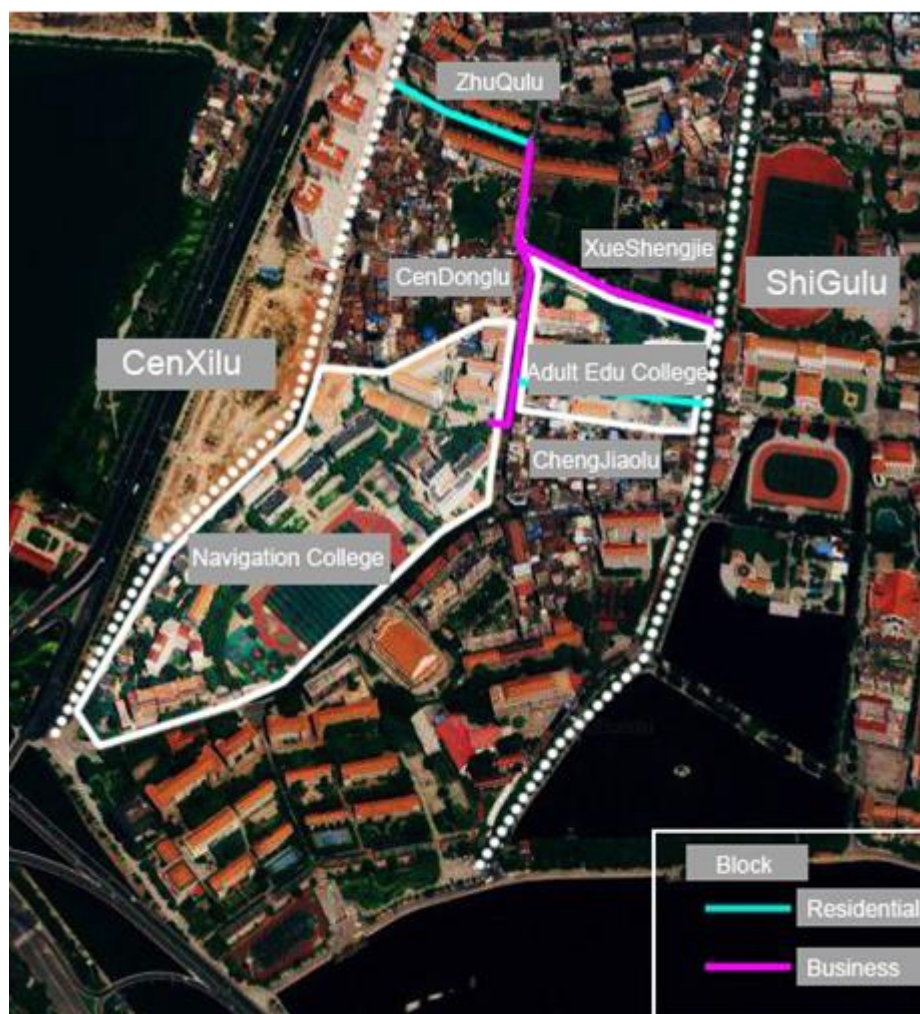


Figure 7 The Distribution Map of Roads in Colleges on Neither Side of the Road

(1) Commercial Streets

With regard to Marine College and Adult Education College, they are mainly connected to Shigulu Road and Cenxi Road by four roads: Student Street (namely, Commodity Street); Chengjiao Road (an internal road in Adult Education College to connect Shigulu Road and Cendong Road); the section of Cendong Road near colleges; Zhuqu Road (an internal road in the most historical resident in the block).

Student Street and Cendong Road are mainly used for commercial purposes. In Student Street, people mainly sell cheap clothes and furniture supplies. Stores on both sides of the road are simple sheds. The road is merely three meters wide. For the students, they often attend and dismiss the class via this path, mainly on foot. Although some students will ride bikes, they have to push their bicycles in rush hours

since it is overcrowded. Bicycles can go through freely only in the leisure times (Figure8).



Figure 8 The Student Street at Leisure



Figure 9 A Segment of Cendong Road

One side of Cendong Road (Figure 9) is used for commercial purposes. The other side serves as schools and residences. The road is nine meters wide. It is mainly focused on the catering industry. A majority of them are stores. However, there are also a few scattered street vendors. There is a coexistence of people and vehicles on the road. Most students and local residents travel on foot.

(2) Residential streets

Both Chengjiao Road and Zhuqu Road belong to streets in residences. Chengjiao Road is located among Jimei Gymnasium, Science Museum and dormitories in the Science Museum of Jimei University. In comparison with the Student Street, students to attend and dismiss the class are fewer here. After investigation, the majority of students believe that the Student Street is too noisy and crowded while Chengjiao Road is more quiet. On one side of Chengjiao Road (Figure 10), there is the century-old Science Museum (1922), Old Jimei Library (1954) that has a history of more than 50 years and Jimei Gymnasium (1952). On the other side, there are basketball courts and dormitories (the former classrooms of the Science Museum, with a history of more than 50 years). The road is nearly 7m. It not only provides a quiet road environment, but also exhibits a history and cultures of nearly one hundred years. Students mainly walk here. Although there are also buses and motorcycles parking along the street, most of the users are public figures.



Figure 10 Chengjiao Road



Figure 11 Zhuqu Road

Zhuqu Road (Figure 11) is located in an old residence in Shigulu Block. Residents here are mainly natives of the school village. Since the road is directly connected with Cenxi Road and vehicles are parked disorderly, it is extremely crowded. Through field

observations, the author found that people passing through this road were mainly students walking between the College of Finance and Economics, Marine College and headquarter of Jimei University. Since it is crowded and chaotic, most of the students go to class on foot.

Behavior Trajectories

Through the above analysis, students mainly go to class on foot and by bus. Therefore, the research on behavior trajectories mainly focused on pedestrian diagrams of students and streamlines of buses.

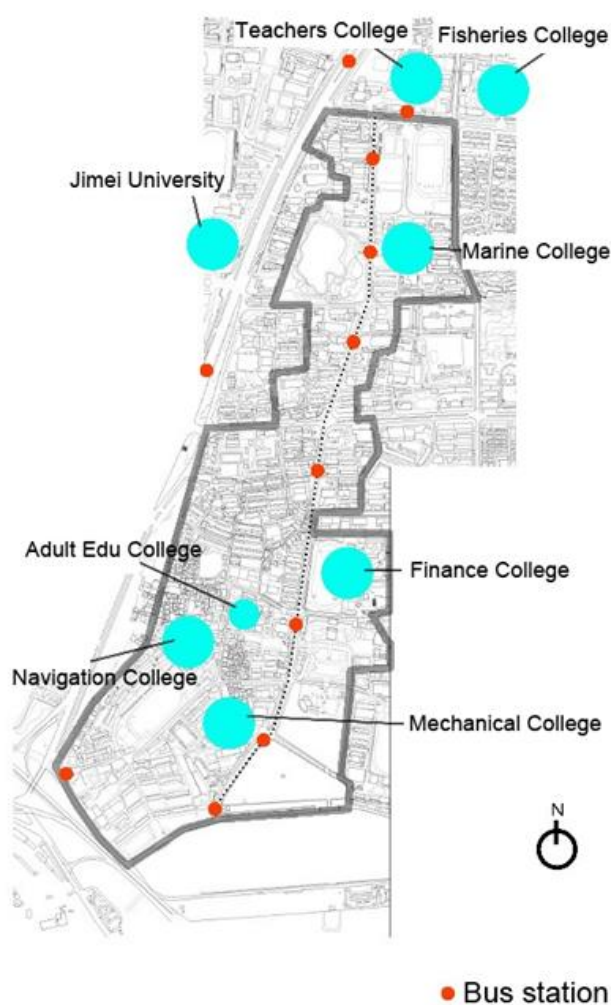


Figure 12 The Distribution Map of Bus Stations in the Block

a. Streamlines of buses: the block has a very convenient bus system. Buses drive along main streets of the city - Cenxi Road, Shigulu Road and Yindou Road. There are fixed bus stations in neighborhoods. According to statistics, there are 7 bus stations (Figure 12) in Shigulu Road (a total of 2 kilometers). The American scholar Robert Cervero has pointed out in the *Transit Metropolis* that “ten minutes are the most comfortable time periods for people to walk” [6]. Calculating at a speed of 50 meters per minute, 500m is the largest distance to meet the comfort of people to walk to the bus station. The paper conducted survey and analysis on the shortest distance between colleges of Jimei University and the nearest bus stations (Table 2). The following conclusions were drawn: it is only 43m from the College of Mechanical Engineering to the nearest bus station. Among the 8 colleges along Shigulu Road, 7 of them are within

300 meters. The one with the farthest distance is the old gate of headquarter of Jimei University, reaching 651 meters. After measurement, it is only 622m to walk from the old gate to Shigulu Road. This once again shows that students in headquarter mainly go to class on foot.

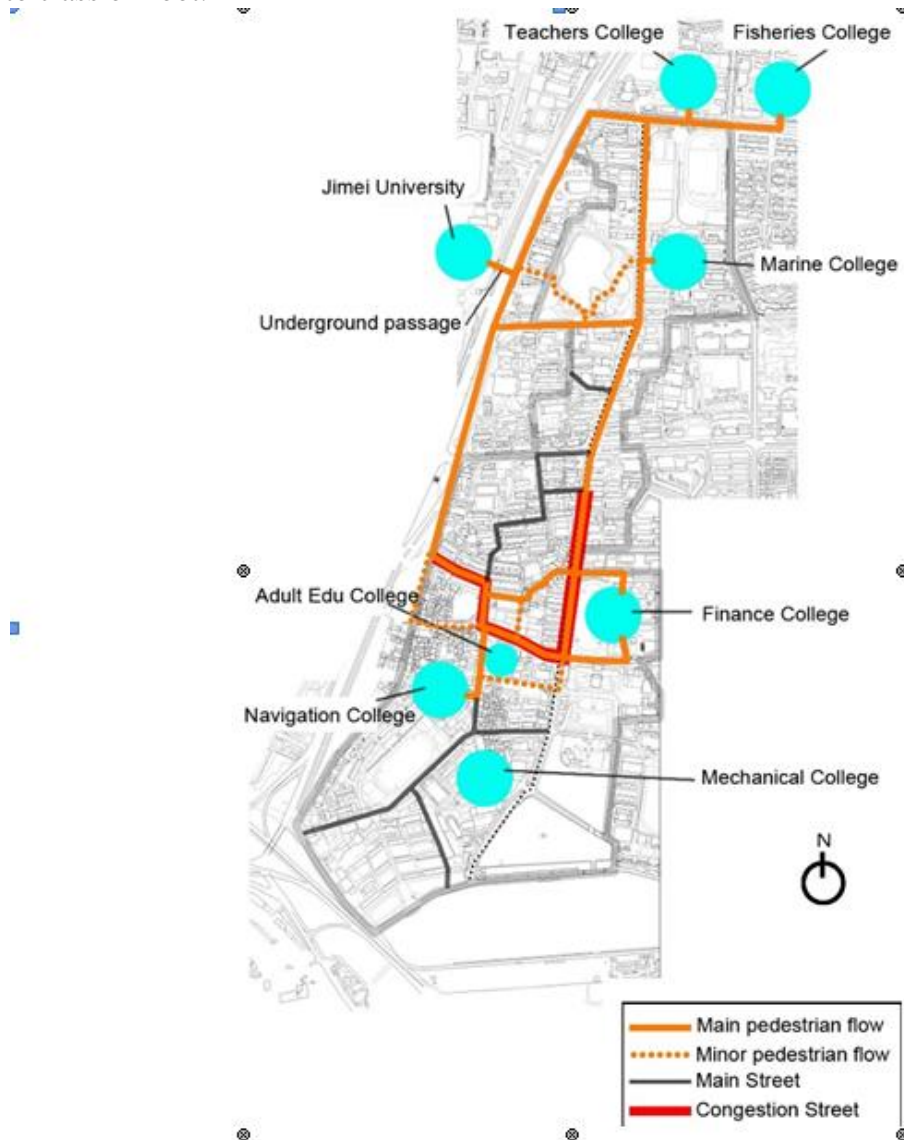


Figure 13 Pedestrian Diagram of Students in Shigulu Block to Attend and Dismiss the Class and Relevant Congestion Conditions

Table 2 Statistics on the Distance between Colleges of Jimei University and the Nearest Bus Stations

Colleges	Jimei University	Teachers College	Fisheries College	Marine College	Finance College	Mechanical College	Navigation College
Minimum distance(m)	307/651	72	317	43	190	53	280

b. Pedestrian diagrams: students mainly go to class on foot. Since walking is relatively laborious, pedestrians will naturally take a shortcut. They are reluctant to make a detour. They won't change their willingness unless they are confronted with dangers or insurmountable barriers [7]. According to the follow-up visits, the main pedestrian diagram of students to attend and dismiss the class (Figure 13) was obtained.

As can be seen from the figure, there are differences between the main streets students walking through and main streets of the city. Students generally follow the principle of “taking a shortcut”. They do not select the “broad roads”. Instead, they try to avoid such complex and tortuous roads, so as to choose the most convenient roads such as Chengjiao Road and Zhuqu Road.

However, since it is difficult to evacuate the crowd in blocks, jams occur frequently. Jan Gehl has pointed out: “the maximum density is about 10 -15 persons per minute in bidirectional walkable streets and sidewalks. In other words, only ten people can pass through the one-meter-wide sidewalk per minute at most. Otherwise, people will feel crowded and uncomfortable [7]. From the crowdedness analysis on five sections in the block (Table 3), it is the most crowded from the food market in Shigulu Road to the junction of Jiceng Road, followed by the Student Street.

Table 3 Degree of Crowdedness of the Five Main Pedestrian Roads for Students in Shigulu Block to Attend and Dismiss the Class

Segment	Shigulu in the Marine College	Shigulu in the Vegetable market	Shigulu in the Finance College	Xueshengjie	Zhuququ
Walkways width(m)	6	2.5	4.5	3	2.5
Pedestrian flow limit	60	25	45	30	25
Practical pedestrian flow	25	40	33	47	36
Crowdedness	41%	160%	73%	156%	144%

Demands of Students in the Block to Attend and Dismiss the Class for Public Space

It is far more important to find out problems than select a solution [8]. In the previous section, the author conducted empirical researches on necessary activities in the block to form a preliminary opinion on three main necessary activities: attending and dismissing the class; going to work and going off work; consuming. He identified the demands of people for public space, especially the demands for space in the block when conducting these behaviors, thereby combining problems with behaviors and relevant material circumstances to analyze the motives behind these problems. Via the investigation and analysis on the behaviors of attending and dismissing the class in time, ways of traveling and behavior trajectories, the author summed up that demands of students to attend and dismiss the class for public space focus on the block space. This is mainly embodied in the following points:

Pedestrian-oriented Road System. Students mainly go to class on foot. To a great extent, this is why rush hours are more frequent and the population flow increases more dramatically than those in ordinary blocks (ordinary blocks refer to those only with commutes). The resultant jams and crowdedness are pressing for solution.

At present, the main method to solve this problem is to take a pedestrian-oriented means of transportation with the coexistence of people and vehicles, such as Woonerf proposed in 1970. By increasing parking space, landscaping and providing facilities for recreation and entertainment, the road presents a zigzag shape, thereby reducing the speed. Moreover, a lot of trees are planted on the street to give an impression of “difficult in passing through”, so as to reduce the traffic flow. This method has successfully changed general mixed roads into more “humanistic” streets with the coexistence of people and vehicles (Figure 14). After decades of development, many countries and cities have proposed corresponding solutions based on this, such as the

“traffic calming” in Germany.

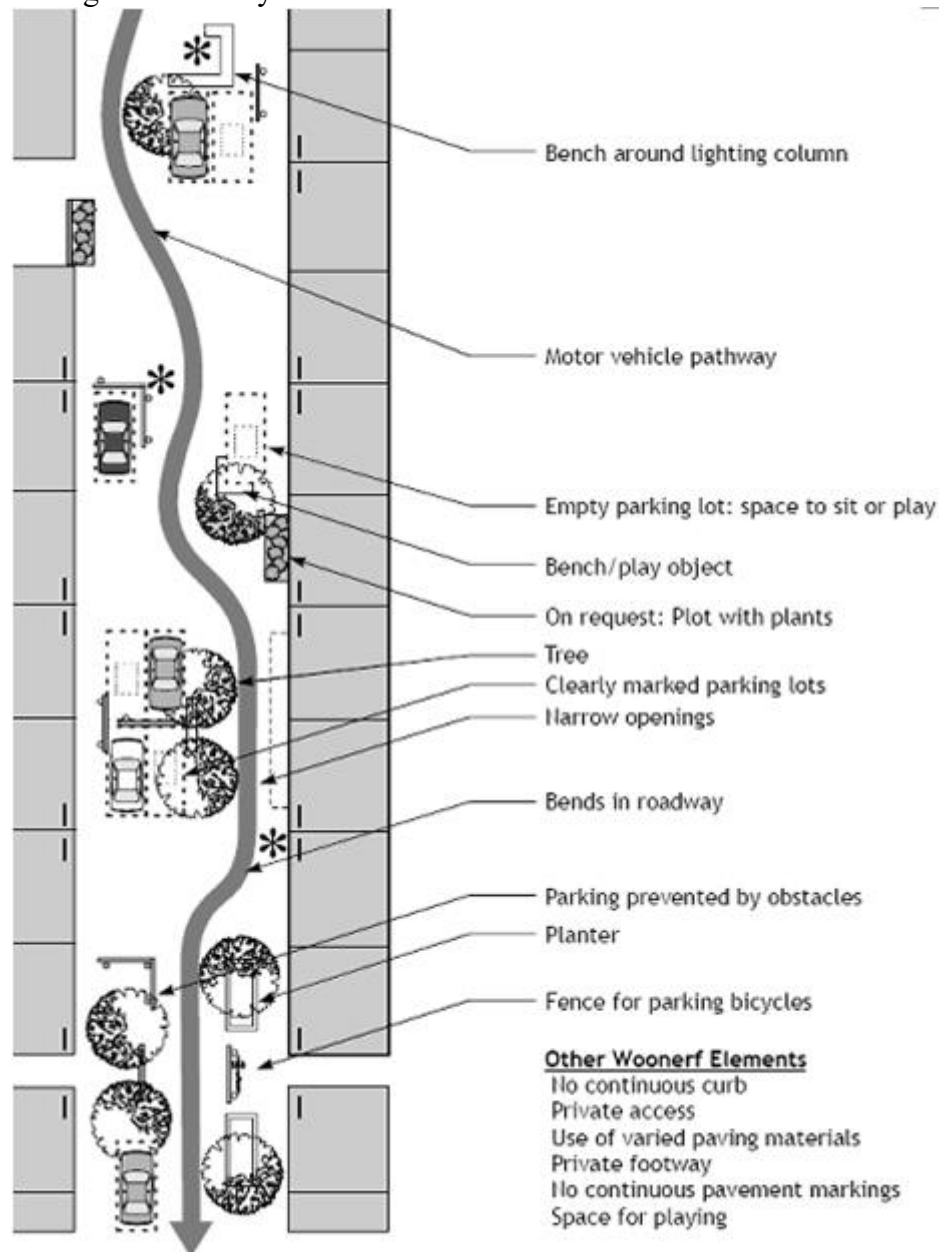


Figure 14 Woonerf method

Complete Pedestrian Systems in the Block. Perfectness of the pedestrian system has a direct impact on the convenience and comfort of students and residents in the block. In the investigation in Chapter 3, due to the psychology of “taking a shortcut”, the “inclined pedestrian roads” of residents failed to fully match the “actual roads” designed for urban development. These “inclined roads” are usually narrow roadways in the block (2 to 3 meters wide). Since they bear too many people not belonging to them originally, they become extremely crowded. Therefore, perfection of the pedestrian system is mainly the improvement of roadways in the block, such as the Student Street and Zhuqu Road (Figure15).

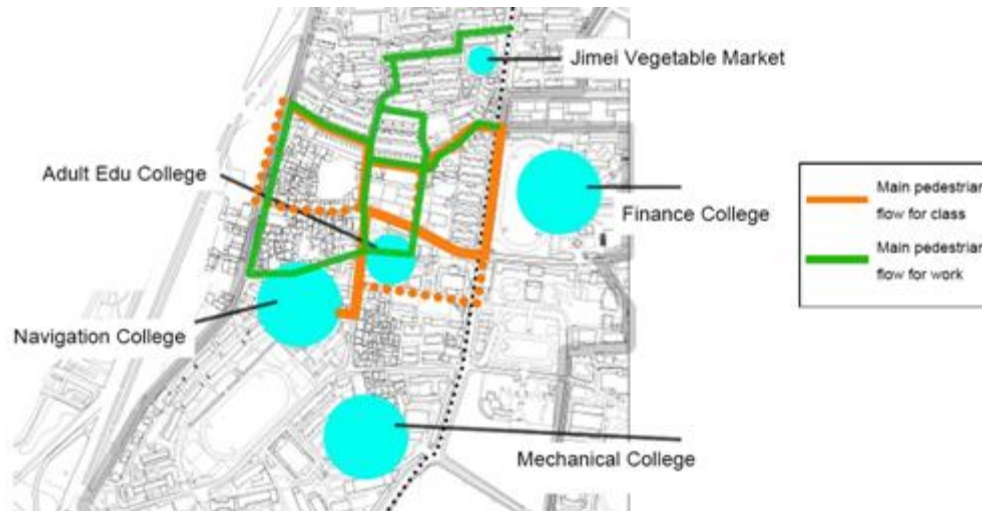


Figure 15 The Road Map for Walking Intentions of Residents in the Block

(1) Widen the pedestrian roadways properly

The narrow width is the direct reason why roadways are unable to bear the pedestrian volume. According to the statistics of road crowdedness in Chapter 3 (Table 3.6), the jam density of each roadway could be obtained. For example, jam density of the Student Street and Zhuqu Road is 56% and 44% respectively. The data is regarded as the basis for road widening. Take the Student Street for example. The pedestrian road is 3m. The actual population flow is 47person/minute. In accordance with the calculation method of Jan Gehl, the pedestrian road should be increased to 4.7 meters at least to satisfy the current pedestrian volume. The widening method gives priority to setback of the first layer of architectures or proper removal of stores (stores in the surrounding roads of the Student Street are mainly simple sheds. Some of them can be removed for concession).

(2) Strengthen traffic control over the roadways

Width of roadways in the block is around 3m. Although it is difficult for motor vehicles to pass through, a majority of residents still take the risk of driving cars into roadways for convenience. In addition to cars, motorcycles and bicycles also occupy roads obviously. This reduces the walking safety of residents. Therefore, the following measure should be taken to restrict the traffic in roadways: refuse the vehicle access. Meanwhile, bike lanes can be set to regulate the traffic orders in roadways and return roadways to pedestrians.

(3) Shorten the “sense of distance” of residents

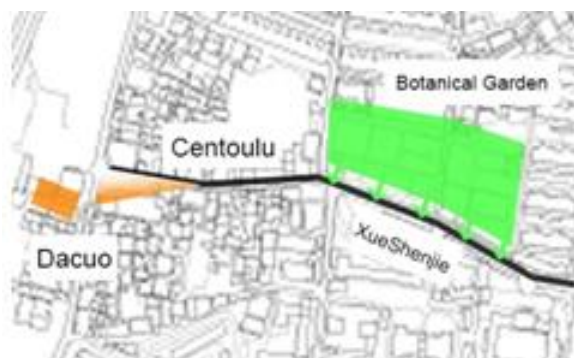


Figure 16 Available Factors around Student Street and Centou Road



Figure 17 Pavement Suitable for Walking

To shorten the “sense of distance”, it is necessary to give people different feelings in the journey. Properly tortuous streets will make the space more compact. Consequently, residents will not take in everything at a glance. Take Shigulu Block for example. Chengjiao Road is quiet while Student Street is dynamic. They are different in scales, functions and surrounding environments. This increases feelings of residents in walking. Nevertheless, it is important to discover special factors around the roadways and incorporate them into the space of roadways to add interests. Student Street and Centou Road are mainly used for commercial purposes. Therefore, the images are relatively simple. However, if the surrounding botanic garden is possessed with landscape treatment and large houses in the middle of Jiceng Road are introduced to the vision of residents, the environment will be greatly improved. Furthermore, the “sense of distance” of residents will be shortened (Figure 1617).

Conclusion

This paper was designed to understand the characteristics of behaviors of students in spontaneously formed university towns to attend and dismiss the class in time, walk ways and trajectories via researches. It intended to utilize the correlation between behaviors and public space to summarize the demands of this behavior for public space in blocks of university towns, so as to provide a “reference and basis” for the optimization of public space in blocks of Jimei School Village.

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