

# Post-occupancy evaluation of the built environment of college campuses based on students' daily behavior -----Evidence from Zijing Road of UJN

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**Abstract.** The research on the Post-occupancy evaluation of the built environment of college campuses based on students' daily behavior is a preliminary study on the renewal of the built environment of super-large educational institutions in the context of China's large building stock era[1].According to the user's behavior on the road section and the evaluation of the space use effect, summarize the relevant problems and put forward targeted improvement suggestions based on the safety, privacy, comfort and other needs of college students' life and learning in the new era, so as to promote the sustainable development of college campuses and the quality of daily life of students.

**Keywords:** Post-occupancy evaluation, built environment, students' daily behavior.

## 1. Introduction of Research Background

With the implementation of Chinese strategy of rejuvenating the country through science and education and the popularization of higher education, the enrollment scale of each university has been expanded. The construction of the campus was completed early, and the original university construction was mostly "one-time planning, one-time forming" so subsequent expansion of enrollment was a great challenge for the carrying capacity of the university. The Post-occupancy evaluation of the existing built environment is conducive to more efficient and scientific environmental renewal and environmental governance, and has making a profound impact on improving the environmental experience of college students' living and learning[2].



Figure 1. UJN floor plan

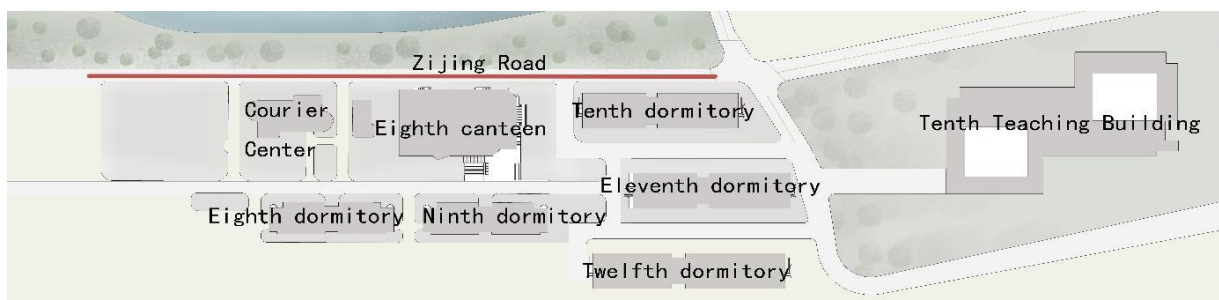


Figure 2. Zijing road floor plan

The usual evaluation of existing buildings is based on a macro perspective or based on local building information, but few scholars evaluate existing buildings from the user level. In order to fully meet the needs of students, research for student use is necessary for the sustainable development of university campuses[3].

## 2. Research Design

### 2.1 Research objects

University of Jinan has a large-scale school and a long history of establishment. There are currently about 35,000 students on campus. The school construction is relatively complete. The teaching buildings are mainly located in the western and eastern parts of University of Jinan. Moreover the student dormitory area is mainly located in the school's Nanyuan and in the middle of the North Campus of the school, the overall spatial organization of the school is in the shape of a fish-bone. The roads that connect student life and teaching groups on campus have diverted people and vehicles, and along Zijing Road, there are canteens, express delivery centers and other necessary campus infrastructures that connect the east and west. Therefore, Zijing Road is the main commuting road for students in UJN, and this road can better present the current situation of the existing built environment of the existing university campus.

### 2.2 Research procedures and research methods

#### 2.2.1. Research procedures

This research is based on the observation of students' daily life behavior, and at the same time, a preliminary investigation is carried out on the main campus of University of Jinan, and the main survey methods are questionnaire survey, visit survey, and fixed-point observation. The traffic situation of students on Zijing Road is roughly predicted, and then on-site research is conducted, data is organized and analyzed.

### 2.2.2. Research methods

The research mainly adopts three forms: questionnaire survey method, visit survey method and fixed-point observation method.

The questionnaire survey method is to collect the data of the respondents by distribution of questionnaires. In this survey, the paper method mainly conducts surveys on the applicable population from three aspects: use comfort, update requirements, and psychological feelings of use. A total of questionnaires are distributed in this survey. 50 questionnaires, 50 returned questionnaires, and 50 valid questionnaires.

The visit investigation is to conduct a record investigation on the spot. In this investigation, we visited Zijing Road and its surrounding areas, and took photos to record the spatial elements such as the facade along the street.

Fixed-point observation is to record the changes of relevant survey factors within a certain period of time. In this survey, we selected five key nodes on Zijing Road, and recorded the behavior of the people at the five nodes in different time periods..

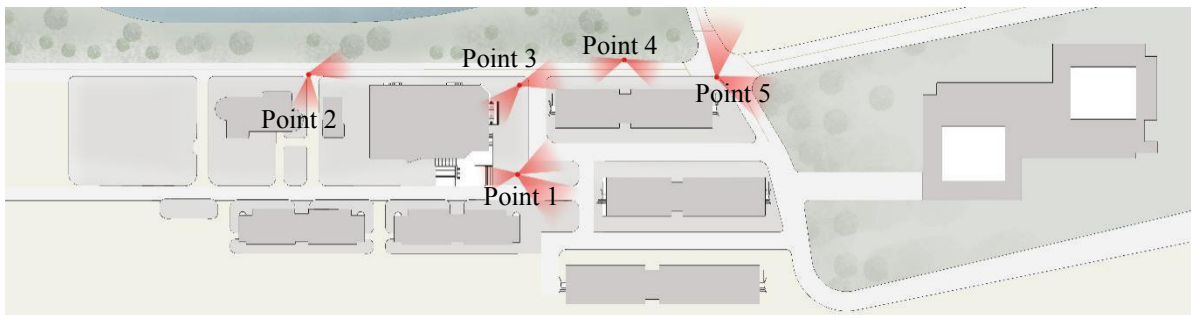


Figure 3. Point Distribution

## 3. Research evaluation and analysis

### 3.1 Analysis of the existing built environment

The University of Jinan is located at No. 336, Nanxin Zhuang West Road, Shizhong District, Jinan City. The campus has relatively complete infrastructure construction, including canteens, teaching buildings, express delivery centers, staff dormitories, student dormitories and other infrastructure. The main research object of this research is Zijing Road of UJN, which is located in the middle of UJN and is adjacent to Jiazi Lake in the north. It is the main road for students of UJN to commute

#### 3.1.1. Inherent building information

There are canteens, dormitories, express delivery centers and other buildings in this section[4].

**Canteen :** The canteen has three floors above ground and has two main exits, an auxiliary exit and several employee exits. There are supermarkets, barber shops, and photocopying shops on the ground floor, and there is a larger personnel distribution plaza on the east side of the eight canteens.

**Dormitory :** There are three dormitories near the area: boys' dormitory 9 and girls' dormitory 10.11.12, of which the side of school 10 faces the main road

**Express Center:** The express center was originally the bathing center of UJN. It has a superior geographical location. There are a large number of express delivery in this area, and it is the most important express delivery point.

#### 3.1.2. Greening and infrastructure

There are better greening and basic infrastructure on this road section, which can meet the most basic needs of students.

street tree: French plane trees are planted on both sides of the road, the tree canopy is huge, the tree age is longer, and there are stumps left by 3-4 trees withered by the roadside.

trash can: Recyclable and non-recyclable are separated. Except for fixed public trash cans, there will be large green trash cans according to different needs.

Street lamp: The traditional street lamp made of iron has a shabby appearance, and many street lamps are dimly lit at night and have poor lighting.

### 3.1.3. Elevation display along the street

There are mainly two types of facades along the street near Zijing Road. The north side of the road is mainly natural green landscape, which has good natural scenery conditions. The south side of the road is surrounded by building facades, and some of the facades are dormitories.



Figure 4. Elevation of the south side of the road



Figure 5. Elevation of the south side of the road

### 3.1.4. Classification of space along the street

The space along the street can be divided into two parts: positive space and negative space according to the different use efficiency, among which the positive space is limited due to the limited carrying capacity, in the process of large-scale personnel flow.

## 3.2 Use crowd behavior summary

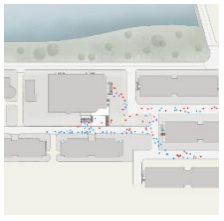
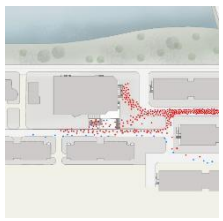
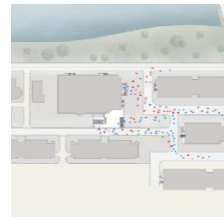
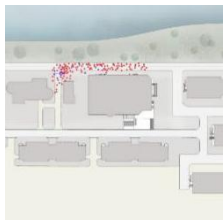
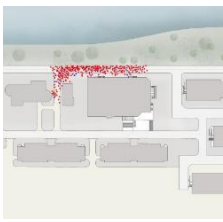
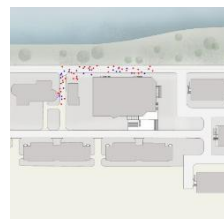
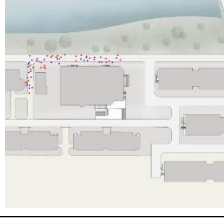
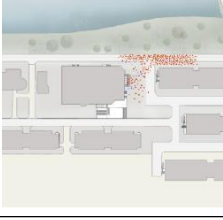
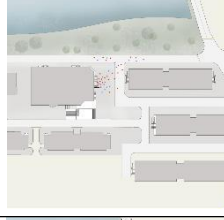
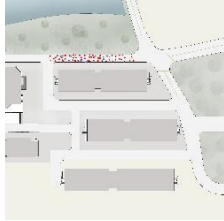
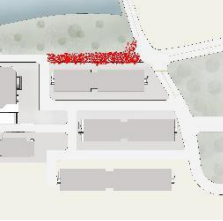

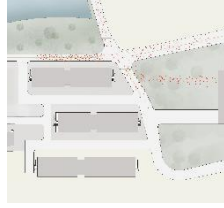
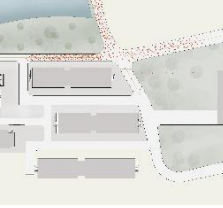
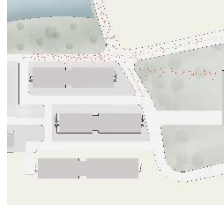
Students are the main users of this road section. At the same time, the behavior of students in daily life has strong regularity, and the purpose and direction of travel also have strong regularity. In Jan Gale's theory, the activity will be The nature is summed up into three types—"necessary activities", "spontaneous activities" and "social activities". According to the questionnaire survey on the students, more than 50% of the students pass through this road section, and they all pass through it more than 3 times every day. And most of the destinations are classrooms or libraries, which belong to the category of necessary activities. In Jan Gale's definition of a good street, the research road section itself lacks spontaneous activities and social activities. Crowd behavior is more monotonous.

### 3.2.1. Temporal characteristics of crowd behavior

The traffic behavior of the crowd on this road section has a high degree of regularity at the time level. The crowds are the most dense at the three time points of 8:00, 12:00 and 18:00, and have the

poor traffic at the time points of 10:00 and 16:00. Due to the commuting to and from get off work, the flow of people fluctuates at the time of the bureau, and the flow of people is relatively average at other times.

Table 1. Statistics of people at each location

Time	11:50	12:10	12:30	Summary
Point 1				The number of pedestrians is significantly more than the number of cyclists, the number of people is increasing but not obvious, and people and vehicles cannot be separated
Point 2				Zijing Road is very crowded, people and vehicles are mixed, and the congestion is serious
Point 3				The bicycles in front of the square are cluttered, which seriously affects the traffic level of the front square.
Point 4				The direction of the crowd is very concentrated, the purpose is clear, and it is located at the intersection, which is the junction of the two streams of people.
Point 5				Here, it can be clearly observed that the two main streams of people are overcrowded, resulting in the behavior of stepping on the lawn to open the road.

Annotation :Red point represents people from east to west, blue point represents people from west to east

### 3.2.2. Coupling of crowd behavior

In the correlation-coupling theory of urban design, a square is generally an urban "coupler", which will meet multiple streams of people through the square, and generate various behaviors in the square at the same time. The crowds going to the teaching area from various directions are coupled into a single stream of people. At the same time, according to the questionnaire survey, there will also be some spontaneous activities in the square, such as holding club promotion meetings.

3.2.3. Blindness of crowd activities





Due to the frequent congestion in this road section, crowds usually conflict in the process of traveling in the opposite direction, which will further cause road congestion. At the same time, excessive pedestrians will also affect the passage of non-motorized vehicles such as bicycles, which further reduces the capacity of the road.

3.3 Psychological needs of users

Maslow's Hierarchy of Needs is a motivational theory in psychology that includes five levels of human needs, namely: physiological (food and clothing), safety (job security), social needs (friendship), esteem and self-actualization[4], Among them, for college students, physiology, safety, social needs and respect are important needs of college life. According to the questionnaire survey, Zijing Road cannot meet the social needs and safety needs of students in daily life. The Xue 10 dormitory along the street is a female dormitory. According to the survey, 20% of the respondents believed that going to school 10 would bring discomfort. At the same time, there is not enough space to stay on Zijing Road, except for the square at the entrance of the eight cafeterias, which cannot meet the social needs of students.

4. Built environment assessment

According to the investigation and analysis, the Zijing Road section of UJN can meet the most basic traffic needs of students, and there is a good form of ecological greening beside the road. At the same time, the road for students' commuting in this section can better meet the students' basic material life needs. Due to the expansion of school enrollment, the wear and tear of infrastructure, and the psychological needs of students, the Zijing Road area of UJN has been unable to meet the needs of students' social, respect and self-realization, and the following problems have been exposed.[1]

			
<p>Figure 6. Disorderly parking of bicycles in the square</p>	<p>Figure 7. The pavement on the plaza is damaged</p>	<p>Figure 8. Empty stair space</p>	<p>Figure 9. Poor night lighting</p>

1. The existing road traffic planning is based on the design of the roadway, but the road is mainly used by walkers in reality. The size ratio of the sidewalk and the non-motorized vehicle road is improper, and it is difficult to divert people and vehicles during peak hours. Some roads are uneven. It is not conducive to the safe passage of large-scale people in a short period of time.

2. The tenth building of the student dormitory is a female dormitory. The building is close to the sidewalk, with poor sound insulation and poor privacy. It cannot meet the safety needs in Maslow's theory, and it also brings unnecessary pressure of psychological distress to passers-by.

3. The landscape along the lake has not yet been fully developed, the green space along the lake lacks effective intervention paths for peers, there is no design stop space, and the landscape along the lake lacks culture.

4. There are many negative spaces in the square space, such as the sunken stairs on the south side of the main entrance of the eighth canteen, etc. At the same time, due to long-term use of the square

space, the overall pavement is severely worn, which has bad effects on the safety of passers-by. It has an adverse effect and has a greater impact on the passing speed of passers-by.

5. The infrastructure on Zijing Road is lack of maintenance, some street lights have been damaged, and the configuration of trash cans is too scarce to meet normal needs.

6. Although Zijing Road has been planned for the diversion of people and vehicles, it lacks effective management. First, a parking lot for motor vehicles is formed near the car stop, which blocks the road, and the second is the planning of non-motor vehicle parking spaces near Zijing Road. There are a large number of non-motor vehicles parked at will, blocking the road, occupying too much space in the node square, resulting in a huge decline in road traffic capacity.

## 5. Suggestions for renewal and renovation

The node update of the campus can adopt the mode of micro update. Through the strengthening of management and the renovation of various infrastructures and node spaces, the cultural and identifiable nature of the entire road can be strengthened to meet the higher psychological needs of students. It can break the greening with a strong sense of boundary, set up accessible roads, provide students with parking spaces, and at the same time update existing nodes, replace severely damaged pavements and various infrastructures, and redesign negative spaces, endowing it with cultural and social attributes.

## 6. Summary

In recent years, updating the campus under the background of large stock is a major method to improve the quality of the campus. Campus research based on the daily life of students can help to better evaluate the built environment through the user's evaluation feedback, and it is also helpful for the updating strategy. Provide research support for retrofit strategies.

This paper mainly investigates Zijing Road, University of Jinan, analyzes the main space composition and the needs of the crowd, summarizes and analyzes the main problems, and summarizes the management, facilities and other aspects from the perspective of users. It is a bottom-up approach. Trying to evaluate from a high angle, breaking the macro evaluation of the traditional evaluation mechanism, and summarizing and analyzing from the user's point of view, will be more conducive to the sustainable development of the campus and create a modern university campus. Make the campus more humane care.

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