Evaluation of the Front Square of Harbin West Railway Station Based on POE Method

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Abstract. The square in front of the railway station is an important portal space in the city, carrying important functions such as transportation hub, people gathering and distribution, and leisure and entertainment. Based on the theory and method of POE, this paper takes the space in front of Harbin West Railway Station as the research object, and constructs the research system of post occupation evaluation of space use from two aspects: satisfaction evaluation and use mode evaluation. The activity characteristics and demands of the people using the square in front of the station are understood through the methods of participatory observation, questionnaire issuance and interview. The information and data obtained from the survey are analyzed through SD method and behavioral map method, and the evaluation results of users on the square in front of the station are obtained. Combining with the evaluation results using SPSS statistical methods of correlation analysis between evaluation factors and overall satisfaction, it obtains the priority of reconstruction in the square in front of Harbin West Railway Station, and then puts forward the effective

1. Introduction

As an important node of the railway transportation hub, the square in front of the railway station is not only the space for passengers to transfer, wait for rest, but also the symbol of a city gateway [1]. Business center, railway station and Haxi passenger station are distributed around the square of Harbin West Railway Station. It is not only a hub for the transformation of various transportation tools such as train, subway and bus lines, but also a distribution area for people, logistics, capital flow and information flow, and an important spatial node of Haxi new district. The POE (Post Occupancy Evaluation) method is a user-oriented research method to conduct systematic Evaluation on the designed facilities (outdoor space) that are being used [2]. Through the combination of participatory observation, questionnaire survey and interview, users' needs can be understood, and their information and data can be sorted out, analyzed and evaluated.

2. POE Summary

2.1 POE Conception

It emerged in the 1960s in European and American countries, which is still widely recognized by European and American countries. It is a research on feedback of use evaluation [3]. POE is to evaluate outdoor space after use from the user's point of view. It mainly analyzes and evaluates its use situation according to users' needs, to propose strategies to improve the quality of space use. POE is divided into comprehensive evaluation and focus evaluation. This paper mainly studies the satisfaction

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evaluation and space use evaluation of the square in front of Harbin West Railway Station through the analysis of users’ behavior psychology. Among them, the satisfaction evaluation belongs to the comprehensive evaluation, which is the subject evaluation, and the spatial use evaluation belongs to the focus evaluation, which serves as the perfection and supplement of the satisfaction evaluation.

2.2 POE Evaluation Method
The POE evaluation methods used in this paper are questionnaire, interview, participatory observation, SD scale and behavior map. The POE data collection methods are questionnaire, interview and participatory observation. The data analysis method of satisfaction evaluation is SD scale, and the data analysis method of spatial usage evaluation is behavior map. Finally, statistical method SPSS is used to analyze the correlation of evaluation factors, and the reconstruction priority is obtained, to put forward an effective optimization strategy.

2.3 POE Evaluation System Construction

2.3.1 Determine POE Evaluation Factors. The evaluation factors set of satisfaction evaluation should be selected from three factors: material factors, social behavior factors (social culture, environmental psychological factors, behavior space factors) and human factors (demographic variables, psychological variables) [4]. Through consulting a large number of relevant literatures and listening to experts' opinions, the POE evaluation factors of the square in front of the station can be divided into four aspects: traffic organization, space design, service facilities and landscape aesthetics. Moreover, fifteen evaluation factors, such as traffic flow line, public transport transfer, walking distance, spatial scale and spatial orientation, are shown in Table 1.

| First level evaluation factor | Second level evaluation factor |
|------------------------------|-------------------------------|
| Traffic organization         | The traffic flow              |
|                              | Transfer by public transport  |
|                              | Walking distance in and out of station |
| Space design                 | Sense of space scale          |
|                              | Space orientation             |
|                              | Space atmosphere              |
| Public facilities            | Rest facilities               |
|                              | Indicator facilities          |
|                              | Barrier-free facilities       |
|                              | Activity facilities           |
|                              | Commercial facilities         |
|                              | Service facilities            |
| Landscape aesthetics         | Plant configuration           |
|                              | Landscape sketches            |
|                              | Environmental health          |

2.3.2 POE Evaluates Process Design. The process framework of POE is established according to the evaluation objective satisfaction evaluation and the use method evaluation in this paper (Figure 1). The satisfaction evaluation mainly studies the evaluation of the physical space environment of the square in front of Harbin west station from a quantitative perspective. The usage evaluation is mainly conducted in a qualitative way, which is a supplement and improvement of satisfaction evaluation. The dynamic atmosphere and functional requirements of the square in front of the station are understood through participatory observation. According to the evaluation results of satisfaction evaluation and use mode, the optimization strategy is proposed.
3. POE Evaluation Contents

3.1 Research Objects and Methods

3.1.1 Summary of Harbin West Station Square. Harbin West railway station is located at the junction of Harbin new area and Qunli new area. Harbin West Railway Station is divided into East and West squares. At present, the West Square has not been completed completely. The research object of this paper is East Square in front of Harbin West Railway Station. East square is about 260m long and 180m wide. East square east west direction close to the parking and bus station and other traffic facilities, the south close to Harbin Street (Figure 2).

![Figure 2. Location of Harbin West Railway Station square](image)

3.1.2 Research method. During the period from March to May 2008, participant observation was conducted on the square in front of Harbin West Railway Station at different times and different weather conditions, and 300 questionnaires were distributed to users of the square in front of Harbin West Railway Station, of which 280 were valid, with an effective rate of 93.3%. The time span of the investigation is large, and the different times of different days were selected to ensure the universality and representativeness of the subjects. In addition, people of different ages, genders and activity preferences were distributed in the survey population.

3.2 Participatory Observational Analysis

3.2.1 Features of Square Space Use. The square space in front of Harbin West Railway Station is divided into pedestrian space, green space, rest space and service space. The pedestrian space is mainly the large area of the square, and the rest space is mainly the steps near the station room and the adjacent service auxiliary room, but there is no seat or clear rest space for users. Green space is a small
number of flower pools in the central area of the square and the surrounding green isolation zone. The green plant species and color are single, without higher tree species to play the role of shade, and the overall landscape effect is not good. The service space is the auxiliary service rooms on both sides of the square; mainly including public toilets, ticket offices, small supermarkets and parking entrances and exits, but some of the service rooms are idle and not effectively used. In the center of the square, there is also a large commercial plaza, which has not yet been put into operation (Figure 3).

![Figure 3. Station square space](image)

According to observation and behavior map analysis, the behavior mode of users is mainly divided into walking crowd and stopping crowd (Figure 4). The main flow line of people walking is the station house to the bus station yard, parking lot and subway entrance. As the station house is far away from Harbin Street, a small number of people go to the street to change to a taxi. People stop near the station house and the area near the service auxiliary room with sunshade. When the sun is strong, few people sit by the flower pool in the center of the square for rest. The central area of the square looks empty and the site utilization rate is not high.

![Figure 4. Behavior map.](image)

3.2.2 User activity characteristics. During the survey period, clear weather and cool weather were selected, and the activity characteristics of users could be observed accurately by conducting the survey at different times of the day. In the cool and rainy days, there was little crowd activity in the square. The activity characteristics of the crowd on the day with strong sunshine are shown in Table 2, and on the day with weak sunshine and the day with strong sun are basically the same between 6:30 and 8:30 and between 18:00 and 22:00. Other times were similar on the day with weak sunshine.

| Period of time | Major crowd activities |
|----------------|-----------------------|
| 6:30-7:30      | It was the first peak flow of people. A large number of people walked through the square, and fewer people stayed in the square to rest. |
| 8:00-9:00      | The flow of people got smaller. Most people rested near the station. |
| 9:30-14:30     | At this time, the sun was more intense. About 10 people sat in the central area of the square by the flower pool. About 400-500 people sat near the station and on the... |
3.3 Questionnaire survey and interview results analysis

3.3.1 Structural analysis of survey population. According to the survey, the users are mainly young and middle-aged, and the male is slightly larger than the female. About 59 percent of them are men and 41 percent are women. Among the groups surveyed, 6 percent were under 18 years old, 50 percent were between 18 and 35 years old, 34 percent were between 35 and 50 years old, and 10 percent were over 50 years old (Figure 5). The education level of junior middle school and below accounted for 20.1%, that of senior middle school and technical secondary school accounted for 35.8%, that of junior college and undergraduate school accounted for 35.5%, and that of graduate school and above accounted for 16.13%.

![Figure 5. Age composition of survey population.](image)

3.3.2 Reasons and stay time for users to visit. Most of the users of the square in front of Harbin West Railway Station were passengers, accounting for 85% of the respondents, 10% of people passing by take a rest, and 5% of the residents nearby take a rest (Figure 6). It can be seen that the square in front of the station mainly serves passengers and is not attractive to nearby residents. According to the survey results, 41% of the users choose to stay in the square for less than half an hour, 32% of the users stay for between half an hour and one hour, 22% of the users stay for one to two hours and 5% of the users stay for more than two hours (Figure 7). It can be seen that most of the user stay time is less than 0.5 hours.

![Figure 6. Reasons for users to visit](image)
3.3.3 Major activities. According to the survey, 46% of the users rested in the square, 33% of the users chatted in the square, 12% of the users took pictures in the square, and 9% of the users walked in the square (Figure 8). Most of the activities selected by users are static activities with single activity type. The square should provide more rest facilities and reasonable activity facilities to increase the comfort and interest of the square in front of the station.

![Figure 7. Stay time for users to visit](image)

3.4 SD scale method

3.4.1 Results of SD scale method. Each evaluation factor is divided into five evaluation levels, which are "very satisfied", "relatively satisfied", "general", "relatively dissatisfied" and "very dissatisfied" respectively. The evaluation quantitative values are corresponded to "2", "1", "0", "-1" and ",-2" respectively. From the results of SD scale (Table 3) and SD curve (Figure 9), there are nine positive factors and six negative factors, and the SD curve tends to positive factors. The traffic organization level basically meets the user's needs, and the evaluation factors are all positive factors. In the aspect of space design, space atmosphere is a negative factor. At the level of public facilities, four of the six factors are negative factors, including rest facilities, activity facilities, commercial facilities and service facilities. The evaluation of plant allocation is poor in landscape aesthetics.

![Figure 8. Proportion of activity type.](image)

| First factor | Second level evaluation factor | Total score | Average |
|--------------|-------------------------------|-------------|---------|
| Traffic organization | The traffic flow | 336 | 1.2 |
| | Transfer by public transport | 308 | 1.1 |
| | Walking distance in and out of station | 308 | 1.1 |
| Space design | Sense of space scale | 112 | 0.4 |
| | Space orientation | 336 | 1.2 |
| | Space atmosphere | -56 | -0.2 |
| Public facilities | Rest facilities | -336 | -1.2 |
| | Indicator facilities | 392 | 1.4 |
| | Barrier-free facilities | 336 | 1.2 |
| | Activity facilities | -224 | -0.8 |
| | Commercial facilities | -196 | -0.7 |
| | Service facilities | -252 | -0.9 |
| Landscape aesthetics | Plant configuration | -84 | -0.3 |
| | Landscape sketches | 112 | 0.4 |
| | Environmental health | 420 | 1.5 |
| Overall satisfaction | | 168 | 0.6 |
According to the analysis of SD results, the users are satisfied with the traffic organization level, which reflects that the square in front of the station is reasonably designed in terms of traffic function and has good guidance. The user's evaluation of the spatial orientation in the space design level is "relatively satisfied", the evaluation of the spatial scale is "general", and the evaluation of the spatial atmosphere is "relatively dissatisfied", which is mainly reflected in the large spatial scale and single spatial level of the square in front of the station. In public facilities, rest facilities, service facilities, activity facilities and commercial facilities were rated negatively due to the lack of activity facilities and rest facilities in the square, the single type of commodity in the small supermarket, and some idle service auxiliary rooms. In the aspect of landscape aesthetics, the evaluation of plant allocation is relatively poor, and the evaluation of landscape sketches is general, which is mainly reflected in the problems of single greening, lack of shade, single paving and lack of landscape sketches.

3.4.2 Correlation analysis. SD scale method can get the satisfaction degree of the group to the square space environment, but will not get which factor will affect the user's emotions more. Therefore, it is necessary to analyze the correlation between each factor and the overall satisfaction degree through SPSS, so as to determine the factors that need to be paid attention to in front of Harbin West Railway Station and the priority of reconstruction. Through the correlation analysis of the average scores of 16 factors, the correlation coefficient table is generated(Table.4). The correlation coefficient $r (-1 \leq r \leq 1)$ represents the degree of correlation between factors. The larger the absolute value of $r$ is, the higher the correlation between factors is.

| Order | Evaluation factor                          | Correlation coefficient with overall satisfaction degree(r) |
|-------|--------------------------------------------|------------------------------------------------------------|
| 1     | The traffic flow                           | 0.895                                                      |
| 2     | Transfer by public transport               | 0.832*                                                     |
| 3     | Indicator facilities                       | 0.891*                                                     |
| 4     | Space orientation                          | 0.785                                                      |
| 5     | Walking distance in and out of station     | 0.763                                                      |
| 6     | Rest facilities                            | 0.731*                                                     |
| 7     | Environmental health                       | 0.682                                                      |
| 8     | Commercial facilities                      | 0.651                                                      |
| 9     | Service facilities                         | 0.584*                                                     |
| 10    | Activity facilities                        | 0.527*                                                     |
| 11    | Plant configuration                        | 0.498*                                                     |
| 12    | Sense of space scale                       | 0.386                                                      |
| 13    | Barrier-free facilities                    | 0.275                                                      |
| 14    | Landscape sketches                         | 0.153                                                      |
| 15    | Space atmosphere                           | 0.032                                                      |

* , At the 0.05 level (bilateral) significant correlation

According to the correlation analysis of 15 factors and overall satisfaction, the traffic streamline, public transport transfer, indicating facilities, spatial orientation and the walking distance of passengers in and out of the station are the top five correlated, reflecting that the traffic function demand of the square in front of the station is the most important. At the same time, the design of
these aspects is relatively perfect. Secondly, rest facilities, environmental health, commercial facilities, service facilities and activity facilities were significantly correlated, among which rest facilities, commercial facilities, service facilities and activity facilities had poor satisfaction evaluation, and they need to be properly set up to meet the needs of users. The correlation between plant configuration, spatial scale, barrier-free design, landscape sketches and spatial atmosphere was not obvious. The priority of transformation is determined according to the coefficient of correlation, which is in order of rest facilities, commercial facilities, service facilities, activity facilities, plant allocation and space atmosphere.

3.5 Summary of POE evaluation. Through the POE evaluation of the square in front of Harbin west station, it can be concluded that the users are satisfied with the design of the square in front of Harbin station, but there are still many deficiencies, and the advantages and disadvantages are summarized in Table 5.

| Name                              | Advantage                                                                 | Disadvantage                                                        |
|-----------------------------------|---------------------------------------------------------------------------|                                                                    |
| Square in front of Harbin West    | • Square traffic flow line is reasonable, accessibility is strong          | • Lack of rest facilities and shading facilities, the comfort of the |
| Railway Station                   | • The sign of the square is clear and directional                         | rest space is poor                                                  |
|                                   | • The sanitary environment is good and the square space is comfortable    | • Landscape is single, lack of ornamental.                          |
|                                   | • The square is orderly and well managed and maintained                    | • Lack of commercial, service and activity facilities               |
|                                   |                                                                          | • The space level is single and the utilization rate is low, so it is |
|                                   |                                                                          | difficult to form a good space atmosphere.                          |

According to the quantitative and qualitative analysis, the main optimization aspects are as follows in order: rest facilities, commercial facilities, service facilities, activity facilities, plant allocation and space atmosphere. In the optimization design, the optimization sequence is determined according to the correlation significance, which can improve the spatial environment quality and meet the user's needs more efficiently.

4. Optimization strategy
Based on the investigation and analysis, the following optimization strategies are put forward in order to solve the problems existing in the square in front of Harbin West Railway Station:

a. Increase the rest facilities and shelter from the sun and rain, reflecting the human design. At present, there is a lack of shade space in the square. Some rest seats with ceiling can be set to form semi-outdoor waiting area, which can not only shade in summer but also wind in winter. In this way, it can meet users' demand for rest space and improve the use efficiency of the square.

b. Improve commercial service facilities and revitalize the square. Strengthen the management and supervision of the operation of the square, and put the business of the sunken square into use as soon as possible. In the shopping mall, we can set up certain commercial service functions, such as shopping, catering and entertainment. In some auxiliary rooms and idle outdoor space can be arranged some small, convenient business, to meet the needs of different users, through these commercial catalyst points to stimulate the vitality of the square in front of the station.

c. Increase leisure facilities and improve the utilization rate of the square. The square in front of the station is too large, and some activity facilities can be set in the area in transition with urban space, which can not only make waiting passengers more interesting in their leisure time, but also provide places for residents' entertainment activities near the railway station.

d. Enhance the landscape of the square. The combination of trees and shrubs can be considered in the arrangement of tree species without affecting the sight and traffic flow lines to form a scattered
plant landscape. Meanwhile, tall trees can also have shading effect. The selection of tree species should also take into account the seasonality and prevent the lack of vitality in the winter landscape.

e. Increase spatial level and create a good space atmosphere. The level of space can be distinguished according to the dynamic and static activities, from the perspective of humanization to determine open space or closed space, so that the space has characteristics and sense of sequence. Space can be divided through greening and paving to avoid excessive size of space.

5. Conclusion
Although different people have different impressions of the square, the same city square will be similar in people's image. People's experience and process of recognition of the place is basically consistent, which has become the basis of the square evaluation and the starting point of the POE evaluation model [6]. In this study, POE research theory was used to evaluate the square in front of Harbin west railway station, and optimization strategies were proposed according to the reconstruction priority to meet users' needs. It can not only serve passengers well, but also attract more nearby residents, and become a vibrant city square, inspiring the urban vitality of Harbin west station area. Due to the limitations of research conditions and data processing capacity, this study still needs to be improved. The square in front of the station is of great significance to the development of the city and the vitality of the region. It needs long-term exploration and in-depth research and objective evaluation and optimization to meet the needs of users.

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