

# How to use POE to intervene in the design and renovation of rail transit public buildings

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**Abstract:** This paper discusses the method of Post-Occupancy Evaluation (POE) for the design of rail transit public buildings in cities. Starting from the functional requirements of public buildings, the Post-Occupancy Evaluation (POE) is used to analyze the design and renovation of rail transit public buildings; There are deficiencies and optimization, with the goal of establishing a complete cycle mechanism for evaluation feedback and construction decision-making, to provide a basis and guarantee for the entire design process of rail transit public building facilities. In order to promote the application of post-use evaluation for the construction of rail transit public facilities, better realize the iterative change and development of the building life cycle, and improve the overall quality of urban rail transit.

**Keywords:** Post-Occupancy Evaluation (POE); Rail Transit Public Buildings; Design and Renovation

## 1. Introduction

With the continuous advancement of urban renewal, policies such as transportation oriented urban development (TOD), green and low-carbon transportation, and improving people's livelihoods have been introduced one after another. The design and renovation of urban rail transit public buildings has gradually attracted a lot of attention in the field of contemporary urban construction and planning. As a design evaluation method that can be widely applied in the construction and urban planning industries, how to integrate post use evaluation (POE) into the design and renovation of urban rail transit public buildings is a problem worth exploring and solving in the fields of design theory and professional practice.

## 2. Development status

### 2.1. The emergence and development of POE

Post-Occupancy Evaluation (hereinafter referred to as POE) is the key content of architectural environmental evaluation. It can promote the building environment to realize its own value, emphasizing in giving feedback to architectural design and management through scientific theory and guiding practice to make breakthroughs and re-creation<sup>[1]</sup>. In 1988, Preiser, the author of the book "Post-Use Evaluation", once again defined it precisely as: "After the building is built and used for a period of time, a systematic and rigorous evaluation process is carried out on the building." That is, POE, which has Very strong practical significance, through observation and comparison of the expected purpose of architectural design and actual use conditions, with actual relevant benefit standards, and provide feedback information that can improve architectural design, providing a solid foundation for future design. He also pointed out that it has three values: short-term, medium-term and long-term: its short-term value is for researchers to complete commissioned tasks, obtain investigation reports and properly deal with the existing problems; its medium-term value is to improve and update known design and development Defects in the process to achieve a virtuous cycle of "planning, design, construction, use, POE"<sup>[2]</sup>; long-term value is to provide feedback to government decision-makers through the research results of POE, promote the innovation of relevant standards and norms, and improve the overall industry design standards. It can be seen that post-use evaluation, as an indispensable and important link in the process of scientific architectural design, has very strong practical significance. Necessary means and tools to realize intelligence, systematization and scientificity.

## **2.2. Development background of rail transit public buildings**

The current rail transit public buildings and facilities show the development characteristics of improving their efficiency and environmental protection performance through the development of various new construction technologies. At the same time, through the use of innovative design, the architectural space is endowed with unique cultural connotations, making it an external display of urban characteristics. In recent years, with the development of urban renewal from incremental to high-quality, cities have increasingly demanded and paid more attention to rail transit public buildings. This field has attracted the common attention of urban planning, architectural design and environmental designers. But at the same time, the spatial design of rail transit public buildings pays too much attention to the expression of the urban material level, while ignoring the practical functions of buildings and the feedback from actual building users; there is also insufficient understanding of rail transit public Miscapture of mental and physical properties leading to problems that prevent their continued development.

## **3. The purpose and significance of POE applied to guide the design of rail transit public buildings**

The important concept of "people's city built by the people, people's city for the people" in his important speech on his inspection of Shanghai, and the National Development and Reform Commission clearly stated Proposed: "It is required to attach great importance to the evaluation of new smart cities; use evaluation as a means to improve the level of urban convenience and benefit the people." The continuous development of urban public buildings, facilities and services is an important indicator that reflects the improvement of people's livelihood. It emphasizes the service of the government, while also emphasizing the rights of citizens. In recent years, China's smart city process has continued to accelerate, and has achieved remarkable results in rapidly expanding urban space, building a rapid urban three-dimensional transportation network, and improving the digital level of the urban environment. It has its own development rules and characteristics.

At present, under the background of "people-oriented" demand in the design industry, functionality and fluidity are no longer the only functional pursuits of the quality of rail transit public building space. Then there are issues such as how to improve the current rail transit public buildings, how to provide effective feedback information for the newly built rail transit public building facilities, and which environmental factors have an important impact on passenger satisfaction. Highlights the need to use POE. As a relatively complete scientific evaluation method and evaluation technology system, POE can truly feedback people's demand for space from a unique perspective, so as to obtain the satisfaction with the use of rail transit public building facilities. It can also clearly identify the problems and defects in the existing space, bring about a design mechanism for supervision and feedback, and improve the quality of the current and future public space environment. In order to make the construction of rail transit public buildings closer to the actual needs of users, POE can provide a more suitable research path.

## **4. The research framework and implementation method of applying POE in the construction of rail transit public facilities**

### **4.1. Research methods**

E. Wiesenfeld defines satisfaction as a state of balance between the user and the environment, between the needs and expectations of use and the actual living environment<sup>[3]</sup>. It is very important to study the satisfaction degree of public space environment to users in the development of rail transit public facilities construction, so in the post-use evaluation research of rail transit public facilities, the satisfaction comprehensive evaluation research is introduced as a supplement to the process. On the other hand, there are data-based evaluation results throughout the evaluation process, such as the evaluation of measurement, collection of environmental physical characteristics, and user behavior data. To understand and deal with the changes in the space environment well, make a more accurate and comprehensive evaluation of the space environment, so as to make up for the defects and insufficiencies only from the perspective of the user, and expand the specific implementation steps and content of using POE from the methodology, and then Better prepare for spatial evaluation. One is exploratory research; the other is on-the-spot investigation; the third is philological research and analysis. Based on the real situation, these three aspects are constantly summarized and corrected, and feasible evaluation indicators are established.

#### **4.2. Implementation method**

(1) Collect key variables and analyze key considerations. Through data research and analysis, find out the key factors that affect passenger satisfaction in rail transit public building space, such as space decoration, physical environment, functional streamlines and information guidance, etc., and analyze these factors to study<sup>[4]</sup>. The scientific method of comprehensive evaluation of satisfaction is introduced, and the variables of the study are obtained through multidisciplinary cooperation and multi-angle analysis. After collection and analysis, this study concludes that the general "semantics" of rail transit public facilities in the underground space of subway stations include: shopping space, traffic convenience, regional characteristics, visual guidance, pedestrian flow, route map, landscape configuration, There are 21 items such as temperature comfort, information display, emergency evacuation, culture, artistry, integration, access for the disabled, light comfort, safety, convenience facilities, etc. After analysis, the above 17 items are retained as variable elements.

(2) Questionnaire information design and collection. According to key variables, questionnaires are designed for urban rail transit public building space satisfaction and distributed to target buildings. Semi-structured interviews can be combined to understand respondents' answers to open-ended questions. In this study, the model framework for post-use evaluation of subway station underground space is divided into four aspects, the first aspect is space design; the second aspect is function and streamline design; the third aspect is service facility layout; The fourth is the optimization of the physical environment. The implementation verification proves that the semi-structured interview method using questionnaire and open-ended question answering is a more suitable research method in the post-use evaluation of public facilities construction.

(3) Statistical analysis. Use the collected actual data and questionnaire results to sort out, and conduct statistical analysis based on passengers' satisfaction with different aspects. In order to achieve the data portrait of the post-use evaluation of the target rail transit public building, and obtain the main problems of the target building based on the statistical results.

(4) Establish an optimization mechanism: Based on actual cases, the effectiveness and improvement of individual cases have been used to prove the effectiveness of the evaluation model. Feedback and enlightenment can thus be obtained, which facilitates the optimization of social resources for reuse and maximizes the management efficiency of rail transit operations. In the fourth chapter, this article will take the underground space of a subway station as an example to present the enlightenment and optimization suggestions after the evaluation and analysis.

### **5. Taking the underground space of a subway station as an example, how does POE intervene in the design and renovation of rail transit public buildings**

#### **5.1. Suggestions for optimization of space design**

##### **5.1.1. Orientation and richness of spatial form.**

The design of guiding direction cannot be perfected only by relying on the guiding sign system, but should also be consciously expressed in the design process of the entire subway space, such as: using load-bearing structures for construction or using late-stage soft decoration to realize the rhythm of the space arranged in sequence, so as to guide smoothly Crowds create a spatial form that can not only create a visual guidance, but also add a sense of beauty to a single space. You can also use rich shapes to enhance the interest of the space, such as: interpenetration of space, size contrast, virtual reality contrast, high and low contrast, etc. to break the inherent impression<sup>[5]</sup>.

##### **5.1.2. Integration of space, environment and humanities.**

The humanistic connotation of the subway space can best reflect the development process of the city where it is located. The decoration effect and style achieved by using various materials, colors and decorations, and the space with strong cultural characteristics are created to reflect the cultural connotation and character of a city, so that people have a sense of desire and belonging to the city where the subway station is located.

##### **5.1.3. Landscape configuration.**

In the semi-structured interviews, 39% of the interviewees showed interest in the spatial landscape configuration of subway stations, which is exactly what is currently neglected in Chinese subway stations.

It can innovatively cooperate with technological means such as ventilation and dehumidification, and properly introduce greening, sketches and other landscape configurations to limit and separate the space while reducing people's anxiety and irritability during the waiting process, avoiding monotony and boring feelings.

### ***5.2. Suggestions for optimization of function and streamline design***

(1) The rationality of the arrangement of public building facilities: An easily identifiable subway space is inseparable from a perfect streamline design, and the streamline layout must conform to the pattern of the main function of the space. Different modules should be independent of each other, independent of each other, streamlined and clear, convenient and reasonable.

(2) Ingenious and intelligent streamline design: fully consider the location and function of the station site, the division of paid areas and non-paid areas, the number of entrances and exits, the choice of platform form, the rationality of vertical traffic layout, and the peak hours of passenger flow Reservation of flexible space and humanized design such as barrier-free.

(3) Guidance in special time periods: During special periods such as holidays and rush hours, the guidance of space in the subway can reduce the high probability of crowding during peak periods, and reduce the possibility of panic, stampede and other emergencies caused by crowding.

### ***5.3. Suggestions on the optimization of service facility layout***

(1) Effectiveness and clarity of information guidance: Because of the special environment in which the subway is located, information guidance is particularly important. There are three types of signage settings: hanging type, attached type and standing type. The design principle should take into account the identification of information such as the specific time of the train, and a clear and clear identification system can make passenger flow more effective. Allow users to quickly and accurately locate, effectively eliminate the sense of disorientation caused by the direction in the underground traffic space and quickly find the entrance and exit.

(2) Supporting convenience facilities: supporting facilities for auxiliary services mainly include ticket vending machines, trash cans, public seats, ATM machines and toilets, etc., to improve the service quality of the subway in an all-round way, enhance the comfort and convenience of riding, and thus greatly improve the quality of passengers. car frequency.

### ***5.4. Suggestions for optimizing the physical environment***

(1) Acoustic environment: A good acoustic environment will not only make passengers feel more comfortable and happy, but also have a direct impact on the health of passengers. On the basis of retaining the acquisition of effective sound information, considering the acoustic environment as an important factor affecting the quality of subway space can more fully reflect the space quality of this type of building.

(2) Lighting environment: The lack of sunlight in the public space of the subway will make many people feel strong psychological uneasiness and it is difficult to travel in the subway with peace of mind and comfort. Excessive light intensity will cause visual pollution. It is necessary to scientifically and rigorously cooperate with the space streamline design to partition and accurately design the lighting light required by each part.

(3) Ventilation and temperature and humidity environment: Subway stations are located in underground, semi- open spaces, and the freshness of the air is not easy to maintain. The temperature and humidity are obviously different from the ground, which has a great impact on the physical experience of users. The monitoring of temperature and humidity should be strengthened, and timely adjustments should be made to factors such as passenger flow at each site to ensure a suitable temperature and humidity environment.

## **6. Conclusions**

At present, there is a lack of factors such as comprehensive environmental assessment that comprehensively considers the user's psychology and behavior, social culture and architectural technology in the practical research of post-use evaluation in my country. In addition, there is a serious

disconnect between evaluation theory and actual implementation. Evaluation is mainly limited to the needs of researchers for the research itself, lacking support and follow-up supervision from society, the market, and the government, and there are concerns about implementation difficulties. The factors that the main body and users of rail transit public buildings need to consider are complex and changeable, which determines that the development process will not be smooth sailing and needs to be constantly iteratively updated. This paper attempts to explore how to further develop the design of rail transit public buildings on a more scientific and rational development path through POE, and further explores through the effectiveness of individual cases. How to establish a post-use evaluation system for urban rail transit public buildings that is suitable for China's actual conditions is a long-term and arduous task and task. It is hoped that this article can provide some reference for the construction and renewal of urban rail transit.

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