Analysis of Design Elements about the Spirit of Place in Traffic Station Based on Analytic Hierarchy Process

ChangXi Wang[1], JunLi Wang[2], MingHui Cheng[*3], YiWei Sun[4], Qi Liu[5]

wangchangxi-cn@whut.edu.cn[1], 93443970@qq.com[2], chengmh@zjnu.edu.cn[3], 1135891619@qq.com[4], 357556964@qq.com[5]

School of Art and Design, Wuhan University of Technology, Wuhan, China[1],
Wuhan Comprehensive Transportation Research Institute Co., LTD, Wuhan, China[2,5],
College of Engineering, Zhejiang Normal University, Jinhua, China[3,4]

Abstract. Traffic station can not only ensure the normal operation of urban traffic, but also an important display window of urban culture and image. However, at present, the design of urban traffic station has the sameness and the lack of uniqueness. And in the process of design, there is neglect of regional culture, art space, etc., which fails to reflect the spirit of place. This results in traffic stations that do not display the city's character well. Therefore, on the basis of the current investigation, this paper summarizes the factors that affect the spirit of traffic station. And combines the results of experts' grading, using analytic hierarchy process (AHP) , this paper quantitative analysis the influence factors of regional culture, natural environment and comfortable artistic space. Finally, using the analytic hierarchy process, it is concluded that regional culture has the greatest influence, followed by architectural form, humanized facilities and comfortable art space. Therefore, the design of spirit of place in the traffic station should focus on these four elements.

Keywords: Spirit of place; Traffic station; Analytic hierarchy process; Local culture; Artistic atmosphere

1 Introduction

With the rapid development of China's economy, urban transportation has also made significant progress, and the development of urban transportation can be largely reflected in the design of traffic station, such as train stations, subway stations, etc. As the gateway of a city, traffic station is the primary channel for the city to communicate with the outside world, and it is the first impression of the city to the outside world. It has a strong symbol, and the cultural spirit and connotation of the city can be fully displayed by the traffic station. However, in recent years, the phenomenon of convergence and "Uniform cityscape" in the field of transportation and architectural design has become increasingly serious, and regional characteristics have been gradually eroded by "globalization", Even worse, some cities have blindly pursued "trends" and eagerly sought to be unique, causing many traffic station to deviate from the local architectural culture. Travelers find it difficult to emotionally connect with traffic station, and as a result, they fail to leave a lasting impression on the transportation spaces or the city itself.

In 1979, Norberg Schulz introduced the theory of "the spirit of place" in design[1]. The emergence of new elements provides new ideas for the renewal and development of transportation architecture, so as to better explore the construction of different architectural

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spatial elements and create a place containing emotional experience and identity[1-2]. The spirit of the place of the traffic station can be understood as that people can have a sense of identity and belonging to the station when they complete their travel purpose. The traffic station with the spirit of place not only can be transformed into a city landmark, but also can continue the context and historical culture, and can make passengers have a strong sense of identity and belonging[3].

Many researchers have carried in the research on the design concept of traffic stations. Wen. proposed a combination of modern transportation stations and urban landscape, as well as matching the local cultural characteristics[4]. Li. proposed that in the design of traffic stations, not only the function should be realized, but also the cultural connotation should be considered[5]. Peng. proposed that when designing the public space of subway stations, it is not only necessary to create diversified art space, but also pay attention to the layout of humanized facilities[6]. Yang., et al. believe that the design of subway platform space should also match the local culture and transmit the city culture[7]. To sum up, scholars are basically studying the strategies to create place spirit in subway stations and other transportation stations, but have not study on the design elements and importance of place spirit. Therefore, based on the results of field investigation of traffic stations in major cities in China, this paper analyzes and summarizes the design elements of the spirit of place in traffic stations, and uses the analytic hierarchy process to calculate the importance of each element. The research results of this paper can enable designers to grasp the key points in the design, so as to design a traffic station that can show the cultural connotation and spiritual style of the city. This not only can deepen passengers' sense of identity to the city, but also help to improve the comprehensive strength of the city. Moreover, through the analysis of traffic station design elements, it can also provide some reference for the study of traffic station design specifications.

2 Investigation of the current situation of traffic station

With the rapid development of urban economy, various parts of the country have started to accelerate the construction of transportation infrastructure, and the number of traffic station such as subway stations, railway stations, and airports has been increasing year by year. For further study the connotation and embodied element of the spirit of traffic station, this paper selects some typical traffic stations in Chinese cities to investigate the current situation, and analyzes them from the perspectives of regional culture, architectural form and natural environment.

2.1 Wenzhounan Railway Station

Wenzhounan Railway Station is located in Wenzhou City, Zhejiang Province. In terms of architectural form design, it is inspired by the heavy eaves of traditional houses in Wenzhou, as show in a) of Figure 1. Combined with the architectural features of covered Bridges, pavilions and so on, from the perspective of large scale and large volume, it re-interprets modern large-scale traffic stations with traditional techniques. It can not only reflect the contemporary sense of modern architecture, but also show the classical charm. At the same time, Wenzhounan Railway Station is also located in the new city of Wenzhou high-speed rail, combined with the air corridor, Wenzhounan Railway Station and the surrounding business district constitute a "city balcony", more convenient for tourists to walk. In addition, five national intangible cultural

heritage projects in Wenzhou are displayed in the corridor, which highlights the regional culture.

a) Wenzhounan Railway Station

b) Nanjing Railway Station Subway Station

c) Ningbo Lishe International Airport

Fig. 1. Photos of traffic stations

2.2 Nanjing Railway Station

Nanjing Railway Station is the transfer station for Line 1 and Line 3 of the Nanjing Subway, which is called "Virtue Station". The theme of "Virtue" is everywhere on the walls, glass, columns and other places of the station hall and underpass. In addition, a mural was also painted in one of the corridors, depicting the scene of Yuanchun, the eldest daughter of Jia Zheng and the undermaster of Rongguo Mansion, returning to Jia Mansion to visit parents after being conferred the title of the imperial concubine, as show in b) of Figure 1. Once passengers get off the train, they feel as if they have strayed into the world of Dream of the red Mansions, fully highlighting the cultural characteristics of Nanjing.

2.3 Ningbo Lishe International Airport

Ningbo Lishe International Airport is located in Haishu District, Ningbo City, Zhejiang Province. It has two terminals, T1 and T2. Among them, the integrated curved roof of T2 is naturally connected to T1, transforming the calm waves into an open and free architectural form, as show in c) of Figure 1. The shape of T2 is inspired by Ningbo's Marine culture, and its design is inspired by the beautiful "shells" that twinkle in the sand after the sea fades. At the same time, the calm sea waves are transformed into a stretch and free architectural form, making the airport as a whole wing-like. The architectural form and the architectural structure are unified, which not only meets the space use requirements of the modern airport, but also shows the local context and the characteristics of the era of Ningbo.

3 Analysis of the creating elements of the spirit of place in the design of traffic station

Through the investigation of the current situation and the references, it is found that there are mainly six factors affecting the embodiment of the spirit of place in traffic station, namely: regional culture[3-5], natural environment[5-6], comfortable art space[5,6], humanized facilities[5-7], architectural form[5], and building materials[5,7]. This paper uses analytic hierarchy process to compare and analyze the importance of the six elements. Analytic Hierarchy Process (AHP) is a flexible and practical multi-criteria decision making method proposed by Saaty Tl in the early 1970s. It represents a complex decision problem as an ordered hierarchical structure, and gives

the order of pros and cons of alternatives through people's subjective judgment and scientific calculation, which is a method that combines qualitative analysis with quantitative analysis[8].

Table 1. Scoring belly scale

Score assignment	Implication
1	Both elements are equally important
3	Comparing two factors, one factor is slightly more important than the other
5	Comparing the two factors, one factor is significantly important than the other
7	Comparing two factors, one factor is more important than the other
9	Comparing two factors, one factor is extremely important than the other
2,4,6,8	The values between each of the above two adjacent judgments indicate similar importance
Count backwards	The importance of factor i with respect to j is a_{ij}, then the importance of factor j with respect to i is $a_{ji} = 1/a_{ij}$

Table 2. Element code

Element	Code
Regional culture	A_1
Natural environment	A_2
Comfortable art space	A_3
Humanized facility	A_4
Architectural form	A_5
Building material	A_6

3.1 Construct the judgment matrix

Eight experts from universities, associations, research institutes and transportation bureaus were invited to score the relative importance of the factors in pairs according to the 5 scale methods shown in Table 1. Finally, the judgment matrix is obtained. For the convenience of calculation, the six elements are represented by different codes, as shown in Table 2.

$$\boldsymbol{A} = \begin{pmatrix} 1 & 3 & 4 & 5 & 2 & 9 \\ 1/3 & 1 & 1/3 & 1/5 & 1/4 & 4 \\ 1/4 & 3 & 1 & 1/3 & 1/2 & 5 \\ 1/5 & 5 & 3 & 1 & 1/3 & 5 \\ 1/2 & 4 & 2 & 3 & 1 & 7 \\ 1/9 & 1/4 & 1/5 & 1/5 & 1/7 & 1 \end{pmatrix} \tag{1}$$

3.2 Calculation step

(1) The eigenvector is obtained by calculating the product of each row of elements in the judgment matrix, as show in equation (2).

$$\boldsymbol{m_i} = \prod_{j=1}^{n} a_{ij} (i = 1,2,\cdots,n) \tag{2}$$

(2) Calculating the n root of m_i, as show in equation (3).

$$\overline{\boldsymbol{w}} = \sqrt[n]{m_i} (i = 1,2,\cdots,n) \tag{3}$$

(3) The feature vector is normalized and becomes the weight vector w_i after normalization, as show in equation (4).

$$\boldsymbol{w_i} = \overline{\boldsymbol{w_i}} / \sum_{k=1}^{n} \overline{\boldsymbol{w_k}} (i = 1,2,\cdots,n) \tag{4}$$

(4) Calculating the maximum eigenvalue, as show in equation (5).

$$\lambda_{max} = \frac{1}{n} \sum_{i=1}^{n} \frac{(\boldsymbol{Aw})_i}{\boldsymbol{w_i}} (i = 1,2,\cdots,n) \tag{5}$$

Where, A is the judgment matrix; $(Aw)_i$ is the i-th component of vector Aw.

3.3 Calculation result

The results obtained by using analytic hierarchy process are shown in Table 3.

Table 3. Analysis result by AHP

Element	Weight(%)	Sort	λ_{max}	CI
A_1	37.654	1	6.612	0.122
A_2	7.352	5		
A_3	11.63	4		
A_4	16.982	3		
A_5	23.591	2		
A_6	2.79	6		

The calculation results of analytic hierarchy process show that λ_{max} is 6.612, and the corresponding RI value is 1.25 according to the RI table, so CR=CI/RI=0.098<0.1. The result of AHP analysis meets the requirement of consistency test and does not need to modify the judgment matrix.

As show in Table 3, among the six elements, the regional culture (A_1) has the largest weight with a value of 37.645. This shows that in the design of traffic stations, the primary time to consider the local regional culture. The design should match the regional culture of the city and continue and inherit the historical and cultural characteristics of the city. Secondly, the weight of architectural form (A_2) is 23.591%, which is also very important for the construction of the spirit of place. Therefore, in the design of traffic stations, the architectural form can be designed as a symbol of local cultural characteristics. This creates a strong sense of belonging among locals. Than, the third important element is humanized facilities, with a weight of 16.982%.

Urban traffic stations are mainly places to provide travel services for passengers, and certain barrier-free facilities should be built to provide humanized services for passengers with mobility difficulties. And some special group activities of women such as mother and baby rooms. So that all passengers in the station can get due respect in the space. The weight of comfortable art space is 11.63%, ranking fourth. Therefore, in the design of traffic stations, should also be set up some specific art space. Creating a unique art space can not only provide a place for passengers to rest for a short time, but also enable passengers to have a spiritual impact in the internal space, highlighting the spirit of the place. Finally, the weight of natural environment and building materials were 7.352% and 2.79% respectively. So these two elements are of little importance and can be ignored when creating the spirit of place of traffic station.

4 Conclusion

As an indispensable part of urban landscape and transportation system, transportation architecture can not only provide travel services for passengers, but also show and inherit the cultural characteristics of the city and reflect the spirit of the place. It enables passengers to have a strong sense of identity, direction and belonging in the traffic station, which can play the role of a city symbol and fully reflect the cultural features of the city. When creating the spirit of place in the traffic station, we should not only pay attention to the realization of the basic function of the traffic station, but also improve the function of the city. We should also focus on regional culture, architectural form, humanized facilities, comfortable art space, etc., so that all aspects can be coordinated and unified. Only in this way can people resonate with the traffic station, enhance the memory of the traffic station, and strengthen the deep impression of the city.

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