Research on Innovative Design of railway passenger service

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ABSTRACT: In order to improve the quality of railway passenger service, the quality of railway passenger service is investigated through field investigation and questionnaire survey, the evaluation index system of railway passenger service quality is established, and the Delphi method is used to screen important service quality evaluation indicators, The model of railway passenger service quality evaluation is established by Delphi method and analytic hierarchy process based on passenger perception, the top five indicators in the weight ranking in the station service quality evaluation index system can show the importance of the station environment in improving the quality of passenger service. On this basis, 1088 valid questionnaires on the addition of lifting stools in station waiting halls were analyzed. The results show that most passengers are concerned about the comfort of the renovated seats and the safety of luggage storage, and the innovative design of the lifting stool greatly improves the space utilization of the waiting hall when improving the railway passenger service.

1. INTRODUCTION

1.1. Innovative design background and research significance

Today, with the rapid development of railway, China has become the country with the fastest developing high-speed railway, the most complete system and technology, the strongest integration capability, the longest operating distance, the highest operating speed and the largest scale under construction in the world. China's high-speed rail is leading the new trend of high-speed rail development in the world.

Before traveling, the waiting hall is a must for every passenger, for most passengers, before taking the high-speed train will be in the waiting hall, then the passenger's suitcase placement has become a big problem. Now there are many unreasonable aspects in the design of the lobby in the high-speed railway station, while passengers are waiting to get on the train, the suitcases accompanying the passengers are generally placed next to them, and the luggage of the traveling passengers is relatively similar in appearance, and if you don't pay attention to it, you may take it wrong, and when the passenger flow is large, mixed people and luggage will cause certain safety hazards; Although the waiting hall is generally large, there has never been a fixed place to put luggage, and the luggage left by passengers everywhere often causes congestion in the aisle.

Based on the innovative design of the lifting stool, passengers with small luggage can directly put their luggage under the chair lift without lifting adjustment, nor will it affect the passengers' waiting experience, while passengers with large luggage can adjust the height of the chair lift, so that they can not only place their luggage close to themselves, but also will not cause congestion in the aisle of the waiting hall, and there will be no luggage being taken by mistake. This chair lift not only solves the safety of passengers' luggage, but also stifles the risk of congestion and chaos in the waiting hall.

1.2. Status of relevant research at home and abroad

Ding Yingchang (2005) introduced the quality concepts of so-called facility quality, behavior quality and perceived quality from the connotation of clarifying the quality of railway passenger transport, pointed out the shortcomings of the current railway passenger transport quality, and put forward specific suggestions to improve the quality of railway passenger transport.[1]

Gao Hongling (2006) proposed four key links be grasped to improve service quality on the basis of studying the relationship between customer expectation and actual perceived service quality. Perfect internal management system, committed service, humanized service and timely service remediation.[2]

Jozee Lapierre, Pierre Filiatrault, and Jean Perrien (1996) studied that standard, professional service systems should be based on specific service quality content and its evaluation indicators. And from empirical work, a methodology for systematic review guidelines is proposed.[3]

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Although China has realized that there are certain problems in the luggage placement in the waiting hall in recent years, and has also carried out various in-depth research, and even begun to try to solve it, such as delimiting a fixed area in the waiting hall for luggage placement, there has been no relevant research and attempt on the transformation of chairs in the waiting hall.

1.3. Content and methods of thesis research

This paper mainly reads and sorts out the literature on improving the quality of railway passenger service, [4]establishes a station service quality evaluation index system based on passenger perception, and screens and analyzes the indicators through the Delphi method and analytic hierarchy method. On this basis, the questionnaire survey method was used to investigate passengers' needs and satisfaction with the station environment (equipment and facilities), and the results were analyzed, and the seats used for passenger rest in the station waiting hall were innovatively designed, and the original row of seats was designed as independent lifting stools.

2. EVALUATION OF RAILWAY PASSENGER SERVICE QUALITY

Consulting the relevant information, it is concluded that railway passengers have the characteristics of paying attention to both hard and soft quality of the train from the perspective of passenger perception.[5]Like air passenger transport and road passenger transport, railway passengers first require comfortable hardware facilities and a riding environment. Secondly, we should take meeting the needs of passengers as the starting point, effectively consider the passengers themselves, and do our best to make passengers feel at home.

The station service quality evaluation index system is established, as shown in Table 1.[6] Starting from the passenger service process, the station service quality is mainly reflected in the links of ticket purchase, arrival, waiting, check-in and departure, etc. Therefore, from the overall situation of the station, the key service factors that passengers feel and run through the ride process are selected and combined with the service process perceived by passengers. The classification is as follows:

(1) Ticketing service. It is mainly used to evaluate the convenience of passengers to purchase and collect tickets, mainly including ticket purchase, ticket collection and ticket inspection at stations.

(2) Station environment. It is mainly used to evaluate the degree to which the station provides safety and tangibility for passengers.

(3) Information services. It is mainly used to evaluate the convenience and reliability of the information provided by the station to passengers.

(4) Staff. It is mainly used to evaluate the comprehensiveness of the station's service to passengers and the good attitude of responsibility.

Table1. Station service quality evaluation index system based on passenger perception

Evaluation object	First-order index	Secondary index
Station service quality evaluation index system Z	Ticketing service A	Purchase and collect tickets A_1
		Check ticket A_2
	Station environment B	Public security order B_1
		Station environment B_2
		Walk inside the station B_3
	Information services C	In-station broadcast C_1
		Guide mark C_2
	Staff D	Special service D_1
		Groom-ing and appearance D_2
		Service attitude D_3

The Delphi method is used to analyze the evaluation indicators of station service quality, as shown in Table 2:

Table2. Result table of station service quality evaluation indicators

Test statistics	numeric value
Number of cases	10
Kendall Wa	0.247
Chi-Square	19.781
Degree of freedom	8
Asymptotic saliency P	0.011

As can be seen from the results in Table 1, $0.01<P<0.05$ indicates significant.

In this paper, yaahp software is used to establish a hierarchical structure model, as shown in FIG. 1.[7]

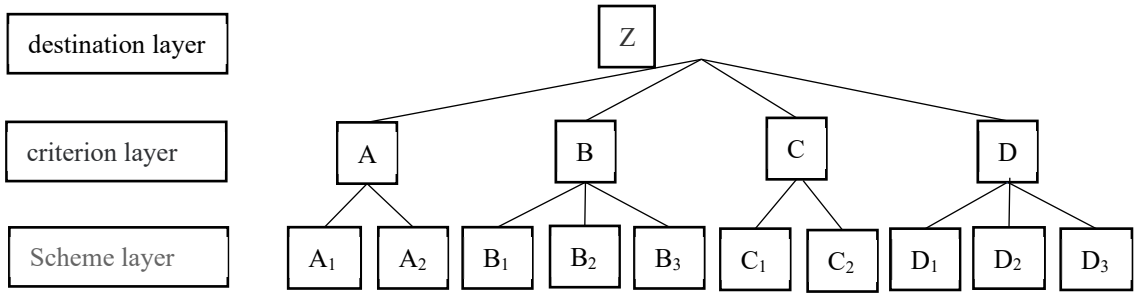

Figure 1. Hierarchical model

The paired comparison matrix between criterion layer and target layer is $Z=\begin{bmatrix} 1 & 6 & 3 & 4 \\ 1/6 & 1 & 1 & 1/2 \\ 1/3 & 1 & 1 & 1 \\ 1/4 & 2 & 1 & 1 \end{bmatrix}$.

The pair comparison matrix between scheme layer and criterion layer is $A=\begin{bmatrix} 1 & 6 \\ 1/6 & 1 \end{bmatrix}$, $B=\begin{bmatrix} 1 & 1/5 & 3 \\ 5 & 1 & 8 \\ 1/3 & 1/8 & 1 \end{bmatrix}$, $C=\begin{bmatrix} 1 & 1/4 \\ 4 & 1 \end{bmatrix}$ and $D=\begin{bmatrix} 1 & 1/2 & 1/4 \\ 2 & 1 & 1 \\ 4 & 1 & 1 \end{bmatrix}$.

Calculate the relative weight of the comparative elements to the upper elements,

$$W=(W_1\,W_2\ldots W_n)^T \quad (1)$$

Calculate the weight vector and do consistency check, calculate the maximum feature root,

$$AW=\lambda W \quad (2)$$

$$\lambda max=\frac{1}{n}\sum_{i=1}^{n}\lambda max \quad (3)$$

coincidence indicator,

$$CI=\frac{\lambda max-n}{n-1} \quad (4)$$

Finally, the comprehensive total weight of each layer factor in the overall goal of the system is calculated, and the weight ranking of A1-D3 evaluation indicators in the station service quality evaluation index system is conducted, as shown in Table 3:

Table 3. Weight and λmax of consistent ratio on "station service quality evaluation index"

	Consistency ratio	The weight of "station service quality evaluation index"	λ_{max}
Station service quality evaluation index system Z	0.0266	1.0000	4.0710
Ticketing service A	0.0000	0.5747	2.0000
Station environment B	0.0424	0.1076	3.0441
Information services C	0.0000	0.1515	2.0000
Staff D	0.0516	0.1662	3.0536

The weight ranking of evaluation indicators is shown in Table 4:

Table4. The evaluation indicators are weighted

Evaluation Indicators	Weight
Station ticket purchase and pick up ticket A1	0.4926
Guide sign C2	0.1212
Station ticket A2	0.0821
Station environment B2	0.0798
Service attitude D3	0.0788
Grooming D2	0.0626
Site broadcast content C1	0.0303
Service for featured travelers D1	0.0248
Public order in the station B1	0.0197
Walk around the station B3	0.0081

In summary, we select the top five indicators according to the weight of station service quality evaluation indicators: station ticket purchase and collection, guidance signage, station ticket inspection, station environment, and service attitude, as the main factors affecting the service quality of the station.[8] This shows the importance of the station environment in the quality of railway passenger services. In railway passenger transport, in order to create a good station environment, it is necessary to use limited space to make the already crowded environment orderly. This has to start from the problem of passengers' luggage being placed at will, we can use the advantages of lifting stools to store passengers' luggage by regenerating space, so that one person and one baggage. Therefore, it is urgent to upgrade the hardware facilities in the station, and it is urgent to improve the equipment and

facilities of the waiting environment in the station.

3. INNOVATIVE DESIGN OF LIFTING STOOLS

3.1. Innovative design ideas

In the railway passenger waiting hall, the space under the waiting chair is used to store passengers' individual luggage. During peak hours, passengers can put their luggage under their seats and manage their luggage well without taking up other space and avoiding congestion at the station. Create a more comfortable and convenient waiting environment with limited space.

The adjustment range of the lifting luggage stool is designed based on the size table of the suitcase and the volume of the conventional seat.[9] The size of the suitcase is shown in Table 5 below, According to statistics, the most used luggage is 22 inches-28 inches, so the height should be between 60-80cm, the length between 40-50cm, and the width (thickness) between 30-40cm, this range is reserved. In terms of dimensions, The small seat can only meet the needs of 1 passenger, the length dimension is 0.8 meters, the width size is 0.4 meters, and the height dimensions are 0.6 meters.

Table5. Size chart of conventional luggage

Trunk Size	Height * width * thickness (cm)
22inch	58*39*25
24inch	61*41*25
28inch	77*50*30
30inch	88*62*35
33inch	98*62*35

In summary, the design of the independent lifting stool should be between 30-50cm high, 40-50cm long and 60-80cm wide. There is now plenty of space for a single seat, and luggage storage space can be left under the seat by raising the height of the seat and rolling the chute.

3.2. Mechanical structure design

The lifting stool mainly uses a telescopic support bar as the main source of strength to bear the weight from the passenger's own above the seat, and passengers can adjust the most comfortable seat height according to their own needs, as well as the front and rear chute structure to adjust the front and rear position of the seat, and passengers can adjust the appropriate space required to place luggage according to the size and number of luggage they carry.

3.3. The principle of lifting the luggage stool device

There are three buttons at the armrest of the lifting stool: the rise button, the lowering button and the stop fixing button. Passengers can change the height of the lift bar by pressing the rise and down buttons, and when adjusting to the most comfortable position, press the stop button to fix the seat height. At the bottom of the stool, there are front and rear chutes that allow passengers to adjust the space under the seat to store their luggage by moving the chutes back and forth.

3.4. Feasibility analysis

Establish the user's field visit and launch innovative chairs to facilitate the passengers' chair lift to study. This project takes into account the limited space in the waiting hall, excessive passenger luggage, congestion and clutter when waiting, and the minimization of resource utilization, and passengers need to integrate passenger luggage with seats. Research questions take into account passengers and managers, and put theoretical research into practical application, which promotes chair lifts. The questionnaire on luggage storage in the station waiting hall was tested for validity using SPSS software, using the KMO test (Kaiser-Meyer-Olkin) and the Bartlett's Test of Sphericity.

Table6. Bartlett sphericity test for questionnaire validity

Kaiser-Meyer-Olkin measure of sampling adequacy		0.526
Bartlett's sphericity test	Approximate chi-square	153.498
	df	105.000
	Sig	0.000

From the data in Table 6, it can be seen that the KMO value is 0.526, which is greater than 0.5, indicating that the correlation between the variables is strong, and the measurement results of the questionnaire are very consistent with the content to be investigated, and the validity is high.

3.5. Product features

Through the current investigation of the waiting room facilities, it is found that there are a lot of fixed long rows of chairs in the waiting hall. In the peak period of holidays, the passenger flow is particularly large and the frequency is dense. Passengers stay in the waiting hall for a long time without interruption, and passengers carry a lot of luggage. To solve this problem, lifting luggage stool on the one hand to reduce the passenger flow is too large, there is no seat for passengers to rest and wait for check-in, on the other hand, reduce the waste of space resources, so that the original seat under the free space to be reasonable use, reduce the chance of luggage wrong, and will not affect the passenger waiting experience. Therefore, it is very innovative and practical. [10]

4. SUMMARY

Railway passenger transport has always adhered to the "people-oriented" service concept, providing passengers with efficient and high-quality service is the value of railway passenger service, so in the passenger journey, the

station to make passengers feel at home is the current railway passenger service strive for the service attitude. With the development of railways in China, passenger services can not be left behind, from the passenger service content, service level requirements and development trends, capturing and identifying the real needs of passengers, and design efficient service products to meet the needs of various passengers is particularly important. The design of railway passenger transport products should be practical, which is conducive to maintaining the stability of the product and promoting the cultivation and development of the railway passenger transport market.

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