Original Paper

Expressway Service Area Service Quality Analysis

Qiangqiang Feng[1,2] & Kaijia Fu[1,2]

[1] Xi'an Highway Research Institute Co., Ltd., Xi'an, Shaanxi Province, China,

[2] Shaanxi Xigongyuan Engineering Testing Co., Ltd., Xi'an, Shaanxi Province, China

[*] Qiangqiang Feng, E-mail:·379676429@qq.com

Abstract

Expressway service area is to provide services for people in the city between the city, but also an indispensable link in China's road transport service system, its service quality and service satisfaction are directly related, the construction of service facilities and the quality of the highway service area will play a role in promoting. The service area is an important link in China's road transport system. With the rapid development of China's economy, the service quality requirements continue to improve, and improving the service quality of the service area has become a top priority. Taking the service quality of the expressway service area in Shaanxi Province as the research object, this paper uses the questionnaire survey method to analyze the service quality of the expressway service area in Shaanxi Province in five dimensions: formability, reliability, assurance, responsiveness and empathy, and establishes the service quality model by using the hierarchical analysis method. Through the calculation comparison, people's satisfaction with each service quality factor in the highway service area is obtained, the average satisfaction value of each impact factor is about 7.5 points, the satisfaction of "reasonable layout of the service area and complete facilities" is the highest, the average value is 8.10, and the satisfaction of "fully understanding customer needs" is the lowest, the average value is 7.42, through the analysis of the relevant data on the service quality satisfaction of the highway service area, it is found that people are generally dissatisfied with the service quality. The satisfaction of drivers and passengers with the service area directly affects the level of economic benefits. This article studies the influencing factors of driver and passenger satisfaction and aims to improve the economic benefits of the service area by improving driver and passenger satisfaction.

Keywords

Highway, service area, service quality, AHP, SPSS software

1. Introduction

Expressway service areas play a significant role in the economic development and mileage planning of the highway industry. Reasonable construction and high-quality services can reflect the social public service function of highways, expand the benefits of service enterprises, realize the social service value of highways, create employment opportunities, utilize idle land resources, and increase land use value. This paper analyzes the service quality of service areas based on the current status and development trends of highway planning and construction in Shaanxi Province.

From 2013 to 2021, many scholars conducted research on the service quality evaluation system of expressway service areas. These studies cover service quality evaluation (Liu, 2013; Tan, 2015), construction of service area standard levels from the user perspective (Wang, 2016), humanized expressway (Zhang, 2018), regional development planning (Yang & Yan, 2018), service area planning and management, etc. (Feng, Yang S., Yang H., & Xu, 2018). In recent years, scholars have also proposed new ideas and methods in terms of service area operation models (Liang, 2019; Zhao, 2019; Ma, 2019) and service quality improvement (Mu, 2019; Lu, 2021), providing theoretical support and practical guidance for the development of expressway service areas in my country.

At present, my country's expressway service companies focus on improving customer satisfaction, of which service areas are an important carrier. Service satisfaction affects travel choice behavior and is a potential psychological variable. Analyzing the satisfaction generation mechanism and influencing factors will help improve service area service quality and service area entry rate.

2. Questionnaire Design and Implementation

2.1 Questionnaire Design

This questionnaire was designed based on the Shaanxi Expressway Service Area Customer Satisfaction Evaluation Index System, with a total of 44 survey items. The first four questions collect personal information, and the last forty questions are divided into two parts: impact factor satisfaction evaluation and impact factor importance evaluation. This survey sent out two questionnaires to customers in the expressway service area of Shaanxi Province. 125 copies were issued for the first time, and 121 copies were recovered, with a recovery rate of 95.8%. For the second time, 155 copies were issued and 151 were recovered, with a recovery rate of 97.4%.

2.2 Questionnaire Data Statistics

Through online and offline channels, this survey mainly targets drivers and passengers in expressway service areas in Shaanxi Province to obtain the status and service quality of service areas in people's minds. Questionnaires were distributed randomly to ensure the authenticity and accuracy of the survey. The survey statistics are shown in Table 1.

Table 1. Questionnaire Data Collection Form

Survey type	Attributes	Number of people	Proportion
gender	male	52	45.22%
	female	63	54.78%
age	18-25	93	76.86%
	26-35	15	12.4%
	36-45	8	6.61%
	46-55	4	3.31%
	55+	1	0.83%
purpose of stay in service area	get fuel for the ca	45	37.19%
	to the restroom	98	80.99%
	food acquisition	38	31.4%
	car repair	12	9.92%
	rest	69	57.02%
	others	7	5.79%
stay time in service area	under 10 minutes	33	27.27%
	10 minutes to 20 minutes	72	59.5%
	20 minutes to 60 minutes	15	12.4%
	more than 60 minutes	1	0.83%

The data in Table 2 shows that the ratio of male to female students in this survey is close to 1:1, with young and middle-aged people accounting for a larger proportion, and fewer respondents over 55 years old. The main purpose of the respondents' stay in the service area was to use the toilet and rest, and the stay time within 20 minutes accounted for 86.77% of the total number of people. Customer dwell time also reflects the importance of service areas on expressways.

Table 2. Customer Satisfaction Demand Statistics Table

Service area layout, facility status, etc.	Very satisfied	Satisfied	Average	Dissatisfied	Very dissatisfied
1. reasonable layout of service area and complete facilities	51	37	25	4	4
2. complete rest and accommodation services	38	35	30	9	9
3. service area environment is good	46	35	26	7	7
4. modern refueling facilities	46	39	27	4	5

5. service area parking area is reasonably designed	42	36	33	6	4
6. clean and hygienic restaurant	38	42	27	7	7
7.complete bathroom facilities	46	32	33	4	6
8. complete car repair services	37	32	36	10	6
9. conveniently accessible entrances and exits	50	38	24	5	4
10. charges at toll stations and service areas are standardized and reasonable	41	31	36	8	5
11.smooth traffic	49	36	26	5	5
12. short waiting time for toilet	46	39	22	9	5
13. convenient service in restaurants and shops	45	42	23	6	5
14.service staff respond promptly	42	32	36	6	5
15. good service attitude	42	37	31	5	6
16. find a parking space quickly and easily	46	35	30	6	4
17. service staff have the knowledge to answer questions	45	35	28	8	5
18. provide help according to people's needs and in a timely manner	40	41	30	5	5
19. fully understand customer needs	36	37	32	9	7
20. provide value-added services	40	34	29	12	6

2.3 Analysis of Service Quality in Expressway Service Area

This highway service area service quality survey adopts a five-level scoring system. Among them, very satisfied corresponds to 10 points, satisfied corresponds to 8 points, average corresponds to 6 points, dissatisfied corresponds to 4 points, and very dissatisfied corresponds to 2 points. After collecting the questionnaire, the data was summarized and imported into SPSS for analysis and calculation, and the mean and standard deviation of service quality were obtained.

(1) According to the obtained questionnaire survey, the service quality satisfaction is shown in Table 3.

Table 3. Service Quality Satisfaction Table

Service area layout, facility status, etc.	Customer satisfaction
1. reasonable layout of service area and complete facilities	8.10
2. complete rest and accommodation services	7.39
3. service area environment is good	7.75
4. modern refueling facilities	7.93
5. service area parking area is reasonably designed	7.75
6. clean and hygienic restaurant	7.60
7.complete bathroom facilities	7.79
8. complete car repair services	7.39
9. conveniently accessible entrances and exits	8.07
10. charges at toll stations and service areas are standardized and reasonable	7.57
11.smooth traffic	7.97
12. short waiting time for toilet	7.85
13. convenient service in restaurants and shops	7.92
14. service staff respond promptly	7.65
15. good service attitude	7.72
16. find a parking space quickly and easily	7.87
17. service staff have the knowledge to answer questions	7.77
18. provide help according to people's needs and in a timely manner	7.75
19. fully understand customer needs	7.42
20. provide value-added services	7.49

(2) Open the service quality satisfaction table in SPSS data analysis software, and automatically analyze it through SPSS software to obtain the service quality mean and standard deviation in Table 4 below.

Table 4. Service quality Average Value and Standard Deviation

Factor	No.	Average Value	Standard Deviation
Tangible factor	C11-C18	7.7125	0.2470
Reliability factor	C21-C23	7.8700	0.2646
Response factors	C31-C33	7.8067	0.1401
Assurance factor	C41-C43	7.7867	0.0764
Empathy factor	C51-C53	7.5533	0.1739

Data analysis shows that the average value of each factor is around 7.5 and the standard deviation is around 0.2, indicating that the difference in satisfaction is small and the difference in customer feelings is small. Generally speaking, it is biased towards satisfaction on a neutral basis. The data results show that the satisfaction value is above the median, indicating that the service can meet the basic needs of customers, but there is still room for improvement. Especially for accommodation services and car repair services, there are many dissatisfied people. The service area needs to sum up experience and take measures to improve customer satisfaction. Therefore, at this stage, there are problems with the service form and content of expressway service areas, which are the focus of the service quality improvement plan.

3. Analyzing Expressway Service Area Quality Using Analytic Hierarchy Process

3.1 Weight Determination Based on Analytic Hierarchy Process

3.1.1 Hierarchical Structure Model Building

In the hierarchical structure model of this article, the target layer is Shaanxi expressway service quality, the criterion layer includes tangibility, reliability, responsiveness, assurance and empathy, and the program layer includes 20 evaluation indicators. A represents Xi'an Expressway service quality, and B1, B2, B3, B4, and B5 represent tangibility, reliability, responsiveness, assurance, and empathy respectively. C11 represents the first service quality influencing factor in tangibility, and by analogy, C51 represents the first service quality influencing factor in empathy.

A=(B1, B2, B3, B4, B5);

B1=(C11, C12, C13, C14, C15, C16, C17, C18);

B2=(C21, C22);

B3=(C31, C32, C33, C34, C35);

B4=(C41, C42, C43);

B5=(C51, C52, C53);

3.1.2 Judgment Matrix Construction

By consulting the literature, the judgment matrix between the five dimensions and the judgment matrix of each indicator under each dimension were obtained. Establish a hierarchical structure diagram, calculate weights, and conduct consistency tests. Finally, the following data is obtained.

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Table 5. Judgment Matrix and Weights of Five Dimensions

A	B1	B2	B3	B4	B5	weight	consistency test
B1	1	2	2	3	3	0.3241	λ_{max}=6.3123
B2	1/2	1	2	3	3	0.2341	CI=0.0345
B3	1/2	1/2	1	3	3	0.2011	CR=0.0123
B4	1/3	1/3	1/3	1	2	0.1012	
B5	1/3	1/3	1/3	1/2	1	0.0452	

A judgment matrix is established with 5 dimensions, as shown in Table 6. The order of importance from high to low is tangibility, reliability, responsiveness, assurance, and empathy. λ_{max}=6.3123, CI=0.0345, the calculated CR (0.0123) is less than 0.1, and the matrix passes the consistency test.

Table 6. Judgment Matrix and Weights of Tangibility

B1	C11	C12	C13	C14	C15	C16	C17	C18	weight	consistency test
C11	1	1/5	1/3	1/2	1/3	1/4	1/3	1/5	0.0349	λ_{max}=8.1938
C12	5	1	3	4	3	2	3	19	0.2445	CI=0.0277
C13	3	1/3	1	3	1	1/2	2	1/3	0.1021	CR=0.0197
C14	2	1/4	1/3	1	1/2	1/3	1/2	1/4	0.0503	
C15	3	1/3	1	2	1	1/2	2	1/3	0.0971	
C16	4	1/2	2	3	2	1	2	1/2	0.1519	
C17	3	1/3	1/2	2	1/2	1/2	1	1/3	0.0748	
C18	5	1	3	4	3	2	3	1	0.2445	

Table 6 is a judgment matrix established based on 8 factors included in tangibility, including C11 (reasonable layout of service area and complete facilities), C12 (complete rest and accommodation services), C13 (service area environment is good), C14 (modern refueling facilities), C15 (service area parking area is reasonably designed), C16 (restaurant is clean and hygienic), C17 (complete bathroom facilities), C18 (complete car repair services). The order of importance of influencing factors from high to low is C12, C18, C16, C13, C15, C17, C14, C11. λ_{max}=8.1938, CI=0.0277, the calculated CR (0.0197) is less than 0.1, and the matrix passes the consistency test.

Table 7. Judgment Matrix and Weights of Reliability

B2	C21	C22	C23	weight	consistency test
C21	1	1/4	1/2	0.1365	λ_{max}=3.0183
C22	4	1	3	0.6250	CI=0.0091
C23	2	1/3	1	0.2385	CR=0.0174

Table 7 is a judgment matrix established based on 3 factors included in reliability, including C21 (conveniently accessible entrances and exits), C22 (charges at toll stations and service areas are standardized and reasonable), C23 (smooth traffic). The order of importance of influencing factors from high to low is C22, C23, C21. The calculated CR (0.0234) is less than 0.1, and the matrix passes the consistency test.

Table 8. Judgment Matrix and Weights of Responsiveness

B3	C31	C32	C33	weight	consistency test
C31	1	2	1/3	0.2385	λ_{max}=3.0183
C32	1/2	1	1/4	0.1365	CI=0.0091
C33	3	4	1	0.625	CR=0.0174

Table 8 is a judgment matrix established based on 3 factors included in responsiveness, including C31 (short waiting time for toilet), C32 (convenient service in restaurants and shops), C33 (service staff respond promptly). The order of importance of influencing factors from high to low is C33, C31, C32. The calculated CR (0.0174) is less than 0.1, and the matrix passes the consistency test.

Table 9. Judgment Matrix and Weights of Assurance

B4	C41	C42	C43	weight	consistency test
C41	1	3	2	0.5396	λ_{max}=3.0092
C42	1/3	1	1/2	0.1634	CI=0.0046
C43	1/2	2	1	0.2970	CR=0.0088

Table 9 is a judgment matrix established based on 3 factors included in assurance, including C41 (good service attitude), C42 (find a parking space quickly and easily), C43 (service staff have the knowledge to answer questions). The order of importance of influencing factors from high to low is C41, C43, C42. The calculated CR (0.0088) is less than 0.1, and the matrix passes the consistency test.

Table 10. Judgment Matrix and Weights of Empathy

B5	C51	C52	C53	weight	consistency test
C51	1	1/5	1/4	0.0974	$\lambda_{max}=3.0246$
C52	5	1	2	0.5695	CI=0.0123
C53	4	1/2	1	0.3331	CR=0.0234

Table 10 is a judgment matrix established based on 3 factors included in empathy, including C51 (provide help according to people's needs and in a timely manner), C52 (fully understand customer needs), C53 (provide value-added services).The order of importance of influencing factors from high to low is C52, C53, C51. The calculated CR (0.0234) is less than 0.1, and the matrix passes the consistency test.

3.2 Satisfaction Analysis

This study aims to analyze public satisfaction with the service quality of expressway service areas through questionnaires. It can better understand the service quality of Shaanxi expressway service areas and solve these problems in a targeted manner.

Table 11. Satisfaction Analysis Form

Indicator	Importance	Satisfaction	IPA index	Results
C11	9.26	8.10	12.5	maintain original status
C12	9.19	7.39	19.6	lower priority
C13	9.27	7.75	16.4	maintain original status
C14	9.25	7.93	14.3	maintain original status
C15	9.34	7.75	17.0	maintain original status
C16	9.19	7.60	17.3	lower priority
C17	9.23	7.79	15.6	oversupply
C18	9.30	7.39	20.5	strengthening and improving
C21	9.28	8.07	13.0	maintain original status
C22	9.18	7.57	17.5	lower priority
C23	9.27	7.97	14.0	maintain original status
C31	9.30	7.85	15.6	maintain original status
C32	9.32	7.92	15.0	maintain original status
C33	9.09	7.65	15.8	lower priority
C41	9.28	7.72	16.8	strengthening and improving
C42	9.15	7.87	14.0	oversupply
C43	9.32	7.77	16.6	maintain original status
C51	9.22	7.75	15.9	oversupply

| C52 | 9.26 | 7.42 | 19.9 | strengthening and improving |
| C53 | 9.07 | 7.49 | 17.4 | lower priority |

IPA refers to importance and satisfaction analysis. Among the various indicators of highway service quality, people's importance indicators are all above 9 points, indicating that the importance of each evaluation indicator is very high. Figure 1 of the IPA model architecture is as follows.
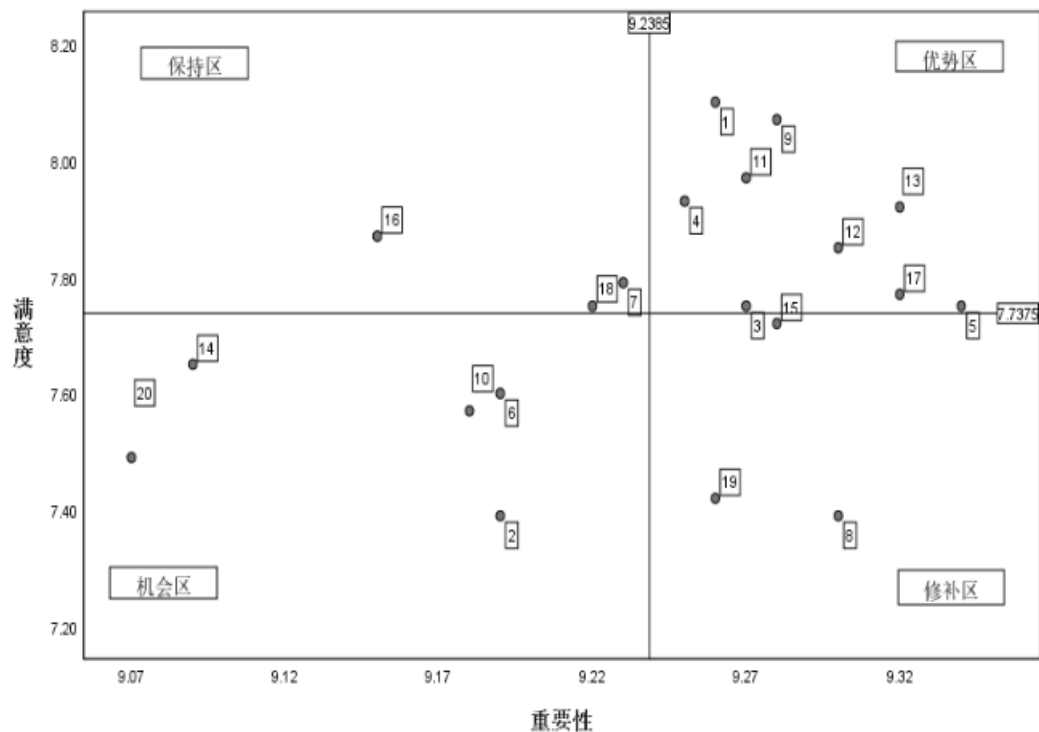

Figure 1. IPA Model Architecture Diagram

It can be seen from this that C41 (good service attitude), C52 (fully understand customer needs), and C18 (complete car repair services) need to be strengthened and improved. Although people don't pay much attention to C12 (complete rest and accommodation services), C16 (clean and hygienic restaurant), C22 (charges at toll stations and service areas are standardized and reasonable), C33 (service staff respond promptly), C53 (provide value-added services), their satisfaction is also not high, and they also need to be improved.

4. Conclusions and Recommendations

Based on the above two findings, the following conclusions can be drawn:

(1) Through calculation and comparison, the average satisfaction value of each index of service quality in the expressway service area is around 7.5 points. Among them, the index "reasonable layout of service area and complete facilities" has the highest average value, which is 8.10; the index "complete rest and

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accommodation services" and "complete car repair services" have the lowest average value, which is 7.39. The standard deviation difference between them is not large, indicating that everyone's perception of service quality is not very different.

(2) Through statistics on service quality and customer satisfaction data, it was found that service quality is generally not satisfactory. Service area operators should focus on improving accommodation and maintenance services in the service area.

(3) In the model architecture diagram obtained through the IPA analysis method, the service area should be clean and hygienic in the restaurant, charge stations and service area charges should be standardized and reasonable, service personnel should respond to questions in a timely manner, service quality should be improved, service quality should be improved, and service quality should be constructed and perfected in the service system. Focus on improving the service attitude of service personnel, fully understanding customer needs and service quality in terms of complete auto repair services.

References

Feng, Y. R., Yang, S. W., Yang, H. Z., & Xu, P. (2018). *Comparative Study on Operation An alysis Methods of Expressway Weaving Area*. Journal of Highway and Transportation Resea rch and Development, *35*(8), 134-143+158.

Liang, Q. (2019). *Study on satisfaction and driving choice behavior of the highway service are a*. Chongqing Jiaotong University. Chongqing, China

Liu, H. J. (2013). *Evaluation on the Service Level of the Freeway Service Area*. Chang'an Uni versity, Xi'an, China.

Lu, J. (2021). Research on Highway Service Area Planning and Design Concepts. *Transpoworl d*, *2021*(22), 64-65.

Ma, J. J. (2019). Exploring the Service Quality Evaluation System of Expressway Service Area s. *Theoretical Research in Urban Construction* (Electronic Edition), *2019*(4), 127.

Mu, D. (2019). *The Research on Operation Mode of Highway Service Based on Topsis Method*. Southwest Jiaotong University. Chengdu, China

Tan, L. W. (2015). Comprehensive and Multi-leveled Evaluation Method for Service Status of Expressway System. *HIGHWAY*, *60*(4), 184-188.

Wang, S. (2016). Research of Comprehensive Evaluation of User-oriented Expressway Service Area. *Journal of Highway and Transportation Research and Development*, *33*(2), 125-129.

Yang, C. F., & Yan, X. C. (2018). Coupling analysis on the development of expressway and u rbanization. *Journal of Railway Science and Engineering*, *15*(2), 530-536.

Zhang, D. (2018). Exploration on highway management and humanized services. *Ability and Wi sdom*, *2018*(4), 23-34.

Zhao, F. Q. (2019). *Research on Service Quality of Expressway Service Area*. Yanshan Universi ty. Qinhuangdao, China.