ISSN: 2414-1895 DOI: 10.6919/ICJE.202410_10(10).0011

Kano Model Analysis of Pedestrian Environment Demand at Railway Stations in the GBA: A Case Study of Six Stations

Wenjin Zhao[1,2], Jingxi Qu[1], Yu Qiao[1]

[1] Academy of Fine Arts, Guangzhou College of Technology and Business, Hua Du, Guangzhou 510850, Guangdong, China

[2] City Graduate School, City University Malaysia, Petaling Jaya, Selangor 46100, Malaysia

Abstract

The Kano model was used to define and prioritise the demands of the walking environment surrounding six typical rail stations in Guangdong, Hong Kong, and Macao Greater Bay Area (GBA) in order to identify the significant characteristics that determine pedestrian satisfaction. The study's findings indicate that safety and accessibility considerations are commonly considered crucial requirements, while the importance of certain features may differ in practical implementations. Furthermore, the function of recognition and enjoyment in increasing pleasure should be noticed. By analysing their comparatively lower priority, designers should rationally deploy resources based on the varying levels of importance of specific aspects. This study serves as a foundation for improving the pedestrian experience in the rail transit station vicinity, encouraging environmentally friendly travel in the region, and boosting the overall travel experience within the metropolitan conglomerations of Guangdong, Hong Kong, and Macao.

Keywords

Kano Model; Rail Transit Station; Pedestrian Demand; Pedestrian-Friendly Environments.

1. Introduction

The Outline of the Plan for the Development of the Guangdong-Hong Kong-Macao Greater Bay Area, initiated by China in 2019, outlines the development strategy for the Guangdong-Hong Kong-Macao Bay Area. The document emphasises leveraging the economic strengths of Hong Kong and Macao as free and open economies, as well as the leadership role of Guangdong in reform and opening up. The plan aims to deepen reforms further, expand economic openness, and establish institutional mechanisms that promote high-quality economic development, positioning the region as a national leader in this regard. The objective is to be at the forefront and assume a prominent and influential position, expedite institutional innovation and early implementation, establish a modernised economic system, enhance integration into the global market system, establish a foundation for emerging industries, advanced manufacturing, and modern service industries, and create a world-class city cluster. After the outline was released, Guangdong Province made significant efforts to advance the construction of its transport network. By the end of 2023, the total length of rail transit in use in Guangdong Province reached 1,390.95 kilometres, effectively achieving widespread connectivity and coverage within the urban agglomeration. The attainment of this distance demonstrates the advancement and progress of the railway transport system in the area, which not only significantly improves the effectiveness of transport within the Guangdong-Hong Kong-Macao Greater Bay Area but also facilitates the integration of the region's economy and society. The inter-city rail network serves a crucial role in connecting the city with the region and facilitating the

ISSN: 2414-1895 DOI: 10.6919/ICJE.202410_10(10).0011

movement of people and commerce. Not only does it serve as a central location for transferring passengers, but it also plays a crucial role in the geographical layout of the city. Railway stations efficiently integrate several modes of transportation, including metro, light rail, buses, and shared mobility, thus improving the overall efficiency of the transportation system. The duration of commuting has been considerably reduced, resulting in improved convenience for inhabitants and fostering collaborative growth in the region.

The train station is a crucial element in establishing the connectivity between metropolitan clusters in the Guangdong-Hong Kong-Macao Greater Bay Area. It serves as a vital connector that links the city with the area and facilitates the movement of people and products. Not only does it serve as a centre for transferring passengers, but it also plays a crucial role in the geographical layout of the city. A railway station efficiently integrates several modes of transportation, including metro, light rail, bus, and shared mobility, thus improving the overall efficiency of the transportation system.

Acknowledging the significance of walking is crucial to improving the entire travel experience of the rail network. Walking plays a crucial role in enabling passengers to transition smoothly in and out of rail stations. Not only is it the most fundamental and eco-friendly method of transportation, but it also serves as a connection between different forms of transport. Thus, a satisfactory walking experience is crucial to guarantee the seamless and effective functioning of rail travel.

The demand analysis of the pedestrian environment in rail transit stations holds significant theoretical and practical importance, as per the Kano model. This study utilises the Kano model to gain a comprehensive understanding of the needs of individuals with various travel purposes and how these needs impact pedestrian satisfaction. Additionally, by identifying the most crucial demand factors in the walking environment of rail transit stations, we can enhance the walking environment and prioritise meeting the needs that have the most significant influence on pedestrian satisfaction. Level of contentment experienced by individuals when walking. Promoting the growth of green travel modes in the rail station area and improving the attractiveness of the public transport system enhances the entire experience, reduces urban carbon emissions, and enhances urban sustainability. The findings of this study offer significant guidance for the development of rail transit and enhancement of pedestrian infrastructure in the Guangdong-Hong Kong-Macao Greater Bay Area, as well as other urban areas.

2. Literature Review

Since rail transport networks have been growing, there has been an increasing amount of research on the influence of the pedestrian environment surrounding rail transit stations. The primary emphasis of this research is on the design of the pedestrian environment, the examination of user behaviour, and the influence of the pedestrian environment on passenger satisfaction and transportation preferences.

The quality of the pedestrian environment is a crucial determinant in passengers' selection of rail transit. Research has indicated that several critical variables, including safety, continuity, comfort, accessibility, and integration with neighbouring services of the walking environment, influence passenger pleasure. Studies conducted in major urban centres, such as Shanghai, have revealed a clear correlation between the quality of the pedestrian infrastructure and the likelihood of citizens opting for rail transportation [1]. Furthermore, additional research has demonstrated that enhancing the overall conditions of the pedestrian environment surrounding urban rail transit stations not only leads to a higher percentage of individuals choosing to walk as their mode of transportation but also fosters the socioeconomic advancement of the entire area [2].

A recent study conducted a comprehensive analysis of the effects of the physical infrastructure surrounding railway stations on several social demographics. The study specifically examined disparities in economic development, property prices, wealth inequality, and resource distribution [3]. Furthermore, a study conducted in the suburbs of Mumbai examined the influence of train schedules on pedestrians using station stairs. This research highlighted the significance of comprehending pedestrian mobility requirements when it comes to facility planning and design [4].

Furthermore, the pedestrian environment plays a crucial role in determining the selection of 'final mile' walks and the maximum distance that commuters are ready to traverse on foot. The pedestrian environment's walkability had a notable influence on the proportion and distance of walking commutes in the Delhi Metro.

The Kano model is a commonly employed instrument for product design and the study of client needs. The concept assists companies and public organisations in developing products and services that align better with consumers' expectations by recognising fundamental, desired, and aspirational needs within customer requirements. The Kano model has been increasingly utilised in various domains, including medical services, online education, and innovative city development, to analyse demand and enhance product quality effectively. Possible uses in assessing walking environments involve the identification and categorisation of essential requirements in walking environments through quantitative analysis of user needs and priorities [5].

The Kano model's theoretical foundation is rooted in the correlation between customer happiness and customer needs. Customer satisfaction can be classified into two sorts of needs by categorising customer wants into Basic Needs, Performance wants, and Excitement Needs. The user's text is empty. The Kano model classifies consumer demands into Basic demands, Performance Needs, and Excitement wants. This categorisation allows for the identification of users' varying levels of sensitivity towards distinct needs. As a result, designers can develop a product strategy that aligns more closely with customers' wants. The approach has gained significant popularity in various domains, including healthcare services [6], eco-city planning, and online education [7], showcasing its efficacy in addressing intricate requirements analysis. The Kano model can be utilised in the evaluation of walking environments to identify the environmental aspects that have a substantial influence on pedestrian happiness. By categorising and prioritising these features, the Kano model can contribute to enhancing the overall quality of the walking environment. The Kano model can be utilised to define and categorise different requirements in the evaluation of a walking environment. For instance, the model can be utilised to distinguish between essential and appealing characteristics of walking environments and to modify the design and enhancement initiatives of these settings using input from various user groups. Studies have demonstrated that utilising the Kano model for requirements analysis can significantly enhance user satisfaction, particularly in intricate and varied settings [8].

3. Research Design

3.1 Kano-IPA Model

The Kano model is a framework used to categorise and rank user requirements based on their influence on satisfaction. The model is designed to effectively address the perceived requirements of the pedestrian environment surrounding urban rail transit stations. It is capable of assessing and enhancing these requirements, as well as uncovering the non-linear correlation between the various elements and pedestrian satisfaction. The KANO model categorises the needs of pedestrians for the walking environment around rail transit stations in a systematic manner. According to the Kano model, the functional attributes of the pedestrian environment around urban rail transit stations fall into different demand categories. The functions belonging to these different demand categories have a non-linear relationship with pedestrian satisfaction (Figure 1). Put, pedestrian happiness is not necessarily increased or decreased by all unfulfilled demands in each category of wants. Consequently, various categories of needs also possess distinct priorities in terms of pedestrian fulfilment. By identifying the necessary categories for each functional element, we can gain a better understanding of how the pedestrian environment affects pedestrian satisfaction. Additionally, clarifying the priority of each component will help us determine which ones are most important and urgent in improving satisfaction.

Volume 10 Issue 10, 2024
DOI: 10.6919/ICJE.202410_10(10).0011

3.2 Data Collection

3.2.1 Questionnaire Design

The questionnaire is designed based on the pyramid theory of walking needs, which includes elements such as accessibility, recognition, safety, functionality, and fun. It is developed by investigating the current situation of pedestrians and selecting 20 walking environment elements that impact the levels of accessibility, safety, comfort, and pleasure at urban rail transit stations. These elements are used as research indicators, as shown in Table 1.

Table 1. Questionnaire design components

Category	Code	Evaluation Factor
Accessibility	F1	Walking path levelling
	F2	Walking path maintenance
	F3	Traffic transfer
	F4	Auxiliary access facilities
Safety	F5	Safety Facilities
	F6	Lighting
	F7	Footpath Width
	F8	Traffic Signals
Identity	F9	Station signage
	F10	Road pedestrian signage
	F11	Commercial and service facilities signage
Functionality	F12	Leisure and cultural spaces
	F13	Shade facilities for roads and waiting areas
	F14	Shade facilities for sitting-out areas
	F15	Service facilities functionality
	F16	Public toilets
Interesting	F17	Public artefacts
	F18	Public activities
	F19	Space design considering seasonal changes
	F20	Interactive design

The questionnaire is divided into two sections. The initial section comprises the fundamental social characteristics of the participants, encompassing their gender, age, frequency of utilisation, and motive for travelling. The second component is the Kano questionnaire. According to the Kano questionnaire criteria, the 20 chosen elements are categorised as positive and negative items and further classified as "like it very much", "deserve it", "don't care", "barely accept it", and "dislike it very much". These classifications are presented in Table 2. The objective of this part is to determine the categories of needs for each element based on respondents' reactions to various aspects of the walking environment, both positive and negative.

Table 2. Positive and Negative Sample Questions

Positive Question	If the walking path to the station is smooth and free of obstacles, how would you feel?				
	Very satisfied	As expected	Indifferent	Reluctantly acceptable	Strongly dislike
Negative Question	If the walking path to the station is uneven or has obstacles, how would you feel?				
	Very satisfied	As expected	Indifferent	Reluctantly acceptable	Strongly dislike

According to the Kano model theory, the respondents' answers to the "forward/reverse" questions for each element were used to classify the need category of each component. This was done by referring to the Kano model's classification table of element needs (Table 3). The frequency of each element's need category was then calculated, and the final need category was determined based on the highest frequency of the demand category. Simultaneously, the priority sequence of each element that satisfies the requirements of the walking environment can be obtained.

Table 3. Classification of requirements for each element of the Kano model

Functional/service requirements		Negative Question				
		Very satisfied	As expected	Indifferent	Reluctantly acceptable	Strongly dislike
Positive Question	Very satisfied	Q	A	A	A	O
	As expected	R	I	I	I	M
	Indifferent	R	I	I	I	M
	Reluctantly acceptable	R	I	I	I	M
	Strongly dislike	R	R	R	R	Q
*Based on the user's answers to the positive and negative questions, the need category for each element can be obtained. "A" stands for "Attractive element"; "O" stands for "Expected element"; "M" stands for "Must-have element"; "I" stands for "Non-differentiated element"; "R" stands for "reverse element"; "Q" stands for "questionable/contradictory answer".						

3.2.2 Questionnaire Distribution and Retrieval

From March to May 2024, the Greater Bay Area, consisting of Guangzhou East Station, Shenzhen North Station, Huizhou South Station, Huacheng Avenue Station, Hong Kong Central Station, and Shenzhen Laogai Station, was chosen as the research location. During this period, a questionnaire survey was carried out on individuals who either currently use or have previously used these six rail transit stations. The questionnaires were disseminated using both online and offline methods. The Questionnaire Star platform facilitated online distribution, while offline distribution was carried out by members of the study team who personally visited stations to collect paper questionnaires. A total of 622 questionnaires were gathered after removing those with uncertain responses. Out of these, 617 questionnaires were deemed valid, resulting in a valid questionnaire recovery rate of 99.2%.

4. Data Analysis

4.1 Reliability and Validity

SPSS AU conducted reliability and validity tests for the questionnaire in both forward and reverse directions, as well as for the total questionnaire. The results of these tests are presented in Table 3.

ISSN: 2414-1895 DOI: 10.6919/ICJE.202410_10(10).0011

Regarding Xindu, the Cronbach's alpha values for the Kano questionnaire as a whole, the forward questionnaire, and the reverse questionnaire were 0.748, 0.946, and 0.958, respectively. These results imply that the questionnaire used in this study is very reliable. The KMO values for the Kano questionnaire as a whole, the forward question, and the reverse question are 0.984, 0.982, and 0.984, respectively. Additionally, the P-values of Bartlett's spherical test are all less than 0.001. These results indicate that the questionnaire demonstrates a high level of validity.

Table 4. Reliability and validity

	Cronbach's α	KMO value	Bartlett's Test of Sphericity (P-value)	Cumulative Explained Variance (%)
Kano Questionnaire	0.748	0.984	0.000	80.992%
Positive Question	0.946	0.982	0.000	50.536%
Negative Question	0.958	0.984	0.000	55.399%

4.2 Statistical Analysis of Fundamental Data

The survey sample consists of 47.49% males and 52.51% females. The majority of users fall into two age categories: 18-25 years old (41%) and 26-30 years old (29.66%). These two groups combined make up more than 70% of the users (Figure 1, Figure 2).

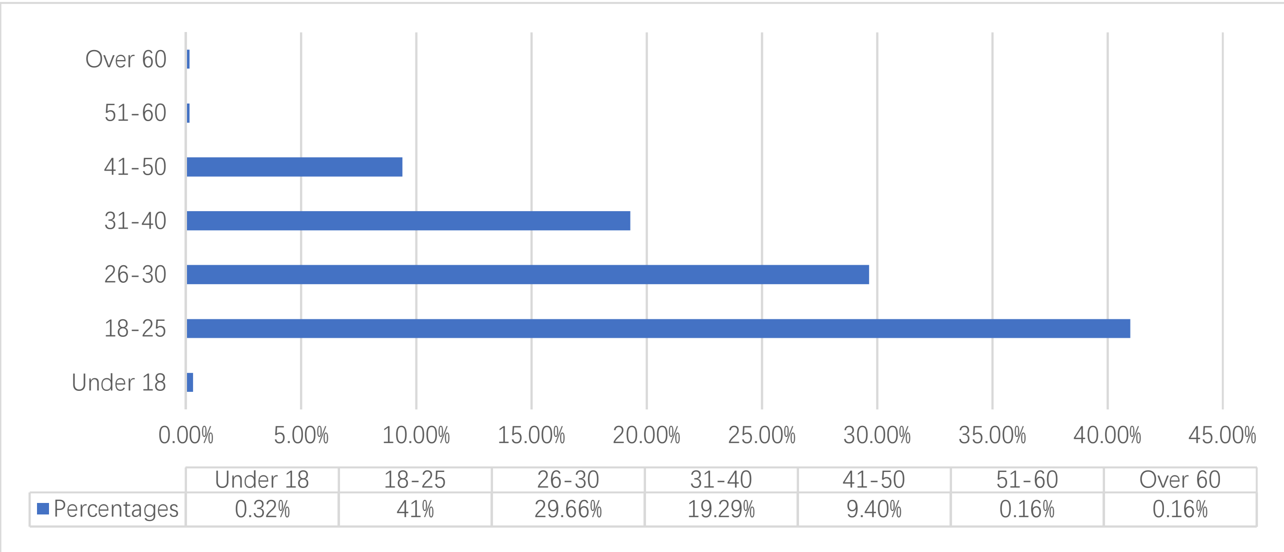

Figure 1. Age distribution of the surveyed population

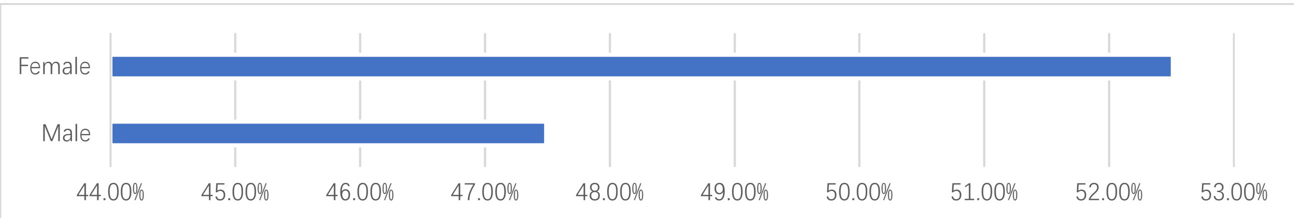

Figure 2. Gender distribution of the surveyed population

Out of all the different occupations, purchasing staff had the most significant proportion, making up 11.35%. This was followed by administrative staff at 11.02% and product/operations personnel at

10.7%. Together, these three categories accounted for almost one-third of the total workforce. Furthermore, the proportion of the student population was also substantial, amounting to 8.59% (Figure 3).

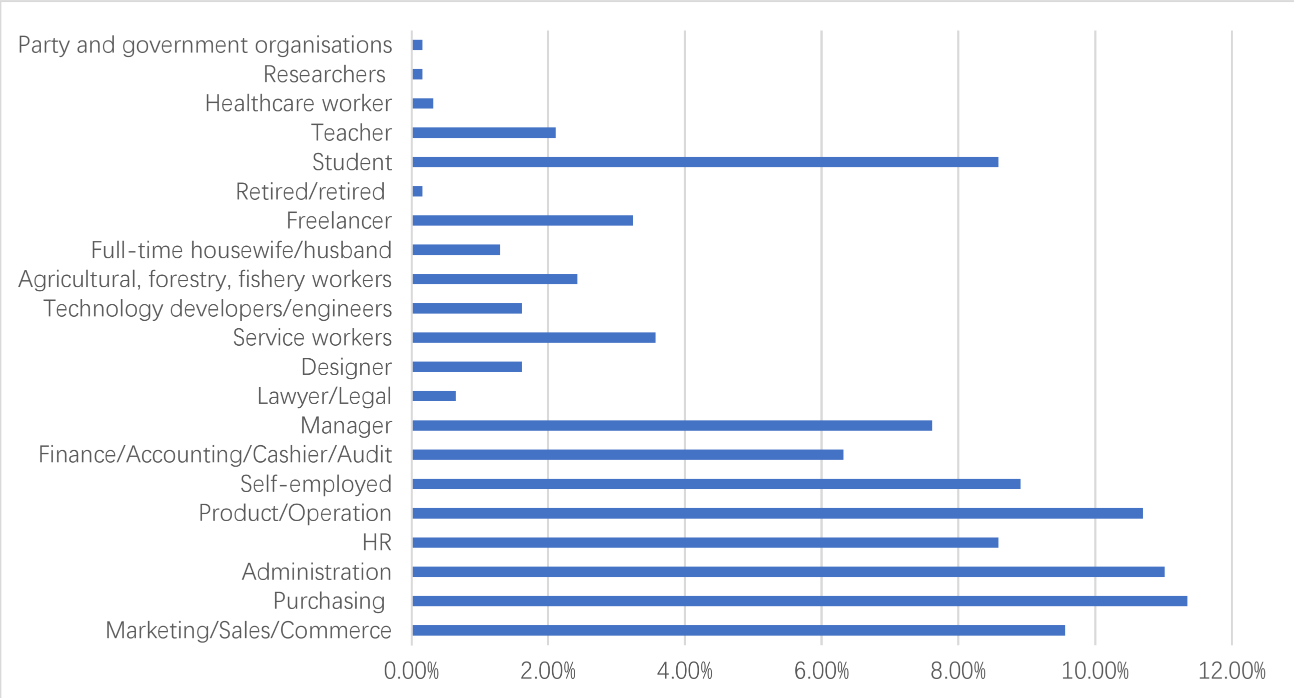

Figure 3. Careers distribution of the surveyed population

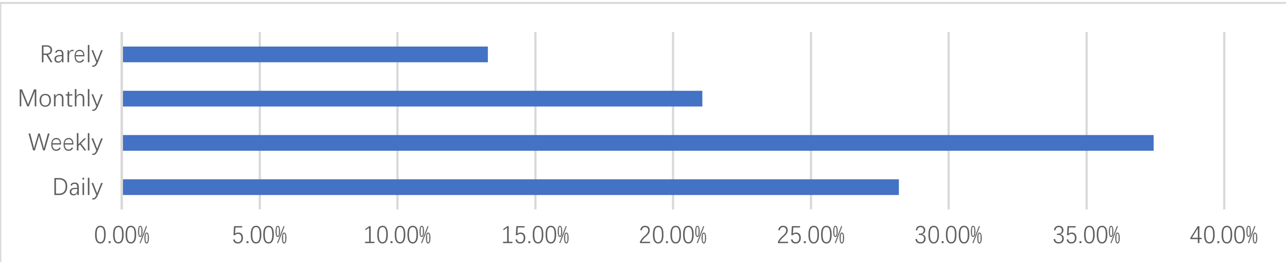

Figure 4. Frequency of use of rail transport

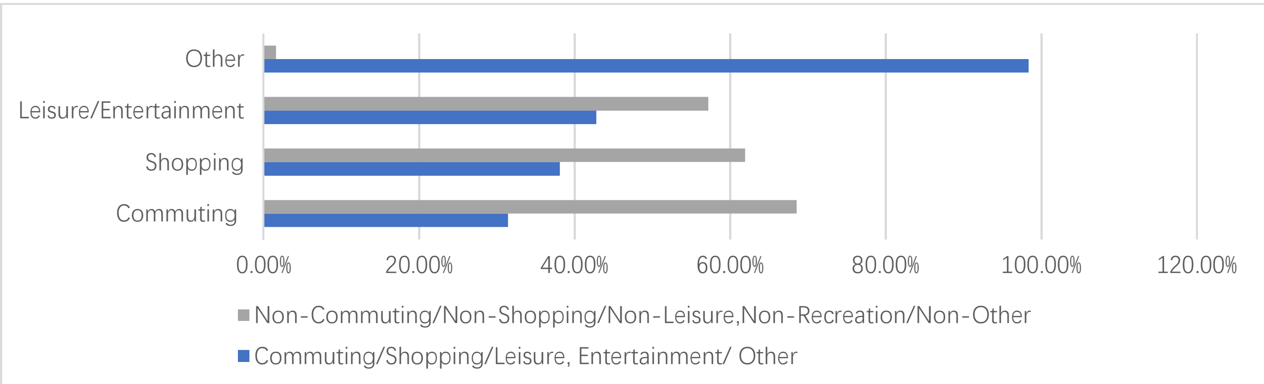

Figure 5. Purpose of travelling by rail

Regarding the frequency of walking, the biggest proportion of users, 37.44%, walk on a weekly basis. Additionally, 28.2% of users walk daily, indicating more frequent walking habits (Figure 4). Non-

 Volume 10 Issue 10, 2024
DOI: 10.6919/ICJE.202410_10(10).0011

commuting needs were the primary reasons for walking, accounting for 68.56% of the total. Shopping, leisure, and entertainment were the main specific goals for walking, making up 38.09% and 42.79%, respectively (Figure 5).

The survey sample is representative and reflects common user characteristics in terms of gender, age group, occupation type, walking frequency, and walking purpose. Young women are the majority, there is a diverse distribution of occupations, and the frequency of walking is high. Overall, the sample is highly reasonable, universal, and representative.

4.3 Categorisation of User Demand Attributes

4.3.1 Functional Service Coordinate Chart

The frequency statistics of the samples are conducted based on the element classification rules outlined in Table 1 (refer to Table 5) as per the findings of the Kano questionnaire survey.

Table 5. Frequency statistics for the classification of all functional elements

Code	A	O	M	I	R	Q
F1	121	76	108	255	42	15
F2	104	100	118	245	36	14
F3	118	82	103	258	42	14
F4	113	108	111	232	38	15
F5	101	82	123	264	35	12
F6	102	83	118	251	48	15
F7	103	93	119	240	50	12
F8	103	92	105	258	44	15
F9	117	83	107	258	40	12
F10	109	80	94	282	39	13
F11	113	81	123	244	42	14
F12	132	80	97	256	39	13
F13	115	94	112	246	38	12
F14	110	107	96	249	43	12
F15	116	85	101	261	42	12
F16	116	91	107	253	38	12
F17	126	74	112	252	41	12
F18	120	73	105	261	46	12
F19	129	73	119	246	37	13
F20	122	82	105	253	42	13

The Better-Worse coefficient, developed by American academic Charles Berger, quantifies users' views and needs about different functions of the pedestrian environment. It is based on frequency statistics collected from Table 5 and evaluates the degree to which functional elements correspond to user expectations in real-world applications.

The categorisation outcomes of user demand attributes provide a comprehensive examination of various functionalities within the pedestrian environment. The equations used to compute the Better-Worse coefficients are as follows:

ISSN: 2414-1895 DOI: 10.6919/ICJE.202410_10(10).0011

- Better coefficient (SI) = (A + O) / (A + O + M + I)
- Worse coefficient (DSI) = (-1) × (O + M) / (A + O + M + I)

A, O, M, and I symbolise the actual utilisation and familiarity of various aspects of the pedestrian environment by users. To simplify matters, the accompanying analysis considers the Worse values as absolute values. The functional attributes are determined by analysing the Better and Worse coefficients. If the Better coefficient is greater than the Worse coefficient and has a higher value, it is categorised as an Excitement factor (A). Conversely, if the Worse coefficient is greater than the Better coefficient and has a higher value, it is classified as a Must-be factor (M). If both the Better and Worse coefficients have high values, it is considered a Performance factor (O). Lastly, if both the Better and Worse coefficients have low values, it is labelled as an Indifferent factor (I).

Out of the 20 characteristics related to the pedestrian environment, five were categorised as Must-be factors (M), five as Performance factors (O), and eight as Excitement factors (A). Table 6 shows that there were 2 Indifferent factors (I) and 0 Reverse factors (R) (Table 6).

Table 6. Frequency statistics for the classification of all functional elements

Code	Better Coefficient Value	Worse Coefficient Value	Category
F1	0.3518	0.3286	A
F2	0.3598	0.3845	O
F3	0.3565	0.3298	A
F4	0.3918	0.3883	O
F5	0.3211	0.3596	M
F6	0.3339	0.3628	M
F7	0.3532	0.3820	O
F8	0.3495	0.3530	O
F9	0.3540	0.3363	A
F10	0.3345	0.3080	I
F11	0.3458	0.3636	M
F12	0.3752	0.3133	A
F13	0.3686	0.3633	O
F14	0.3861	0.3612	O
F15	0.3570	0.3304	A
F16	0.3651	0.3492	A
F17	0.3546	0.3298	A
F18	0.3453	0.3184	I
F19	0.3563	0.3386	A
F20	0.3630	0.3327	A

ISSN: 2414-1895 DOI: 10.6919/ICJE.202410_10(10).0011

By performing calculations and creating a graph of the Better-Worse coefficients of function points, it is possible to illustrate the distribution of user satisfaction and discontent for each function. This analytical approach can assist rail stations in optimising the layout and provision of pedestrian services to more effectively cater to user requirements and enhance the overall quality of service (Figure 6).

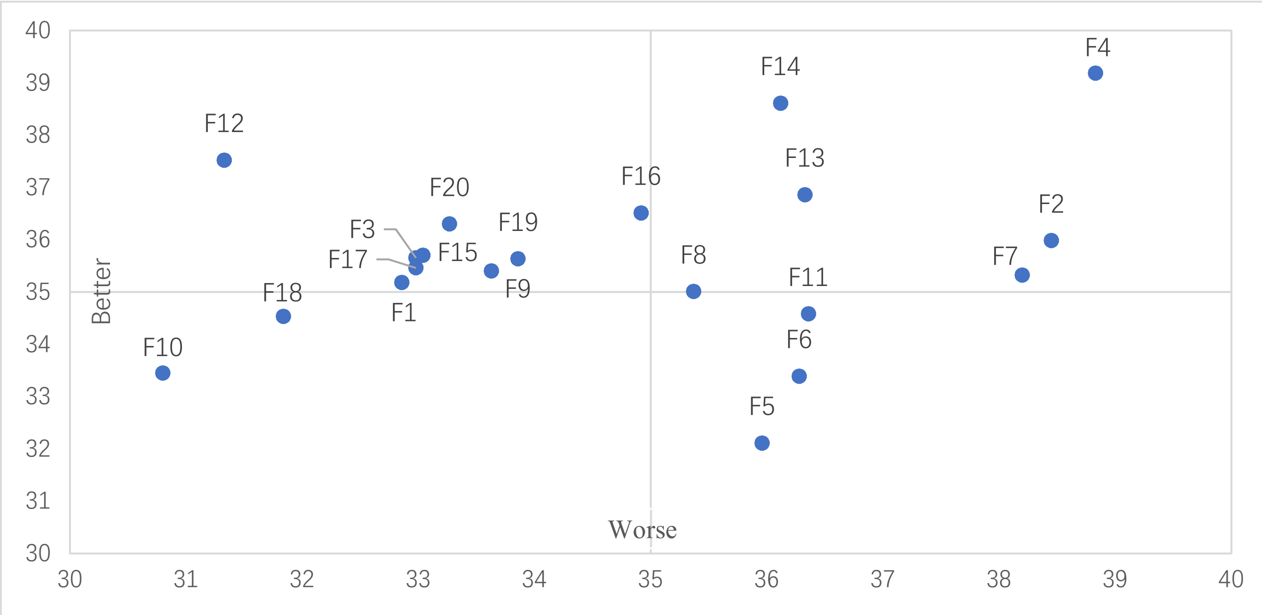

Figure 6. Worse-Better Quadrant Diagrams

4.3.2 Essential Requirements Attributes

The necessary functional requirements for the pedestrian environment around urban rail stations in Quadrant IV consist of designated pedestrian crossings and crossing facilities in the Safety Functional Classification (F5), sufficient lighting conditions (F6), pavement widths capable of accommodating high volumes of pedestrians during peak times (F7), and commercial and service facilities in the Identity Classification (F11). Survey participants expressed the opinion that the design of pedestrian infrastructure should be tailored to meet their requirements. The presence of this aspect does not enhance pedestrian contentment, but its absence might greatly diminish satisfaction, and there is a non-linear correlation with pedestrian satisfaction. This particular aspect takes precedence when the requirements of the pedestrian environment are fulfilled.

4.3.3 Desired Demand Attributes

Within QuadrantI, the pedestrian environment surrounding urban rail stations should prioritise specific functional demands. These include the upkeep of walking paths (F2) and additional access facilities (F4) in the accessibility classification. In terms of safety, attention should be given to the width of pavements (F7) and the presence of traffic signals (F8). Lastly, the functional classification calls for the provision of shade facilities for both paths and waiting areas (F13), as well as sitting areas (F14). Desired features are commonly the characteristics that individuals anticipate the walking environment to possess. The presence of these elements enhances pleasure in the walking environment, whereas their absence diminishes contentment. Furthermore, there is a direct and positive correlation between satisfaction and the presence of these elements. When the requirements of the pedestrian environment are met, these aspects are given priority over the elements that need to be taken into account; thus, O<M.

4.3.4 Attractive Demand Attributes

The elements of charisma in Quadrant II for urban rail stations include smoothness of walking paths (F1) and ease of transferring between different modes of transportation (F3) in terms of accessibility, clear signage at the stations (F9) for identification, availability of leisure and cultural places (F12),

 Volume 10 Issue 10, 2024
DOI: 10.6919/ICJE.202410_10(10).0011

functional service facilities (F15), public toilets (F16) for convenience, and elements of fun (F19) for enjoyment. Additionally, interaction design is used to encourage pedestrians to stay. This particular piece typically represents an unexpressed or unrecognised function that surpasses expectations. Contentment with this specific component will significantly enhance contentment with the pedestrian surroundings. If it fails to do so, it will not diminish contentment with the pedestrian environment, and there exists a non-linear correlation between satisfaction and this particular component. When the requirements of the pedestrian environment are fulfilled, the priority of this group of elements is lower than the priority of the performance and necessary elements, specifically A<O<M.

4.3.5 Undifferentiated Demand Attributes and Reverse Demand Attributes

In Quadrant III, the contentment or discontentment of the undifferentiated constituent (I) does not impact pedestrian happiness and lacks a substantial correlation with pedestrian satisfaction. When the pedestrian environment is well addressed, this particular factor may typically be disregarded. The Reverse Element (R) is associated with a reduction in pedestrian happiness with the walking environment and has a negative linear correlation with pedestrian satisfaction. Typically, it is eliminated in order to mitigate its adverse effect on satisfaction. The statistical analysis reveals that there are two undifferentiated elements, namely public artefacts (F17) and public events (F18), in the exciting classification. Additionally, there are no reverse elements (R), indicating that all the indicator factors chosen for the study are positively associated with walking environment satisfaction, and there is no negative correlation.

5. Conclusion

Through an analysis of the pedestrian requirements in the rail transit station regions of Guangdong, Hong Kong, and Macao, this study has arrived at the following conclusions:

Essential requirements in the pedestrian environment near rail transportation stations, such as safety facilities, lighting conditions, road width, etc., are clearly recognised as vital aspects. Essential components have a direct and substantial influence on pedestrian contentment, which will notably diminish unless the requirements are fulfilled. Hence, when designing and optimising pedestrian environments, it is crucial to prioritise these fundamental requirements to guarantee that walkers can experience fundamental travel safety and convenience.

Secondary needs, such as road maintenance and shade facilities, are less pressing than fundamental needs but contribute significantly to improving the overall walking experience. Meeting these needs can significantly enhance pedestrian satisfaction. Therefore, it is crucial to adequately prioritise and consider the expectation element while designing the pedestrian environment in order to improve the walking experience further.

Furthermore, the inclusion of glamour elements such as well-maintained walking lanes, clear station signs, and engaging design can significantly improve pedestrian enjoyment. While unmet glamour demands do not decrease substantially happiness, they have a distinct appeal and prioritising their fulfilment can dramatically increase the beauty of the walking environment and improve the overall user experience when circumstances permit.

It is crucial to acknowledge that the effects of aspirational and glamour desires can vary significantly over time and in different areas. As infrastructure progresses, items that were first regarded as wanted or luxurious may progressively transform into necessities. Hence, when enhancing the pedestrian environment, planners must be attuned to shifts in the hierarchy of demands and promptly modify their plans to align with the evolving needs and expectations of the public.

Furthermore, it has been discovered that specific unspecified requirements have a lesser effect on pedestrian satisfaction. Therefore, in practical scenarios, the allocation of resources for these unspecified factors can be appropriately decreased. This allows for limited resources to be concentrated on more crucial needs, resulting in a more efficient optimisation of the walking environment.

In summary, the demand analysis utilising the Kano model offers valuable theoretical direction for optimising the walking environment in the station area of the Guangdong-Hong Kong-Macao Greater Bay Area rail transportation. By giving priority to essential needs and efficiently distributing resources, we can significantly enhance the quality of walking trips in rail transit station areas. Additionally, this will effectively encourage the development of environmentally friendly modes of transport, further contributing to the sustainable development goals of urban areas in the Guangdong-Hong Kong-Macao Greater Bay Area.

Acknowledgments

2023 Guangdong Philosophy and Social Science Planning Discipline Co-construction Project (GD23XYS048).

References

[1] He, N. (2023). Analysis of Walkable Environment and Influential Factors in Rail Transit Station Areas: Case Study of 12 Neighborhoods in Shanghai.

[2] Chidambara, & Gupta, S. (2018). Effect of Walkability on Users Choice of "Walking" the Last Mile to Transit Stations: A Case of Delhi Metro. Urban Planning and Development, 1(1), 1-10. https://dx.doi.org/10.22158/USPA.V1N1P1.

[3] Wan, T., Lu, W., & Sun, P. (2023). Equity impacts of the built environment in urban rail transit station areas from a transit-oriented development perspective: a systematic review. Journal of Sustainable Cities and Society, 23(3), 203-214. https://dx.doi.org/10.1088/2515-7620/acf8b2.

[4] Jiten, S., Joshi, G., Purnima, P., & Arkatkar, S. (2015). Impact of Train Schedule on Pedestrian Movement on Stairway at Suburban Rail Transit Station in Mumbai, India. Advances in Civil Engineering, 2015(4), 1-9. https://dx.doi.org/10.1155/2015/297807.

[5] Li, J., Wang, Q., Xuan, Y., & Zhou, H. (2021). User demands analysis of Eco-city based on the Kano model-An application to China case study. PLOS ONE, 16(3), e0248187. https://dx.doi.org/10.1371/journal.pone.0248187.

[6] Ke, J., Chen, X., & Gou, J. (2021). Follow-up data analysis of Internet hospital patients based on the Kano Model. Proceedings of the 2021 International Conference on Big Data Engineering and Education, 1-7.https://dx.doi.org/10.1109/BDEE52938.2021.00007.

[7] Bai, Q. (2019). Demand Analysis of Learning Support Service in MOOCs Based on Kano Model. Advances in Intelligent Systems and Computing, 981-986. https://dx.doi.org/10.1007/978-981-15-6113-9_40.

[8] Zhao, X., Liu, Y., Shen, H., Dang, Y., & Hou, J. (2024). Research on Online Consumer Demand Ranking and Content Prediction Based on Kano Model. Proceedings of the 2024 International Conference on E-Commerce and E-Business, 26-31. https://dx.doi.org/10.1145/3647750.3647760.