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Perceived Level of Service at Commuter Train Station Platforms Based on Passenger Acceptable Distance

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ABSTRAK

Railway station platform density has become a critical issue in commuter rail systems due to the continued growth in passenger demand in urban areas. Increased passenger density reduces available personal space and can impact user comfort and platform acceptance. Although platform service quality is commonly evaluated using a normative Level of Service (LOS) framework derived from conventional LOS, these standards do not directly measure passengers' perceptions of comfort. This study aims to evaluate passenger acceptance of various platform-density conditions, identify critical density thresholds, and assess compliance with LOS classifications. A stated-preference survey was conducted with 297 commuter rail passengers at Depok Station in Indonesia. Respondents evaluated 10 density scenarios ranging from very high to very low, yielding 2,970 observations. The collected data were analyzed using binary logistic regression to estimate the relationship between passenger density and the probability of acceptance. The results showed that density has a statistically significant negative effect on passenger acceptance, with a regression coefficient of -0.777 ($p < 0.001$). The critical density, the point at which the probability of acceptance and rejection is equal, was found to be 6.70 passengers/m². This threshold corresponds to an acceptance distance of approximately 0.386 m, a geometric interpretation of the space per passenger. Comparison with conventional LOS classifications indicates that passenger perception-based thresholds can differ from conventional normative standards. These findings underscore the importance of incorporating user perceptions in platform service evaluations and provide an empirical basis for more user-oriented density management strategies at commuter rail stations.

Keywords: train station, commuter passenger, level of service, platform density

INTRODUCTION

Accelerated urbanization and metropolitan population growth have increased demand for daily travel by public transportation in cities. In the Jakarta metropolitan area and its surroundings, known as Jabodetabek, commuter train services play a crucial role as a mass transit mode, transporting large numbers of passengers and reducing reliance on private vehicles. However, this increased travel demand also puts pressure on station facilities, particularly the platform areas where passengers wait, move around, and board trains. In the context of public transportation, crowding is a significant issue because it can affect comfort, safety, waiting times, service reliability, and overall service quality (Cats et al., 2016, Tirachini et al., 2016).

Density in transportation facilities cannot be understood simply as the physical presence of many people in a given space. The difference between density and crowding: density is an objective measure of the number of individuals per unit area, while crowding is a subjective experience that arises when personal space is perceived as inadequate. Objective measure: density. Subjective measure perceived by users. Therefore, two identical density conditions can yield different levels of acceptance due to passengers' experience, expectations, travel purposes, and social characteristics.

Various studies have shown that passenger density affects passenger behavior and well-being on public transportation. Passenger density can affect comfort, waiting times, travel noise, route choice, and demand estimation, leading to discomfort, failed boardings, and decreased service noise. From a psychological perspective, overcrowding among train passengers is associated with affective responses such as stress, irritation, and fatigue. Therefore, overcrowding is not only a capacity issue but also relates to users' emotional experiences and perceptions.

Studies assessing crowding often treat it as a form of discomfort that influences travel decisions. Previous studies have shown that crowding can be measured in public transport settings by considering both objective and subjective indicators, as the physical conditions of crowding do not always fully reflect the user experience. Discomfort due to crowding is influenced by three main aspects: dissatisfaction with standing, reduced opportunity to utilize travel time, and physical proximity to other passengers. These findings strengthen the argument that comfort with personal space is an important factor in user acceptance of public transport services.

Passenger responses to crowded conditions are also reflected in their willingness to make trade-offs between comfort, waiting time, and travel conditions. The stated preference approach is widely used to measure these responses because it allows respondents to evaluate hypothetical scenarios with different levels of crowding. Liu and Wen (2016) showed that passenger density has a non-negligible impact on travel preferences on metro and bus services, and that crowding disutility increases with higher standing passenger density. In the context of rail transit, Aghabayk et al. (2021) also found that stated preference data can be used to measure changes in passenger perceptions of crowding, particularly when personal space and distance between passengers are important factors in the travel experience. Furthermore, Shelat et al. (2022) demonstrated through a stated-choice experiment that crowding is a key factor influencing rail passengers' travel choices, including their willingness to wait longer for less crowded conditions. This suggests that passenger acceptance of crowding should be understood as a perception-based behavioral response, not simply as a technical measure of density.

Furthermore, Bansal et al. (2022) demonstrated, using a discrete choice experiment with London Underground users, that crowding levels, travel times, mask policies, and vaccination rates influence users' preferences for returning to public transport during the pandemic. Basnak et al. (2022) also used a stated preference survey in Santiago, Chile, and found that travel time values in highly crowded conditions increased significantly compared to those in less crowded conditions, suggesting that crowding should be considered an important factor in assessing travel preferences. Both studies reinforce the importance of the stated-preference approach in capturing passenger behavioral responses to different crowding scenarios.

Crowding has become increasingly important following the COVID-19 pandemic. Shelat et al. (2022) found that crowding, exposure duration, and infection rates influenced public transport user choices during the early stages of the pandemic in the Netherlands. Yap et al. (2023) also showed that in the post-pandemic era, passengers perceived public transport crowding more negatively than in the pre-pandemic period, and these perceptions influenced route choice and the perceived attractiveness of public transport. Therefore, crowding evaluation standards based solely on physical capacity need to be complemented by user-perception-based approaches, particularly in the context of changing comfort expectations post-pandemic. In the context of real-world data-based measurements, Basso et al. (2023) developed a measure of public transport crowding using smart card and GPS data during the COVID-19 pandemic in Santiago, Chile, to illustrate exposure risk and changes in crowding levels before, during, and after the lockdown period. Meanwhile, Yap et al. (2020) demonstrated that smart card data can be used to estimate crowding on tram and bus services and found that crowding significantly influenced passenger route choice. These findings suggest that both stated preference approaches and actual behavioral data can complement each other in understanding the impact of crowding on public transportation users' travel experiences and decisions.

In station facilities, particularly platforms, crowding has more direct implications for safety and comfort because passengers are confined to waiting areas and close to train tracks. Schneider et al. (2021) showed that actual and perceived crowding on station platforms is related to safety perceptions and risky behavior in areas near train tracks. Similarly, Pawar et al. (2025) explained that assessing Passenger Level of Service (P-LOS) in train station facilities requires consideration of both quantitative and qualitative factors, including platform area, accessibility, safety, and comfort, based on passenger feedback from questionnaires. These findings suggest that platform evaluations need to directly consider passenger perceptions, not just technical classifications based on density.

In pedestrian and transit facility planning, the Level of Service (LOS) concept is used to classify service quality based on density, available space per person, and user movement conditions. A study on Passenger Level of Service (LOS) at railway station facilities showed that LOS evaluation can be conducted by combining physical inspection of the facility and user assessments of service factors such as accessibility, safety, and comfort (Pawar et al., 2025). However, LOS that focuses solely on technical indicators is insufficient to fully explain the user experience. Public transportation service quality needs to be evaluated through a combination of objective indicators and subjective passenger perceptions. Satisfaction indices from a user perspective can be used to monitor service quality, identify sources of dissatisfaction, and determine service improvement strategies. Therefore, LOS platform evaluation should integrate physical density indicators with direct user perceptions.

From a travel behavior perspective, user decisions are influenced by perceived utility, not solely by measurable physical conditions. Batarce et al. (2016) demonstrate that stated- and revealed-preference data can be used to assess crowding on public transportation, while Haywood et al. (2017) assert that users' levels of concern about crowding vary with their characteristics and travel conditions. Therefore, integrating behavioral indicators into platform evaluations can provide a more realistic representation of passenger experience and station facility performance.

Although research on crowding continues to grow, most previous studies have focused on in-vehicle crowding, travel time assessments, route choice, or general service satisfaction. Research that specifically identifies passenger acceptance thresholds for platform crowding and links them to LOS classifications remains limited, particularly at commuter train stations in developing countries. Few studies also translate passenger acceptance into practical indicators, such as acceptance distances, that can be compared with conventional LOS standards. This gap is significant because passengers at commuter stations with frequent trips may have crowding tolerances that differ from common technical standards.

Given this gap, this study aims to evaluate passenger acceptance of various platform-crowding conditions at Depok Station, Indonesia. Using a stated-preference approach and binary logistic regression, this study identifies a critical crowding threshold at which passengers are equally likely to accept or reject a given crowding condition. The stated preference approach is relevant because it captures user preferences for hypothetical controlled service scenarios, as is widely used in public transport crowding valuation studies (Batarce et al., 2016; Shelat et al., 2022). This threshold is then converted into an acceptance distance, which represents the minimum interpersonal distance that passengers still consider acceptable. By integrating physical density measures and user-based evaluations, this study contributes to the development of a more passenger-oriented platform service quality assessment framework.

METHOD

Research Location

This research was conducted at Depok Station, one of the busiest commuter train stations in the Jakarta Metropolitan Area (Jabodetabek), Indonesia. This station serves a large number of passengers daily and experiences high passenger volumes during peak hours. The platform area was chosen as the unit of analysis because it serves as the primary waiting area before boarding the train and directly reflects passengers' interactions with crowding conditions.

Data Collection

A stated preference (SP) survey was used to gather passengers' perceptions of platform crowding conditions. This survey targeted individuals with experience using commuter train services and station platforms, ensuring that the sampling strategy aligned with the research objectives. This approach aligns with Etikan et al. (2016), who explain that purposive sampling can be used when researchers require respondents with specific experiences or characteristics relevant to the phenomenon being studied. The crowding scenarios ranged from very crowded to low crowded conditions and were designed to represent realistic platform situations commonly encountered at commuter train stations. Each scenario showed a specific passenger density level, and respondents were asked to rate whether the conditions were acceptable or unacceptable from their personal perspective. Responses were recorded as binary variables, with "accepted" coded as 1 and "not accepted" coded as 0. A total of 297 respondents participated in the survey. Each respondent evaluated 10 density scenarios, yielding 2,970 observations for statistical analysis.

Research Variables

This study used passenger density as the independent variable and passenger acceptance as the dependent variable. Density is expressed as passengers per square meter (passengers/m^2), while acceptance reflects respondents' willingness to tolerate specific density levels.

Table 1. Research Variables

Variable	Type	Unit	Description
Density	Independent	Pasengger/m^2	Passenger density on the platform
Acceptance	Dependent	Biner (0/1)	Passenger acceptance of crowded conditions

Data analysis

The relationship between passenger density and acceptance probability was analyzed using binary logistic regression. Logistic regression was chosen because the dependent variable has two possible outcomes: acceptance or rejection. The logistic regression model is stated as Eq. (1):

$$\text{Logit}(P) = \beta_0 + \beta_1 D \quad (1)$$

With:

P = probability of acceptance;
D = passenger density (passengers/m²);
β_0 = intercept;
β_1 = regression coefficient.

The probability of acceptance is estimated using the logistic function with Eq. (2):

$$P = \frac{1}{1+e^{-(\beta 0+\beta 1x)}} \quad (2)$$

Model significance was evaluated using likelihood ratio tests and goodness-of-fit indicators. The estimated model was then used to identify the critical density threshold.

Determination of Critical Density and Distance Acceptance between Users

Critical density is defined as the density level at which the probability of acceptance equals the probability of rejection (P = 0.50). This threshold represents the point at which passengers are equally likely to accept or reject a density condition.

The identified critical density is then converted into an acceptance distance using the relationship between density, space per person, and interpersonal distance. The resulting acceptance distance is compared with conventional Level of Service (LOS) classifications in platform and pedestrian facility literature to evaluate consistency between technical standards and actual passenger perceptions.

RESULTS AND DISCUSSION

Respondent Characteristics

A total of 297 respondents participated in the survey. All respondents had experience using commuter rail services and station platform facilities. In the stated preference survey, each respondent evaluated 10 platform density scenarios, yielding 2,970 observations for the statistical analysis. This large number of observations provides an adequate basis for estimating passenger acceptance behavior under various density conditions.

Table 2. Distribution of Respondents' Answers Based on Density Level

Density (passengers/m²)	Accepted (Respondent)	Not Accepted (Respondent)	Accepted (%)	Not Accepted (%)
1	295	2	99,33	0,67
2	291	6	97,98	2,02
3	286	11	96,30	3,70
4	271	26	91,25	8,75
5	241	56	81,14	18,86
6	176	121	59,26	40,74
7	106	191	35,69	64,31
8	69	228	23,23	76,77
9	54	243	18,18	81,82
10	36	261	12,12	87,88
Total	**1.825**	**1.145**		

A summary of respondents' responses to each density scenario is presented in Table 2. This table shows the number and percentage of respondents who reported platform conditions as acceptable or unacceptable at each density level. Based on Table 2, the level of respondent acceptance decreases as platform density increases. At a density of 1 passenger/m², the acceptance rate is 99.33%, whereas at 10 passengers/m², it is only 12.12%. The most noticeable decrease occurs in the 6-7 passengers/m² range, from 59.26% to 35.69%. This indicates that this range is an early indication of the point of change in passenger acceptance of platform density conditions.

Relationship between Density and Passenger Acceptance

The relationship between platform density and passenger acceptance was analyzed using binary logistic regression based on stated-preference survey data. The dataset analyzed comprised 2,970 observations from 297 respondents, each evaluating 10 density scenarios. The dependent variable in the model was passenger acceptance of density conditions, coded as a binary variable, with 1 for "acceptable" and 0 for "not acceptable." The independent variable was platform density (passengers/m²).

The figures in Table 3 show the parameter estimates from the binary logistic regression model for this dataset. The B value indicates the regression coefficient, the SE indicates the standard error, and the Wald test assesses the significance of the parameter. Sig. indicates statistical significance, and Exp(B) denotes the change in the odds of acceptance per one-unit increase in density. Therefore, the constant value of 5.205 and the density coefficient of -0.777 are not assumed figures, but rather model estimates based on respondent responses.

Table 3. Binary Logistic Regression Estimation Results

Variable	B	S.E.	Wald	Sig.	Exp (B)
Density	-0,777	0,027	823,925	0,000	0,460
Constant	5,205	0,184	804,241	0,000	182,133

Based on Table 3, the density variable has a regression coefficient of -0.777 and a significance value of 0.000 ($p < 0.001$). This value indicates that density significantly influences passenger acceptance. The negative sign on the coefficient indicates that, as platform density increases, the probability of passenger acceptance decreases.

The Exp(B) value of 0.460 indicates that every increase in density of 1 passenger/m² reduces the odds of acceptance by 0.460 times compared to the previous condition. In other words, increasing density substantially decreases the probability of passenger acceptance.

Based on these estimation results, the resulting logit model Eq. (3) is:

$$\text{Logit}(P) = 5{,}205 - 0{,}777D \quad (3)$$

with P representing the probability of acceptance and D representing passenger density (passengers/m²).

The negative density coefficient (-0.777) indicates that increasing passenger density significantly decreases the probability of passenger acceptance. The statistical significance of this coefficient ($p < 0.001$) confirms that density is an important determinant of perceived platform acceptability. The resulting logistic curve shows a gradual decrease in the probability of acceptance as density increases. At low density levels, passengers generally rate platform conditions as acceptable. However, as density increases, the probability of acceptance decreases substantially, indicating reduced perceived comfort and available personal space.

This finding is consistent with previous studies on crowding, which report that increased passenger concentration negatively impacts comfort, satisfaction, and overall travel experience. These results also support the theoretical assumption that reduced personal space increases the likelihood of discomfort and perceived crowding among public transportation users.

Critical Density Threshold

One of the primary objectives of this study is to identify a critical density threshold that represents the transition point between acceptable and unacceptable density conditions. The critical density threshold is determined when the probability of acceptance equals the probability of rejection, i.e., P = 0.50. At this point, the logit value is zero because the probability of passengers accepting and rejecting the density condition is balanced.

Based on the logistic regression estimation results, the resulting model equation is Logit(P) = 5.205 – 0.777D. By substituting P = 0.50 into the model, the critical density is obtained by comparing the model constant with the density coefficient, i.e., 5.205/0.777. This calculation yields a critical density value of 6.70 passengers/m².

Therefore, a critical density of 6.70 passengers/m² indicates the point at which passengers' probability of accepting and rejecting the density condition is balanced. This value represents the point at which passengers have an equal probability of accepting or rejecting the density condition. Densities below this threshold are generally perceived as acceptable, while densities above this threshold tend to be perceived as unacceptable.

Table 4. Logit Calculation Results and Acceptance Probability Based on the Logistic Regression Model

Density (passengers/m²)	Logit(P)	Probability Model (%)
1	4,428	98,82
2	3,651	97,47
3	2,874	94,65
4	2,097	89,06
5	1,320	78,92
6	0,543	63,25
7	-0,234	44,18
8	-1,011	26,68
9	-1,788	14,33
10	-2,565	7,14

Table 4 shows the results of the logit calculation and acceptance probability based on the logistic regression model. The logit value is obtained by substituting the density value into the equation Logit(P) = 5.205 – 0.777D. Based on these calculations, the acceptance probability decreases from 98.82% at a density of 1 passenger/m² to 7.14% at a density of 10 passengers/m². The probability value crosses the 50% point between 6 and 7 passengers/m², making this result consistent with the critical density value of 6.70 passengers/m².

The data indicate that the transition between acceptance and rejection becomes most pronounced at a density range of approximately 6–7 passengers/m². Within this range, relatively small increases in density can produce substantial changes in passenger perceptions, demonstrating the sensitivity of user acceptance around the threshold level.

Identifying the critical density threshold provides an empirical indicator that can support operational decision-making and crowd management strategies at commuter rail stations. The threshold value in this study, 6.70 passengers/m², aligns with Lu et al. (2024), who found that during peak hours, a standing density of 6-7 passengers/m² is generally considered crowded, while 8 passengers/m² is considered very crowded for all passenger types. Thus, the critical density in this study falls within the density range empirically perceived as crowded by urban rail transit users.

Analysis of Distance Acceptance between Passengers

To provide a more intuitive interpretation of the threshold value, the critical density was converted into an acceptance distance, representing the minimum interpersonal distance that passengers still consider acceptable. To provide a more understandable interpretation, the critical density value was converted into space per person and acceptance distance. The critical density of 6.70 passengers/m² indicates that the average space available per passenger is 1/6.70, or 0.149 m²/passenger. Next, the space-per-person value was interpreted as a linear distance, assuming that the space available to each passenger is represented as a square. Based on this approach, the square root of 0.149 m² yields an acceptance distance of 0.386 m.

Therefore, the acceptance distance of 0.386 m is obtained by mathematically transforming the critical density value into space per person, which is then converted to a linear distance. This value is not interpreted as the actual distance between passengers' shoulders, but rather as a geometric interpretation of the space per person at the critical density limit. In practical terms, passengers can generally tolerate an interpersonal distance of around 38.6 cm while waiting on the platform. Beyond this threshold, perceived acceptance decreases, and the probability of acceptance decreases substantially.

Compared with density-based indicators, acceptance distance provides a more practical representation of passenger perception because it directly relates to the need for personal space. Therefore, this measure can be more easily interpreted by station planners and operators when evaluating platform congestion conditions.

Conventional Level of Service Classification

The passenger reception distances obtained from the empirical analysis were compared with the conventional Level of Service (LOS) classification. The LOS framework for platform and pedestrian facilities generally evaluates service quality based on passenger density, available space per person, and user freedom of movement (Li & Hensher, 2013). A comparison between the research results and the conventional LOS classification is presented in Tables 5 and 6. Based on this classification, the results of this study are in the LOS F category because the value of space per person obtained from the critical density is 0.149 m²/passenger. This value is below the LOS F limit of ≤ 0.46 m²/person. Thus, the empirical passenger acceptance threshold in this study is at a condition that is normatively classified as very dense. However, these results do not mean that LOS F can be used as an ideal design standard; rather, they indicate that some commuter passengers can still tolerate conditions that are technically at the lowest level of service.

Based on Table 6, the critical density value of 6.70 passengers/m² and the space per person of 0.149 m²/passenger fall into the LOS F category according to the Fruin classification. This indicates that the empirical passenger acceptance threshold falls within what is normatively considered very dense conditions. However, these results should not be interpreted as recommendations for platform design at LOS F, but rather as an indicator that commuters have a higher tolerance for density than the normative comfort limit.

Table 5. Fruin Level of Service (LOS) Classification

LOS Category	Space per Person (m²/passenger)	Density (passenger/m²)	Interpretation of Conditions
LOS A	> 3,25	< 0,31	The space is very loose; free movement without significant interference.
LOS B	> 2,30 – 3,25	0,31 – 0,43	The space is still loose; users can still move comfortably.
LOS C	> 1,40 – 2,30	0,43 – 0,71	Space is starting to become limited, but movement is still relatively steady.
LOS D	> 0,90 – 1,40	0,71 – 1,11	Personal space is reduced; movement begins to be impaired.
LOS E	> 0,46 – 0,90	1,11 – 2,17	Dense conditions; very limited space for movement.
LOS F	≤ 0,46	≥ 2,17	High density; movement is very limited and uncomfortable.

Table 6. Comparison of Research Results with Conventional Level of Service Classification

Evaluation Components	Results of the Research	Conventional LOS Reference	Interpretation
Critical density	6,70 passenger/m²	High density indicates low level of service	The density is at a very dense condition
Space per person	0,149 m²/passenger	LOS F: < 0,46 m²/passenger	The space is in the LOS F category
Acceptance of Distance between Passengers	0,386 m	Not used directly in conventional LOS	Geometric interpretation of space per person
Assessment basis	Perception of passenger reception	Normative standards based on space per passenger	Indicates a difference between user tolerances and technical standards

Therefore, the comparison conducted in this study is between the empirical acceptance threshold based on passenger perception and the conventional LOS classification based on space per person. The comparison results indicate that passenger acceptance perceptions do not always fully align with normative standards, so platform service evaluations need to consider both simultaneously.

These findings suggest that passengers can tolerate density levels that differ from those assumed by conventional design standards. These differences may be influenced by travel habits, commuter experience, cultural factors, and adaptation to a dense urban transportation environment. Therefore, while LOS classification remains useful for facility planning and capacity assessment, integrating passenger perceptions provides additional insight into how users actually experience congestion.

Implications of the Results for Platform Density Management

The research results indicate that the critical density value of 6.70 passengers/m² not only serves as a modeling result but can also be interpreted as an operational focus point in platform density management. At this point, the probability of passengers accepting or rejecting the density condition is balanced. This means that when platform density approaches 6-7 passengers/m², service conditions have reached the transitional threshold of user acceptance. In this situation, a relatively small increase in density can lead to a significant decrease in passenger acceptance.

From a station management perspective, these results can serve as an early warning indicator for monitoring platform conditions, especially during peak hours. When density approaches this critical value, operators can consider control measures such as regulating passenger distribution along the platform, enhancing information on train positions and boarding points, regulating passenger flow into the platform area, and increasing surveillance in areas prone to congestion. Therefore, the critical density value should not be understood as an ideal design standard, but rather as an empirical threshold indicating when platform conditions begin to require operational intervention.

The acceptance distance of 0.386 m also needs to be interpreted with caution. This value is not the actual shoulder distance between passengers, but rather a geometric interpretation of the average space per passenger at the critical density level. Therefore, this figure does not indicate comfortable conditions; rather, it shows that some passengers can still tolerate very crowded conditions. This finding demonstrates a difference between conditions that are subjectively acceptable to users and ideal conditions as defined by normative service standards. Compared with conventional LOS classifications, the space-per-person value of 0.149 m^2/passenger falls into the LOS F category. This indicates that the empirical passenger acceptance threshold in this study falls within a technically very crowded service level. However, this result should not be interpreted as justification for designing or operating platforms at LOS F. Rather, it suggests that commuters may have a tolerance for crowding higher than the normative comfort limit, requiring platform service evaluations to consider both LOS standards and user perceptions simultaneously.

Thus, the practical contribution of this research lies in providing empirical indicators based on user perceptions that can complement physical density-based evaluations. Critical density values and acceptance distances can serve as tools for understanding passenger tolerance limits, while conventional LOS standards remain the normative reference for facility planning. Integrating these two approaches is crucial to ensure platform management focuses not only on space capacity but also on the user experience as service recipients.

CONCLUSION

This study evaluates passenger acceptance of platform density at Depok Station using a stated preference approach and binary logistic regression with the following notes:

1. The results indicate that passenger density has a significant negative effect on the probability of acceptance, meaning that increasing crowding decreases passengers' willingness to tolerate platform conditions.
2. The estimated logistic model identified a critical crowding threshold of 6.70 passengers/m^2, representing the point at which passengers are equally likely to accept or reject a crowding condition. This threshold was then converted to an acceptance distance of approximately 0.386 m, reflecting the minimum interpersonal distance that passengers still perceive as acceptable while waiting on the platform.
3. Comparison with conventional Level of Service (LOS) classifications indicates that the empirical acceptance threshold does not always align precisely with normative density-based standards. This finding highlights the importance of incorporating passenger perceptions into platform service evaluations, in addition to physical density-based indicators.

Overall, this study demonstrates that platform service evaluations need to consider two aspects: physical crowding indicators and passenger acceptance perceptions. The critical density values and acceptance distances obtained can serve as empirical indicators for understanding user tolerance limits, while conventional LOS standards continue to function as normative references for the evaluation and planning of platform facilities.

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