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Research Article

Information Service Frequency of Urban Rail Transit Based on Passenger Flow Dissipation Rate

Huijuan Zhou [1,2] Yu Liu [3] Bei Li [4] and Zhe Zhang [2]

[1]Beijing Key Lab of Urban Intelligent Traffic Control Technology, North China University of Technology, Beijing 100144, China
[2]State Key Laboratory of Rail Traffic Control and Safety (Beijing Jiaotong University), Beijing 100044, China
[3]Beijing Engineering Consulting Co. Ltd, Beijing 100124, China
[4]Institute of Transportation Engineering, Tsinghua University, Beijing 100084, China

Correspondence should be addressed to Huijuan Zhou; zhouhuijuan@ncut.edu.cn

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The improvement of the quality of information services can speed up the dispersal of aggregated passenger flow. To alleviate the safety hazards of the outburst mass passenger flow gathering at a certain station, we took the information service frequency as the research object and the passenger flow dissipation rate as an index to study the best information service frequency interval that passengers can accept. Firstly, we analyzed the influencing factors of passenger flow dissipation rate from the perspective of subjective and objective and proposed a model of passenger flow dissipation rate. Then, a corresponding influence factor model was established to determine the influence factor and the corresponding frequency interval. Finally, the model solving impact factors and the passenger flow data of the Wukesong subway station were used to solve the model of passenger flow dissipation rate, combining the frequency interval under a single factor to determine the best information service frequency interval under the influence of multiple factors.

1. Introduction

The rapid development of urban rail has brought great convenience to passengers. At the same time, with the continuous expansion of the scale of the road network, the possibility of urban rail transit networks encountering various emergencies has also increased. Outburst large passenger flow is a special phenomenon of an emergency, due to the factors such as the distribution of major activities nearby or the gathering of passengers on holidays, the surge in passenger flow in the subway station reaches a certain threshold of the design capacity of the station and produces safety hazards, and it is urgent to guide the evacuation of passenger flow.

In order to cope with unexpected situations and ensure the safety and the operating efficiency of the urban rail transit, domestic and foreign researches on traffic emergencies have been carried out and some results have been achieved. Zhang and Chen [1] studied the key factors affecting the emergency management by building the Markov chain model under Petri network and improved the emergency dispatching ability of the operator. Zhao et al. [2] proposed an information propagation model for subway emergencies based on the traditional passenger bounded trust model, which provided a reliable research method for passenger evacuation. Yin [3] proposed the passenger flow induction model from the scope and content of information service based on the passenger route selection behavior when the operation was suddenly interrupted. Hassannayebi et al. [4] proposed a Lagrangian relaxation method to solve the problem of large passenger flow in emergencies by minimizing the average waiting time of each passenger subject to the capacity and resource constraints. Navid et al. [5] developed a vulnerability analysis method for sparse intercity railway network and took the Iranian railways as a case to analyze the cost of railway accidents, and proposed the importance of solving the sudden problems.

However, to the best of our knowledge, few researchers have been focusing on solving the emergencies from the perspective of information service frequency. In the environment of sudden large passenger flow, the visual impact caused by the passengers' closed environment and the surge in congestion around them will cause certain psychological pressure to the passengers. At this time, the low frequency of information release is not conducive to alleviating the congestion of underground sites and may lead to the spread of large-scale negative sentiment. However, excessive information releases reduced passengers' willingness to adapt information. So, finding an appropriate frequency of information services can effectively accelerate the evacuation of passenger flow. Therefore, this paper takes the information frequency as the research object and uses the passenger flow dissipation rate as an indicator. According to the complex psychological state of the passengers, we comprehensively consider the factors affecting the passenger flow dissipation rate and then determined the best information service frequency interval that passengers can accept.

2. Passenger Flow Dissipation Rate

The passenger flow dissipation rate in the context of outburst mass passenger flow scenario means the ratio of the outbound passengers at a station to the summation of the passengers who stayed in the station during the previous study period and the inbound passengers during the current study period. Among them, the outbound passengers during the study period t include passengers who exited from the gate (Q_o^t), passengers who left from the transfer lane ($Q_{x_2}^t$), and passengers who boarded (Q_u^t); the inbound passengers during a study period t include passengers who entered from the gate (Q_i^t), passengers who entered from the transfer lane ($Q_{x_1}^t$), and passengers who got off (Q_d^t).

Therefore, in this case, only the inbound and outbound passenger flows are considered, and the expression of the passenger flow dissipation rate at an outburst mass passenger flow station is expressed as shown in

$$W(f) = \frac{\sum_{j=1}^{v}\sum_{i=1}^{s} Q_u^t + \sum_{j=1}^{m}\sum_{i=1}^{n} Q_o^t + \sum_{i=1}^{e} Q_{x_2}^t}{Q_r^{t-1} + \sum_{j=1}^{m}\sum_{i=1}^{p} Q_i^t + \sum_{j=1}^{v}\sum_{i=1}^{s} Q_d^t + \sum_{i=1}^{e} Q_{x_1}^t}, \quad (1)$$

where Q_r^{t-1} represents the staying passengers in the previous study period; v and s, respectively, represent the number of transits arriving at the station and the number of doors of each transit in the current period. m represents the number of imports and exports of the station. p and n represent the number of gates at each entrance and exit of the station ; e represents the number of transfer lanes in the station.

From the perspective of information services, when studying the passenger flow dissipation rate in an outburst mass passenger flow scenario, the impact of information services on passengers is mainly considered from the subjective and objective aspects, that is, the factors affecting the passenger flow dissipation rate are studied from the perspective of passengers and information itself. The passenger perspective considers the impact of different frequency information stimuli on passengers and the psychological stress caused by high frequency information stimuli on passengers. The information perspective considers the effect of the value of the information itself on the dissipation rate of passenger flow.

Zhu [6] proposed that the service of the railway passenger transportation process is formulated based on the psychological needs of the passengers and emphasized that providing corresponding service methods for different psychological changes of passengers can effectively improve the quality of railway passenger service. In the outburst mass passenger flow scenario, the changes in the passenger's mind are relatively complicated and can easily cause fear, which makes the large passenger flow not dissipate quickly. Therefore, different frequencies of information stimuli have different influence on passengers, resulting in different effects.

Psychologist Lin et al. [7] proposed that when a threat is felt, everyone will instinctively try to restore themselves to the normal state. If the psychological expectations cannot be met, one will resist the external pressure. In the outburst mass passenger flow scenario, passengers' fear and distrust of the surrounding environment has greatly increased, and it is easy to generate resistance and refuse to accept official service information, which is not conducive to the dissipation of large passenger flows. High frequency information will produce certain psychological pressure on the passengers and this may affect their willingness to adapt information.

Information utility is the basic attribute of information. It indicates the degree of effect of each piece of information on all audiences. It is an objective consideration of the impact of information services on the dissipation rate.

As the founder of information theory, Shannon and Weaver [8] proposed the information function, which needs to consider both the subjective utility and the objective possibility of the information. And the information entropy improvement function was expressed as

$$\begin{aligned} H(X) &= H_{\omega(r)}(\omega_1, \omega_2, \cdots \omega_r; p_1, p_2, \cdots p_r) \\ &= -\sum_{i=1}^{r} \omega_i p_i \log p_i, \end{aligned} \quad (2)$$

where p_i represents the prior probability of the information in all information sets X: $\{a_1, a_2, \cdots a_r\}$; ω is the subjective weight of the importance of information to the audience; and$p$ is the prior probability space in the information set X.

The normalized value of the subjective weights ω and prior probabilities p is

$$q_i = \frac{\omega_i p_i}{\sum_{i=1}^{r} \omega_i p_i}. \quad (3)$$

Here,q_i is the utility rate of information, indicating the importance of information to passengers.

During the travel of passengers, the route changes are mainly faced with five types of information induction, including inbound induction, outbound induction, boarding induction, alighting induction, and the induction information on whether the transfers are performed at the transfer station. The utility of the information varies according to the degree of passenger demand. We used the method of sampling survey in the questionnaire. The different information utility rates are shown in Table 1.

According to different situations, different dissipation rate formulas are proposed.

When the information frequency is low, only the influence of the information stimulation on passengers and the utility of information itself are considered, and the objective function is displayed as

Table 1: Different types of information utility rates.

Information	q_i
Inbound induction information	0.18
Outbound induction information	0.03
Boarding induction information	0.21
Alighting induction information	0.04
Transfer induction information	0.55

$$W(f) = \frac{(1+k)\left(q_{iu}\sum_{j=1}^{v}\sum_{i=1}^{s}Q_u^t + q_{ix_2}\sum_{i=1}^{e}Q_{x_2}^t\right) + (1-k)q_{io}\sum_{j=1}^{m}\sum_{i=1}^{n}Q_o^t}{Q_r^{t-1} + (1-k)\left(q_{ii}\sum_{j=1}^{m}\sum_{i=1}^{p}Q_i^t + q_{id}\sum_{j=1}^{v}\sum_{i=1}^{s}Q_d^t + q_{ix_1}\sum_{i=1}^{e}Q_{x_1}^t\right)}, \quad (4)$$

where k represents the impact factor of information stimulus on passenger information reception.

When the frequency of information service is high, the psychological pressure of passengers is also considered, and the objective function can be represented as

$$W(f) = \frac{J\left[(1+k)q_{iu}\sum_{j=1}^{v}\sum_{i=1}^{s}Q_u^t + q_{ix_2}\sum_{i=1}^{e}Q_{x_2}^t + (1-k)q_{io}\sum_{j=1}^{m}\sum_{i=1}^{n}Q_o^t\right]}{Q_r^{t-1} + J(1-k)\left(q_{ii}\sum_{j=1}^{m}\sum_{i=1}^{p}Q_i^t + q_{id}\sum_{j=1}^{v}\sum_{i=1}^{s}Q_d^t + q_{ix_1}\sum_{i=1}^{e}Q_{x_1}^t\right)}, \quad (5)$$

where J indicates the willingness of passengers to adapt service information driven by psychological pressure.

At this point, this section takes the passenger evacuation rate as an objective expression of the effectiveness of information services as the starting point and provides a foreshadowing for the determination of the optimal service frequency for the study of passengers in different psychological states in the following chapters. The overall research idea of this paper is shown in Figure 1.

3. Information Service Frequency under Passenger Psychological State

3.1. Impact of Different Information Service Frequency Stimulation on Passengers

3.1.1. List of Parameters. The parameters are shown in Table 2.

3.1.2. Model Building. When investigating the impact of the different frequency information stimulation on passengers, we took the nervousness of the passengers during the travel as the research object and used the official information as an external stimulus. Taking into account the cross-effects of the official information and the information passed by the nearby passengers, we can quantitatively describe the passengers' emotional changes with cognitive, emotional, and behavioral tendencies.

We referred to the PAD model in Reference [9], and defined emotions as a two-dimensional psychological vector displayed by X, mood $X = [x_1, x_2]$, x_1 represents the direction of mood and x_2 represents the intensity of mood, feeling $Y = [y_1, y_2]$, y_1 represents the degree of enjoyment and y_2 represents the degree of emotional arousal. Cognition $R = [r_1, r_2]$, r_1 represents the passenger's understanding of the information and r_2 represents the passenger's attention to the information. Behavioral tendency $H = [h_1, h_2]$, h_1 indicates the degree of passenger's extroversion and h_2 represents the stability of the behavioral tendency. The values of these variables belong to $[-1, 1]$.

Taking the emotions of the passengers in the normal road network as the system input, and defining the passenger's cognition, emotions, and behavioral tendencies as the influencing parameters, and outputting the emotional states under the stimulation of different frequency information $X(t)$ and $Y(t)$, the model is established as follows:

$$\begin{cases} X(t) = \psi[X(t-1), H(t-1), Y(t-1)] + \vartheta[d, H(t-1), Y(t-1)] \cdot E + \zeta[Q, X(t-1)], \\ Y(t) = \delta[\beta, Y(t-1), X(t-1)] + \gamma[S, Y(t-1)]. \end{cases} \quad (6)$$

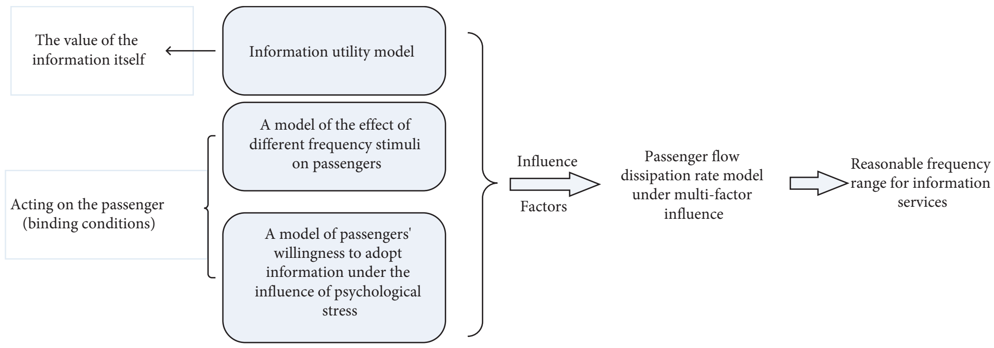

Figure 1: Article research ideas.

Table 2: Variables and their description.

Variable	Description
$X(t-1), X(t)$	Passenger's mood state before and after receiving the message
$Y(t-1), Y(t)$	Passenger's emotional state before and after receiving the message
$H(t-1)$	Passengers' behavioral tendencies before receiving information
ψ	Passengers' own mood changes
ϑ	Mood change caused by official information stimuli
d	Response of passengers' cognitive factors to information stimuli
E	An identity matrix of the specified size
ζ	Mood changes caused by the dissemination of information among passengers
Q	Influence of passenger j on passenger i
δ	Emotional changes caused by the official information
β	Emotional attenuation factor, generally taken as 0.3
γ	Emotional changes caused by the information transmission among passengers
S	The degree of influence of emotional changes between passengers
α	The combined impact factors of emotion and personality on mood
Tr	Passenger trust in official information
$S_y = [S_{y1}, S_{y2}]$	The matrix of the influence of emotion on mood and $S_{y1}, S_{y2} \in [-1, 1]$
$S_h = [S_{h1}, S_{h2}]$	Matrix of influences of behavioral tendencies on emotions and $S_{h1}, S_{h2} \in [-1, 1]$
w	Passenger demand for information.
$S_{yi} = [S_{yi1}, S_{yi2}]$	Matrix of factors influencing emotions by information stimuli and $S_{yi1}, S_{yi2} \in [-1, 1]$
$S_{hi} = [S_{hi1}, S_{hi2}]$	Matrix of factors influencing information stimuli on behavioral tendencies and $S_{hi1}, S_{hi2} \in [-1, 1]$
σ	Adjustment coefficient, its general value is 0.6
Tr_{ij}	Trust degree of passenger i to passenger j
I_{ij}	Influence of passenger i on passenger j
A	Accuracy of the message
T	$T = S_y{}^T$ is the relationship matrix between mood and emotion

How effective the information service is depends not only on the passenger's own cognition and emotional state of the information but also on the nature of the information. Here, we defined the three important attributes of official information, namely, information importance $i_1 \in [0, 1]$, information service frequency $i_2 \in [0, 1]$, and the crisis level of information $i_3 \in [1, 10]$.

For equation (6), the calculation formulas that define the response of the passenger cognitive factors to the information stimuli and the passenger's own emotional changes can be represented as

$$d = (\min(r_1 + r_2, i_1 + i_2) - \max(r_1 - r_2)) \times \left(1 + \frac{\lg i_3}{10}\right). \quad (7)$$

$$\begin{aligned} \psi &= \alpha \times X(t-1) \times Tr, \\ \alpha &= e^{-\left(YS_y^T + HS_h^T\right)}, \\ Tr &= i_1 \times i_2 \times w^2. \end{aligned} \quad (8)$$

We calculated the passenger's mood response to the information stimuli, if $d > 0$, then

$$\vartheta = e^{YS_{yi} + HS_{hi}} d. \quad (9)$$

And if $d < 0$, then

$$\vartheta = e^{-\left(YS_{yi} + HS_{hi}\right)} d. \quad (10)$$

When passenger i passes a message to the passenger j, it can be displayed as

$$\zeta = Q \times X(t-1). \quad (11)$$

In equation (9), Q represents the influence of the passenger j on the passenger i, and the calculation formula is

$$Q = \sigma Tr_{ij} I_{ij} r_2 A. \quad (12)$$

New emotions are generated when the passengers receive information. Under the stimulation of the official information, new emotions can be expressed as

$$\delta = (1 - \beta) \times e^{(-i_2)} \times Y(t-1) + X(t-1) \times T \times e^{h_2^2}. \quad (13)$$

The emotional changes caused by the indirect influence of the passengers around them can be represented as

$$\gamma = S \times Y(t-1), \quad (14)$$

where

$$S = Tr_{ij}A_j h_1 h_2. \quad (15)$$

From the aforementioned model, the direction and the intensity of the emotions and the degree of the emotional pleasure and arousal can be obtained after passengers receive information. Therefore, by solving the model, the frequency range of the information service stimulated by the different frequency information can be obtained, and the optimal information service utility can be achieved with the passenger information status as the constraint.

3.1.3. The Information Service Frequency Interval under the Influence of Information Stimulus. Before solving the model, the parameters used in the model are calibrated. We refer to the emotional experience structure diagram [10] to define the influence factors of emotions on moods $S_y = [-0.5, 0.5]$ and define the influence factors of behavioral tendency on mood based on the literature [9]. Based on characteristics of the influence of external stimuli on people's moods, we valued $S_{yi} = [-0.3, 0.6]$, $S_{hi} = [-0.5, 0.25]$.

The influencing factors of the official information service of the urban rail transit on passengers mainly include passengers' attention, understanding, demand, and importance of the information, and according to the travel characteristics of the passengers, the real data obtained by the questionnaire research is used to substitute the model for experiments. The survey data are summarized and analyzed and weighted average, and the final parameter value is defined.

In the normal riding environment, the basic moods and emotional states of passengers are $X(t-1) = [0.22, 0.45]$ and $Y(t-1) = [-0.27, 0.86]$. In general, the value of the passenger behavioral tendencies is $H(t-1) = [0.46, 0.5]$and the passenger demand for the official information is $w = 0.9$, and the trust degree of the passenger i to the passenger j is $Tr_{ij} = 0.4$. The influence of passenger j on the passenger I is $I_j = 0.4$, the accuracy of the message is $A_j = 0.8$, the passengers' understanding of the official information is $r_1 = 0.82$, the passengers' attention to official information is $r_2 = 0.7$, and the importance of the official information to passengers is $i_1 = 0.9$. According to the level of the outburst mass passenger flow, this study selects the crisis degree of events, that is, $i_3 = 5$.

Based on the survey results, the parameters are introduced into the model in the Section 3.1.1 and MATLAB is used for the experiment to obtain the changing state of the passenger mood and emotions under different official information services, as shown in Figure 2.

The results of the above model solution show that the different frequency information stimulation has different effects on passengers' emotions and moods. Compared with emotion, mood changes are relatively obvious. The effect of the different frequencies on passengers is abstract. Moods reflect the effect of the passengers receiving information at different frequencies, and the direction and intensity of the emotions are the same. Therefore, the influence factor is taken as the value of emotion intensity at different frequencies.

One can see from the figure, that when the frequency is less than 25 times/h, the direction and the intensity of the moods increase with the increase of frequency, reaching a high point at about 25 times/h. With the increase of information service frequency, the degree of the emotional pleasure is always on the rise but its value change is not obvious. The arousal degree gradually decreases with the change of information service frequency, and the numerical change is obvious, indicating that the higher the frequency of information service is, the lower the arousal degree is and the more relaxed the emotional state is. Based on the above analysis, when the information service frequency is 10–25 times, the passenger's mood is in an ideal state, which is conducive to the dissipation of passenger flow in an outburst mass passenger flow environment.

3.2. Passenger's Willingness to Accept Information under Psychological Pressure

3.2.1. Model Building. To study the psychological pressure of the high frequency information on passengers, a passenger information adaption willingness model under the influence of psychological pressure is introduced.

The change of psychological stress at different information service frequencies is similar to the sigmoid curve, so the increasing degree of psychological pressure under the different information service frequencies, namely, the psychological surge coefficient α and the boundary constraint of psychological pressure β when psychological pressure reaches the extreme value should be considered. The change model of psychological stress under different frequencies is shown in the equation.

$$E(f) = \frac{1}{1 + e^{\beta - \alpha f}}. \quad (16)$$

When the passengers have different psychological pressure with the change of information service frequency, their willingness to adapt the service information will also change accordingly. Therefore, driven by psychological pressure, the final service information adaption willingness calculation model can be represented as.

$$J = \frac{1}{1 + e^{qE(f) - k}}. \quad (17)$$

In the formula, q is the decision-making factor of the psychological stress, k represents the constraint of the information value, which is the ratio of the passengers' demand for information to the passengers' recognition of the information, that is, $k = c/n$.

3.2.2. The Information Service Frequency Interval under the Influence of Psychological stress. The solution process of passenger information adaption willingness model under the influence of psychological pressure is as follows:

Step 1. According to formula (18), the psychological surge coefficient α is determined, where β is the boundary constraint value of the curve of the

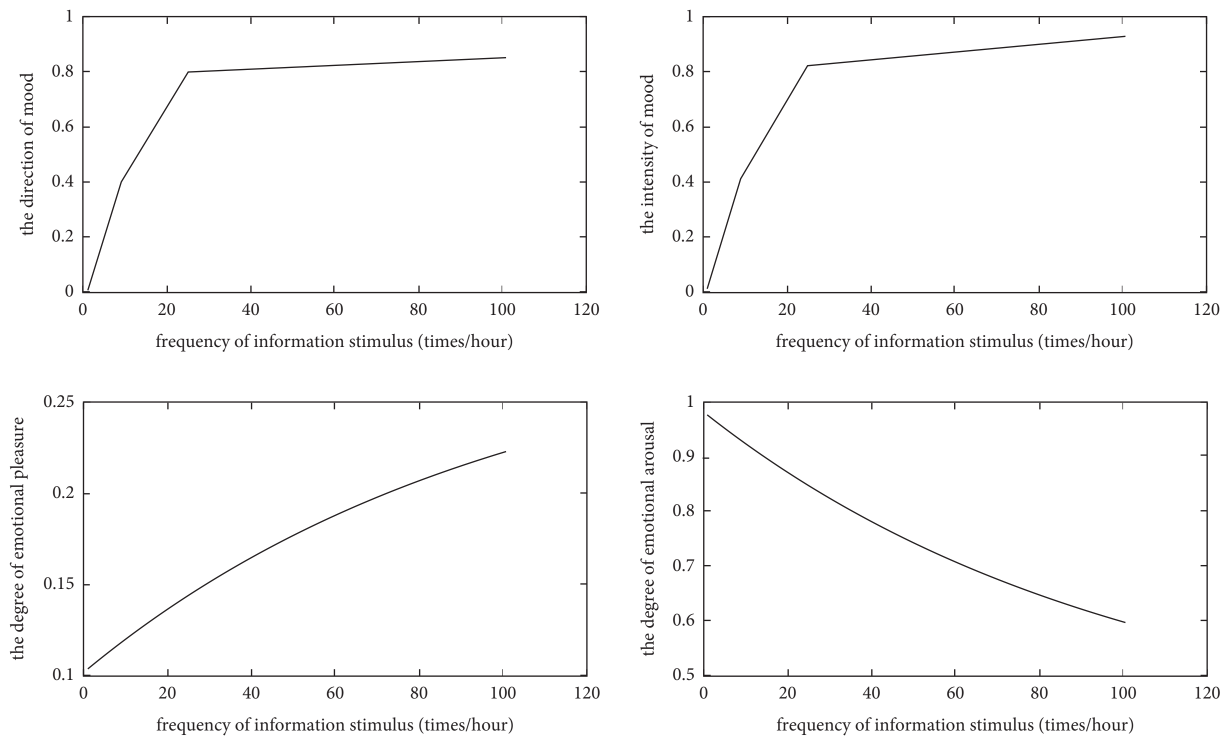

Figure 2: Effects of the different frequencies of information stimulation on passengers.

psychological pressure function, valued as 7.5 [11]. According to Kholshevnikov et al. [12], the extreme value of human psychological stress tolerance is 0.7. Therefore, we take $\beta = 7.5$, $v = 25$, and $E(v) = 07$ into formula (18) and find the psychological surge coefficient $\alpha = 0.42$.

Step 2. We take $\alpha = 0.42$, $\beta = 7.5$ into equation (18) to obtain the psychological stress values of the passengers under different information service frequencies.

Step 3. Determining the information value constraint value k.

The constraint of information value is the ratio of the passengers' demand for information to the passengers' recognition of information, which can be obtained from the questionnaire $c = 0.9$ and $n = 0.4$. Therefore, the value of the information value constraint k is 2.25.

Step 4. According to formula (19), the influence factors of decision psychological pressure q were determined;

According to the data of the questionnaire survey, the best acceptance degree of passengers to information service can reach more than 85%. Therefore, we take $J = 0.85$, $f = 15$, and $k = 2.25$ to obtain $q = 2.35$.

Step 5. By taking the constraint value of the information value $k = 2.25$ and the influence factor of the decision psychological pressure $q = 2.35$ into the formula (19), and taking the passenger psychological pressure at different information service frequencies obtained by the formula (18) as input to the model, the willingness to adapt passenger service information under different psychological pressures can be obtained.

MATLAB is used to implement step 1–step 5 as mentioned, and the results are displayed in figures 3 and 4.

As one can see from Figures 3 and 4, when the frequency is less than 10 times/h, passengers' psychological pressure is not obvious and their willingness to adapt information is high. With the continuous increase of information service frequency, when the information service frequency is in the range of 10–27 times/h, the passenger's psychological pressure monotonously increases, and their willingness to adapt information gradually decreases. When the frequency is 27 times/h, the critical point is reached. High-frequency information has a greater psychological pressure on the passengers and it affects their willingness to adapt information. Thus, we conclude that when the information service frequency is below 27 times/h, the passenger's willingness to adapt information is at a high level, which is conducive to the rapid dissipation of passenger flow.

4. The Optimal Information Service Frequency Interval Is Determined Based on Passenger Dissipation Rate

In this study, the Wukesong station of the Beijing Metro line 1 was taken as an example to solve the reasonable information service frequency interval in the outburst mass passenger flow. Since Wukesong station is a nontransfer station, the solution formula for the dissipation rate of passenger flow in the sampling period is as follows:

Without considering the psychological stress,

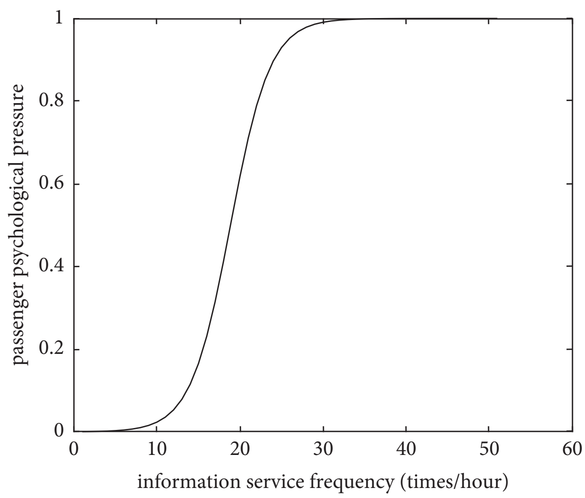

Figure 3: Psychological stress of passengers under different information service frequencies.

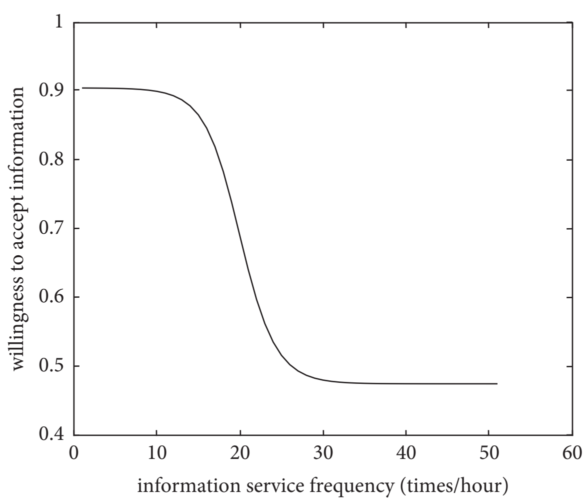

Figure 4: Willingness to adapt passenger information under the influence of psychological stress.

$$W(f) = \frac{(1+k)q_{iu}\sum_{j=1}^{v} Q_u^t + (1-k)q_{io}\sum_{j=1}^{c}\sum_{i=1}^{p} Q_o^t}{Q_r^{t-1} + (1-k)\left(q_{ii}\sum_{j=1}^{m}\sum_{i=1}^{n} Q_i^t + q_{id}\sum_{j=1}^{v}\sum_{i=1}^{s} Q_d^t\right)}. \quad (18)$$

Considering the psychological stress,

$$W(f) = \frac{J\left[(1+k)q_{iu}\sum_{j=1}^{v}\sum_{i=1}^{s} Q_u^t + (1-k)q_{io}\sum_{j=1}^{c}\sum_{i=1}^{p} Q_o^t\right]}{Q_r^{t-1} + J(1-k)\left(q_{ii}\sum_{j=1}^{m}\sum_{i=1}^{n} Q_i^t + q_{id}\sum_{j=1}^{v}\sum_{i=1}^{s} Q_d^t\right)}. \quad (19)$$

There are a total of 9 entrances and exits in the Wukesong station, four groups of exit gates for a total of 12, and two groups of entry gates for a total of 12. The frequency of transit arrival is 2 min/time. The line 1 trains are quasi-B type 6-section marshalling, including DKZ4(s401-s431) and SFM04(g432-g470). There are 4 sets of doors in each train, a total of 24 sets of doors. In this study, the AFC data of the mass passenger flow at Wukesong station on May 19, 2018,

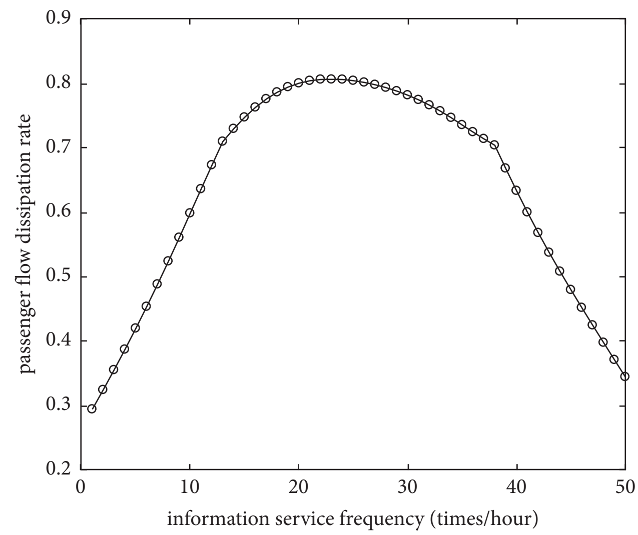

Figure 5: Outburst mass passenger flow dissipation rate in Wukesong Station.

was used, and the parameters were put into equation (19) to obtain the dissipation rate of the outburst mass passenger flow at Wukesong station as shown in the figure.

One can see from figure 5 that the dissipation rate of the passenger flow presents an inverted U-shaped distribution. When the information service frequency is 21 times/hour, the passenger flow dissipation rate reaches a peak. When the information service frequency is 11–39 times/hour, the passenger flow dissipation rate can reach above 0.6, and the passenger flow dissipation efficiency is high. Based on the impact of information services on passenger stimulation and passenger psychological pressure, the optimal frequency range of the information services should be 11–25 times/hour.

5. Conclusion

In this paper, the dissipation rate of the outburst mass passenger flow stations was taken as the index of information service effectiveness to study the optimal information service frequency interval of the urban rail transit under the outburst mass passenger flow. We analyzed the impact factors of the information service on passenger flow dissipation rate from the perspective of passengers and information itself, and proposed a model of passenger flow dissipation rate. Then, based on the factors of passenger flow dissipation rate, the influence model of the passenger flow dissipation rate was established, and the impact factors and the corresponding information service frequency interval were determined with the actual data. Finally, the impact factors in the model solution results and the passenger flow data of the Wukesong station were used to solve the mass passenger flow dissipation rate model under the influence of multiple factors, and combined with the service frequency interval under the single factor influence model. The best information service frequency range acceptable to passengers is 11 to 25 times per hour.

Data Availability

There are questionnaire data, simulation data, and AFC data in this paper. All these data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

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