Holiday Rail Transit Security Scheme for Evaluation of Government[1]

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Abstract

Based on the analysis on the characteristics of holiday passenger flow, the evaluation index system of city rail traffic security scheme holidays operation from the perspective of the government was established and is combined with Shanghai rail transit operation security scheme which was evaluated during the national day in 2013. Research results provide some suggestions for the government department, which is in charge of the service level track traffic regulation and service standards during holidays.

Keywords: holidays, for the government, rail transit project, evaluation

1. Introduction

The mechanism and pattern of Holiday passenger flow are usually completely different. Passenger flow of Rail transit usually sharp fluctuations and changes.

To alleviate the contradiction between supply and demand during the holidays of rail transportation system, the practice of rail transit enterprise make special operations plan, such as including capacity, improving operation to grade and other measures. However, it has not yet been built up on holiday operation security establishment and optimization mechanism of scientifically and systematical evaluation. Operation and management of rail transit enterprise is long in a state of experience decision stage. To a certain extent, it increases government pressure about financial subsidies and is bad for the sustainable development of rail transit enterprise.

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Therefore, historical or practical investigation evaluation data, which is based on rail transit operation security and optimization of the holiday effect, has the important significance for improving the holidays of rail transit operation management level.

This paper analyzes the passenger travel characteristics and regularity of holidays and provides evaluation index system of rail operations security scheme from the perspective of the government. According to the National Day in 2013, evaluation of Shanghai rail transit security scheme was implemented. Results are beneficial to improve the efficiency of limited resources in enterprise and provide the basis for decision-making service standards and service level of rail transit supervision during the holidays.

2. Analysis of Holidays Rail Transit Passenger Flow Characteristics

(1) Changes of Annual Network Traffic

The holiday traffic is a special form of passenger flow, which only appears in the special period, and the number and the scale of general are beyond daily passenger flow. Overall, passenger flow in rail transit network during the holidays is affected by the network scale, living level of the residents, social life and traditional culture factors [2]The general population shows a rising trend year by year and plays a more and more important role in the city residents travel during the national day of 2009-2013 .Shanghai rail transit network traffic growth rate is shown in figure 1.

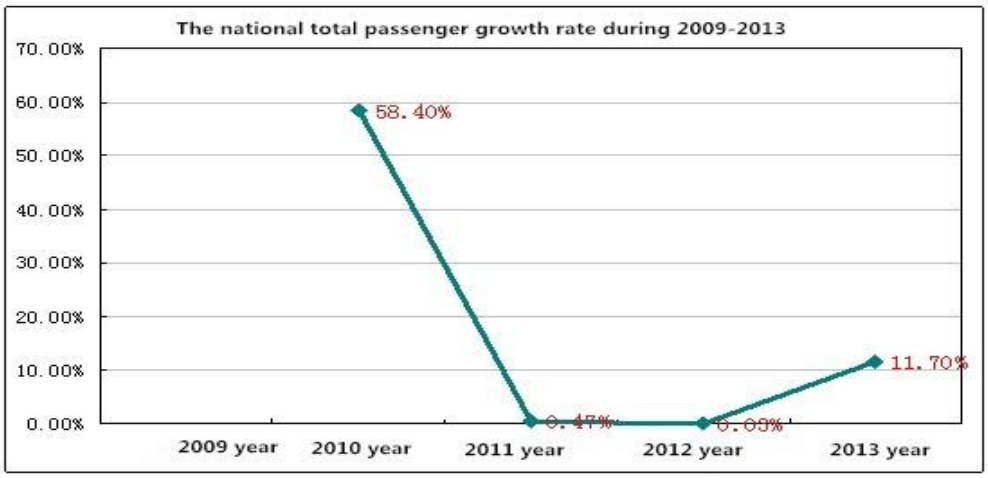

Figure 1

As shown in the above diagram, during the national day in 2009-2013, traffic for Shanghai rail transit is increasing year by year, the year-on-year growth rate, to a certain extent, reflects the change of urban rail transit network scale.

Shanghai subway network was built a few years ago and was launched by a large-scale construction in 2010 World Expo. The network scale expansion and Expo increased passenger flow, which therefore increased passenger flow that reached 58.4% in 2009-2010. In 2011 and 2012, however, road mileage increase was smaller, so during the national day, road network traffic trends stepped in the corresponding period of smooth. In 2013, with the rail transportation 13, 11line completed and put into operation, network scale breakthrough 500kilometres, meanwhile corresponding passenger growth rate reached 11.7%.

(2) Changes Network Daily Passenger Flow

Holiday passenger flow fluctuation is a gradual process, which generally can be divided into early stage, mid-term and later stage. Before the holiday is a large growth of passenger flow. Then passenger flow is relatively stable in mid-term of festival. After festival, it is the back stage of passenger flow; passenger flow will be one-way substantial growth, so the holiday passenger flow has its regularity and repetition [1]. Taking National Day of Shanghai in 2013 for example, during the National Day, which compared to the same a two week characteristics of each day in September, the change of passenger flow is shown in figure 2

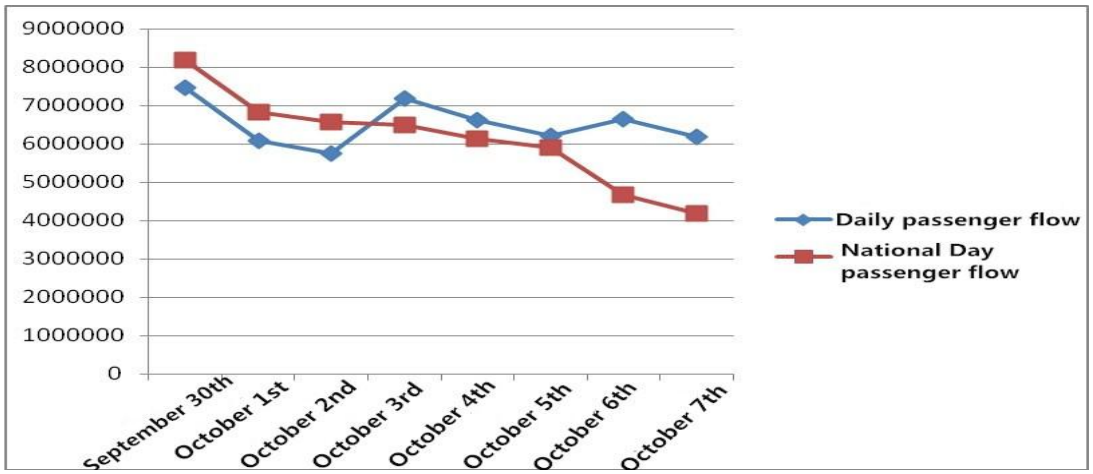

Figure 2

According to the graph, in 2013 ,Shanghai rail transit passenger flow characteristics during the national day was higher than that in the same day, which was a significant growth; section passenger flow gradually tends to be stable in mid-term, but the last two days significantly decreased. The main reason is that, on one hand, visiting relatives of intercity travel significant growth, led to increase of the city of Shanghai residents travel volume; on the other hand, the No. twenty-third typhoon this year, had impact on resident trip, which brought road network traffic plummeted decline.

(3)The Change of Passenger Flow Based Time Division

During the holidays, rail transit passenger flow characteristics and normal weekend are similar, which generally show a full-time "peak" feature; on the other hand, it appears to be significantly different with the features that mean Going out early and coming back at dusk at normal weekend. In 2013, Shanghai rail transit network and station time of the national day can be seen from figure 3

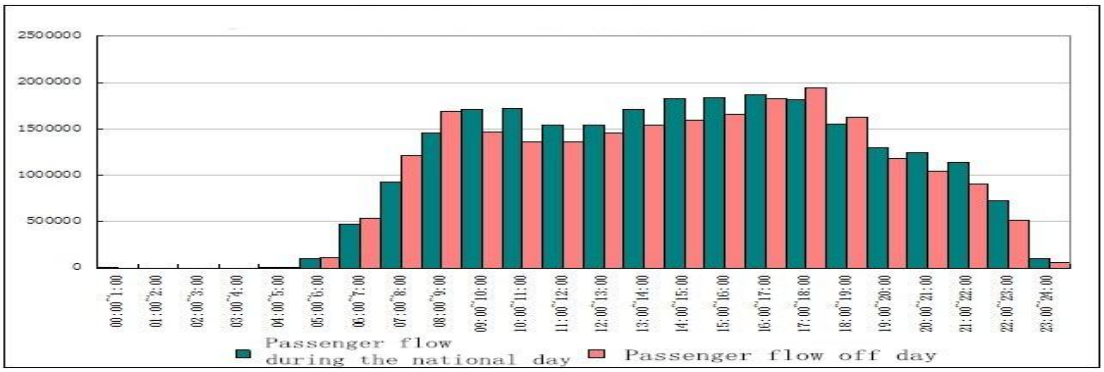

Figure 3

According to the graph, during the National Day in 2013, During the period of 8:00-17:00, passenger flow exceed 1500000 persons, which meet passenger flow characteristics of normal double cease day "the peak". Between 6:00-9:00 and 17:00-23:00, passenger flow is greater than any time of the day. During the period of 9:00-17:00, passenger flow of the national day is also greater than each period of normal days, which suggests that during National Day period residents travel show special features that people would prefer to go out early and come back at dusk.

3. Rail Transit Security Scheme for Evaluation Index System of government

From the perspective of government, evaluation index system of rail transit security scheme need consider operational security scheme of economic benefit, social benefit, operation safety, reliability, service level and other criteria. Of course, it meet the spirit of service level supervision, service standards, financial subsidies, decision making [3, 4, 5] which is shown by figure 4

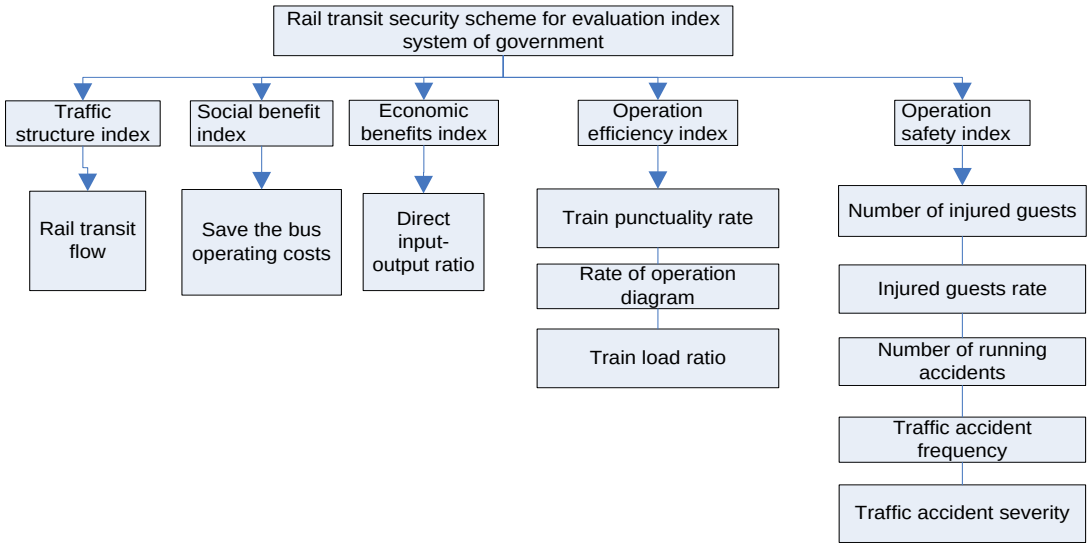

Figure 4

(1) The Traffic Structure Index

Rail transit flow: the total number of passengers who use rail transit trip.

(2) Social Benefit Index

Save the bus operating costs: in the same track traffic in the traffic of new traffic conditions. Passengers who take the special line save operating costs.

$$\text{Savings of the bus operating expenses} = \frac{\text{The new added rail transit passenger flow during holidays}}{\text{The fixed capacity transportation}} * \text{Operating expenses of transportation} - \text{Operating expenses of rail transportation}$$

(3) The Economic Benefits Index

The direct input-output ratio: refers to the holiday, rail transit network new ticket income and new operation cost ratio.

$$\text{The direct input - output ratio} = \frac{\text{holidays ticket income of road net - daily ticket income of road net}}{\text{new added operating costs Holidays road net}} * 100\%$$

(4) The Operation Efficiency Index

Train punctuality rate: the knuckles rail transit trains divide by the number of total column train.

$$\text{Train punctuality} = \frac{\text{The number of operating train on time on holiday}}{\text{The number of totally operating train on holiday}} * 100\%$$

Operation: the rate of operation diagram that is used is that rail transit network and the number of actual ranks will run as the ratio of the number of total column.

$$\text{The use of Running chart} = \frac{\text{Holiday network practical operation column}}{\text{Holiday network planed operation column}} * 100\%$$

The train load ratio: referring to the holiday rail transit passenger volume and passenger mileage ratio, which are used to express the degree of rail transit vehicle class.

$$\text{The train load ratio} = \frac{\text{traffic passenger volume} * \text{Average transport distance}}{\text{The train line rated capacity} * \text{Line running mileage}} * 100\%$$

(5) Operation Safety Index

The number of injured guests: referring to the holiday period, the number of rail transit network in the train transportation process or along the station hall, platform, the entrance of passenger casualties occurred within the scope of the times.

The injured guests rate: during the holiday, rail transit network passenger injury which is caused by casualties and road traffic.

$$\text{The injured guest rate} = \frac{\sum \text{The number of casualties network injured events during the holidays}}{\text{road traffic of the holidays}}$$ The number of

running accidents: referring to the holiday period, due to fault or accident, rail transit network operation and train caused personal injury or property loss event frequency.

Traffic accident frequency: referring to the holiday period, rail transit network traffic accident frequency and line train mileage ratio.

$$\text{Traffic accident frequence} = \frac{\text{The number of road traffic accidents during the holidays}}{\text{train operating mileage of road network during the holidays}}$$

Traffic accident severity: referring to the holiday period, the average severity of all traffic accidents rail transit network, it reflects all the traffic accident, which bring adverse effect line and station operation. Operation accidents rank assignment follows in following table 1

Level	Name	The death toll	The number of the injured	Reference value
1	A serious accident	A	b	10a+5b
2	Major accident		c	6c
3	General accident		d	3d
4	The slight accident		e	1e

Table 1

4. Operational Security Scheme Evaluation of Rail Transportation in Shanghai during the National Day

From the above, affected by the abnormal weather, the 2013 national total passenger was under normal. Passenger flow was unable to obtain the same day holidays and normal characteristics of road transportation. Therefore the government cannot calculate holidays social benefit, so this could not been taken into account about the social benefit evaluation index. According to depth investigation of enterprises and original data, it could be calculated on the evaluation index and carried out the contrast analysis, the main evaluation conclusions are as follows:

(1) The Shanghai rail transit network has played a key role in the transport of large capacity during the National Day.

In 2009-2013 ,during the national day, the passenger flow for rail transit was increasing year by year, which increased from 27540000 people in 2009 to 48970000 people in 2013.It showed that the Shanghai track traffic ,during the national day, high-capacity backbone transport function expansion with the network scale become increasingly important.

(2) Due to low direct economic benefits, we should further strengthen cost control and improve the operation efficiency.

During 2013 national day, bad weather led to a reduction in passenger flow decreased. Ticket sales and special security solution had created additional operating costs, such as passenger organization in overtime personnel costs and equipment maintenance repair costs. From the angle of economic benefits, operational security work run behind one's expenses.

Therefore, in the future, it should be set up reasonable grade for the station. According to the "daily passenger flow, scientific personnel allocation standard should meet train operation plan, meanwhile, organization should take other measures to reduce the additional operating costs of the national day.

(3) Road train load ratio conforms to normal levels, road train punctuality rate and operation with high honor.

In 2013, during the national day, the selection of network line categories on train diagram each day and train load ratio were in table 2.

By comparing with the normal characteristics of daily network train ,during the national day ,the class of train diagram each day corresponds well to the characteristics of passenger flow demand and train diagram categories is chosen properly. But the corresponding index of total train 10.4-10.7 full rate is lower than the same character day, which shows that transport power of the National Day date is more adequate than usual power.

During the National Day in 2013, road train punctuality rate and operation cash rate were 99.62%, 99.92%, which was not only higher than the national standard value of 98.5%, also higher than the full year 2012 index value of 99.67%. It showed that the overall operation reliability and stability were high during the National Day, compared to the same period last year.

(4) The driving safety is higher, but the station passenger safety needs to be strengthened.

In 2013, during the national day of the guests and the number of passenger injury rate were in table 3. It suggests that they are both absolute and relative. During the National Day, Network guest occurrence frequency is higher than normal level.

The reason is the main following aspects: firstly, during the National Day, a large of passengers into the road network is lack of riding experience and easily hurt; secondly, the elderly and children are increasing. Compared with the young people, they travel more vulnerable; thirdly, high density flow in network nodes aggregation effect, such as the service to the tourist attractions of station and foreign transportation hub station, large passenger flow effect of this station also lead to the guest event .Therefore, the guest event prevention should be carried out as one of the focus point of national security scheme to deal with in future.

Date	September 10th	October 1st	October 2nd	October 3rd	October 4th	October 5th	October 6th	October 7th
Road train load ratio	35.81%	34.67%	32.07%	32.54%	31.05%	30.69%	25.20%	22.10%
selected categories of Running chart	Running chart of maximum capacity configuration about work day train	The holiday train operation diagram of maximum capacity configuration			The normal holiday train diagram			
The average of road train load ratio	35.81%	33.09%			27.26%			
The normal characteristic ratio of daily train load	33.39%	31.82%			31.82%			

Table 2

During the National Day in 2013, the Shanghai subway contingency plans are quite perfect careful, coupled with the local public security, including public sector coordination efforts, traffic accident could not happen during the National Day period, the operation is safe and stable.

5. Conclusion

This paper analyses the characteristics of passenger travel by rail transit during the holidays. Evaluation index system was constructed for the government's rail transit security scheme. During national day, the track traffic in Shanghai, provides basis for improving operational security scheme of objective evaluation. Besides, the Shanghai rail transit national rail transit operation security program provides a set of evaluation index system for other big city about rail transit operation security program and evaluation during the holidays. Future research should further operate multi operation rail transit security model and evaluation method of comprehensive quantitative evaluation during the holidays.

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