*International Journal of Research in Engineering and Science (IJRES)*
*ISSN (Online): 2320-9364, ISSN (Print): 2320-9356*
*www.ijres.org Volume 5 Issue 9 ǁ September. 2017 ǁ PP. 43-48*

# Analyzing A Railway Station of Shang Hai Pedestrian Transit Simulation Estimate And optimization Base on VISSIM Transportation Software

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**ABSTRACT:** China is the biggest developing country all over the world. We have specially emphasized on strategy about developing the urban public transportation preferentially from beginning to end since we solved the problem on urban traffic. Thus, rail transit is primary parts of public transit. It will become one of the most important programs which are the establishment of our nation's fundamental facilities in the future. However, the safety of passengers walking and the ability of server facilities used by passengers will be become our main problem considered during the railway and underground station development. Meanwhile, it is also main content of this thesis. At the same time, with the development and application of computer in transportation area, especially transit simulation software such as VISSIM which be used in this thesis.
In the background of Kunming railway station, make a theory summarize about passengers' walking safety and the capacity of service in rail station. Know about the circumstance in rail station by observation and security analysis of passengers walking streamline. By using the function of passenger simulation in traffic simulation software VISSIM 6.0, I will establish simulation model of passengers pass through service facilities such as stations' escalator, stairs, horizontal channel and ticket checking machine and output evaluation of simulation and get a series of index which uses to evaluate the facilities of passing service such as delay, departure time, speed and density. It will offer relevant advice to the establishment of railway and underground station building in the city of Kunming in the future.

***Keywords:*** Passenger Pass Through Safety, The Service Level of Service Devices, The Simulation of Passing Facilities, Evaluation Analysis.

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Date of Submission: 19-09-2017 Date of acceptance: 29-09-2017

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## I. Definition Of Rail Transit

There are two main definitions of urban rail transit: One refers to the transport with a large flow, operational safety, speed, high point to the station, to protect the environment, saving land and energy and other characteristics of the mode of transport. The other is in the national standard "urban public transport commonly used noun terms" in the definition of urban rail transit is usually the power as the driving force to take the wheel and rail operation of the rapid mass transit traffic in general terms[1].Mainly include subway, light rail, magnetic levitation, trains, trams and so on. Rail traffic has a common feature is the need to establish a site to complete the pedestrian distribution. Therefore, for the purpose of pedestrian passage, each site needs to set up a common service facility. Based on this study, the main body of the study is pedestrians and services for pedestrians, including escalators, escalators, up and down stairs, horizontal access[2].

**The General Cause Of The Accident Occurred In The Following Three:**
(1) panic, when the sudden events such as earthquakes, fires, terrorist attacks wounding, subway failure, building collapse caused by pedestrians panic, loss of reason Resulting in a collision, congestion, fall, resulting in more serious security incidents., rapid disorderly evacuation.
(2) sudden obstruction, the subway track station pedestrian normal walking process, because the front pedestrian suddenly stopped, fell, squatting behind the pedestrians do not have enough space to adjust the speed of walking and change the direction of walking to avoid collision. This situation is the occurrence of pedestrian collision accident, serious will cause dangerous stampede.
(3) traffic service equipment failure or can not meet the requirements, this situation is particularly prone to escalators, gate openings and other bottlenecks[3]. As mentioned in the case of Shenzhen subway accident, pedestrians were injured due to escalator failure. In addition, the upper and lower ends of the escalator are the bottleneck of an escalator. Easily lead to personnel accidents.

## II. SUBWAY TRACK STATION INTERSECTS PEDESTRIAN LINE

According to the subway track station space pattern and the layout of the distribution service facilities organization, the subway track station pedestrian walk is a certain law and fixed mode, pedestrians pass in accordance with this kind of stop and exit mode and the law will walk walk line As shown in Figure 1. Subway track station pedestrian area is the main pedestrian, pedestrians in the pedestrian area within the walking flow characteristics determine the pedestrian traffic behavior security. When the pedestrian walk flow area is smooth, pedestrians are not disturbed, the walking space is very adequate, free flow, walking speed free choice, pedestrian traffic safety is relatively high[4]. This is prone to security incidents. Therefore, the intersection of the streamline is also a high incidence of safety accidents at the time of passage.

**Fig. 1** The sketch map of passengers walk line

## III. THE IMPACT OF WALKING STREAMLINE ON PASSENGER SAFETY

In the subway track station, including all kinds of staff, pedestrian pedestrians, outbound pedestrians in the station floor and the platform layer, the ground plane layer flow, resulting in a certain flow process and flow line process, known as the walking streamline. The walking streamline is influenced and constrained by the layout of the subway track station and the layout of the service facilities.

According to the direction of pedestrian flow can be divided into the following two categories: the same line of pedestrian flow and pedestrian flow, the same line of pedestrian flow is the same direction of the two lines, the flow of pedestrians is the direction of the two lines running in the opposite direction[5]. According to the relationship between each other and cross-interference, as shown in Figure 2, can be divided into the following four forms [32]

1) distribution streamlines；
2) Merge streamlines;
3) Weaving streamlines;
4) Cross streamline;

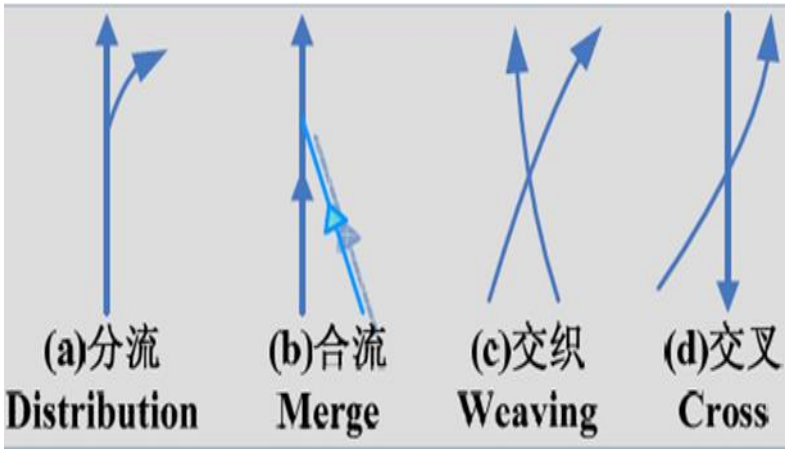

**Fig. 2** The style of walk streamline

When the pedestrian streamline design is unreasonable, pedestrian walk flow line a large number of intertwined, pedestrian walking behavior will be destroyed. When pedestrians encounter intertwined or crossed pedestrian flow as shown in Figure 3, in order to avoid collision and conflict, will adjust their walking direction and bypass, or reduce the walking speed to wait. Therefore, the pedestrian flow line is bound to bring the speed of the change and the rapid growth of local pedestrian density, resulting in pedestrian walking safety risks. Walking speed suddenly reduced or even stopped, the rapid increase in pedestrian density, will lead to pedestrians behind the sudden collision or even fall, resulting in personal walking space has been severely compressed, the buffer distance decreases, serious cases will lead to trampling and other security incidents[6].

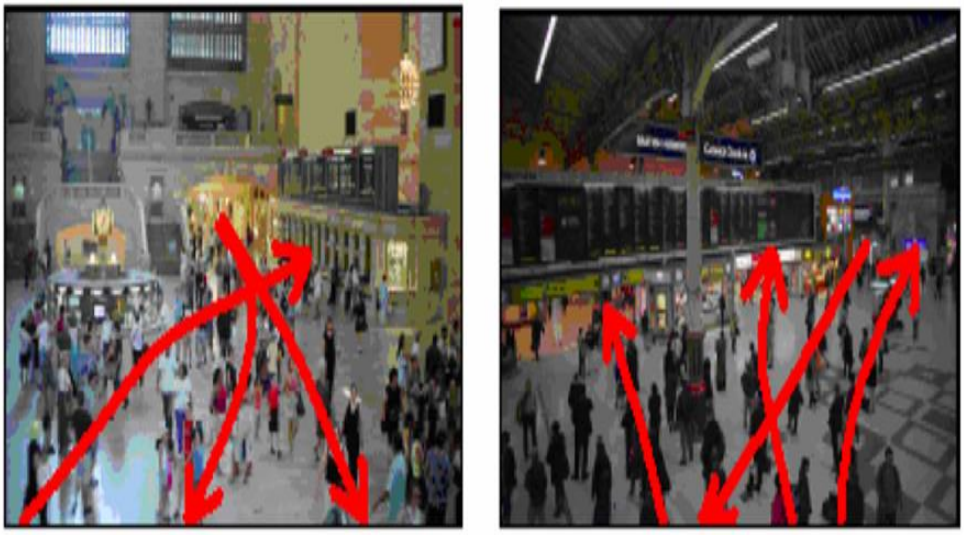

**Fig. 3** Streamline interweave and cross

**3.1Analysis of Capacity of Escalator**

First of all, the escalator capacity is through the VISSIM 6.0 pedestrian simulation software for analysis. Therefore, the simulation must be related to the establishment of the simulation data. The capacity of escalators is measured by the number of passengers per hour or the number of passes per minute. Escalator traffic capacity classification: the maximum capacity, the provisions of capacity, the actual capacity, simulation capacity. Subway escalator construction is completed, its capacity is only related to the speed of operation. The subway escalator is basically a constant speed to run. So its maximum capacity is also determined, the value can be calculated by (3-1) obtained.

$P = \frac{2\times3600*v*d}{0.4}$(3-1)

Inside the formula：P is the capacity of the escalator;
v for escalator running speed;
dfor escalator width.

**Table 1.** The Performance of design

| name | Running speed （m/s） | The number of passes per hour | The number of passes per minute |
|---|---|---|---|
| Escalator wide of 1m | 0.5 | 8100 | 135 |
| | 0.65 | <9600 | <160 |

## IV. RESEARCH AND OPTIMIZATION OF SAFE WALKING ROUTE OF DONGFENG SQUARE STATION

After field investigation, shooting, video and the station level map.The subway track station H channel connecting Youth Road, Nanping Street and other commercial streets.The main route for the station, traffic larger. As the traffic streamline safety is mainly occurred in the large passenger traffic, so it is also the focus of this paper. The pedestrian walk line is shown in Figure 4

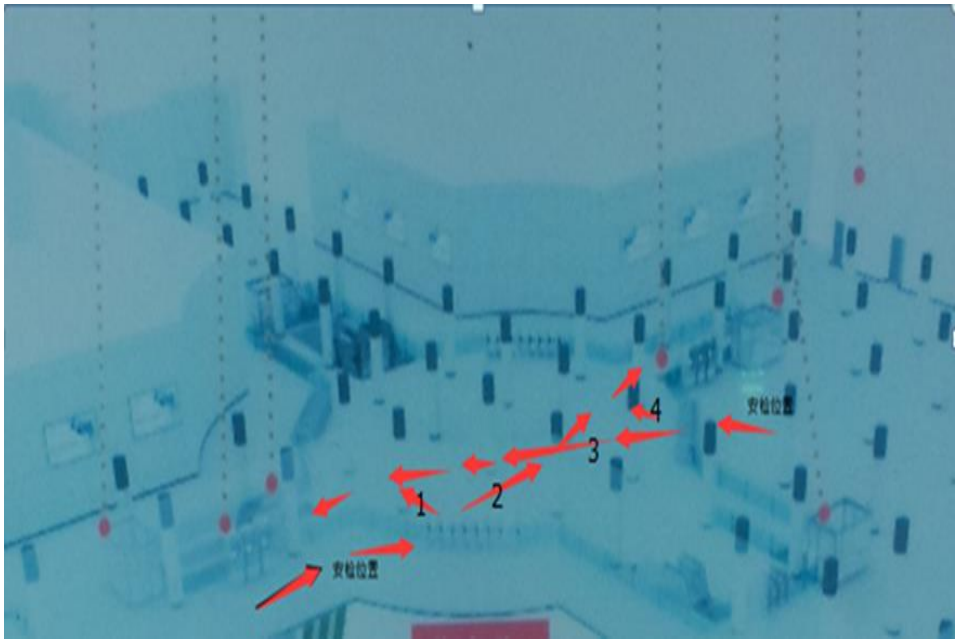


**Fig.4** Passenger streamline of arrival in station

From the above chart, the pilots walking line 1 and 3 confluence, 3 and 4 confluence, and streamline 2 and 3 cross. But because pedestrians are closer to the principle, 2 and 3 are secondary walking streamline[7]. At the same time pedestrian pedestrian more scattered. So there is little effect on the safety of walking. So in general the process of pitching the flow line organization is more reasonable. Figure 5shows the pedestrian flow line.

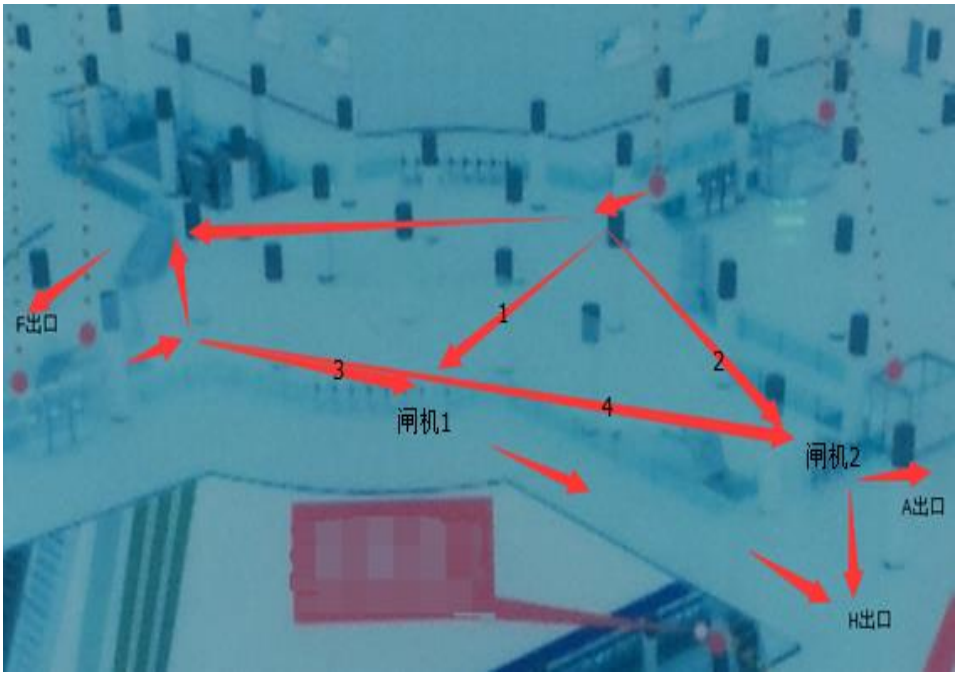


**Fig. 5** Walk line of passenger which out station

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## V. ESCALATOR SIMULATION PROCESS

The escalator's simulation process, pedestrians on the escalator speed and escalator running speed, the horizontal area walking the expected speed is as follows, according to the normal distribution:
Male expectation speed mean: 1.43m / s (maximum 3.515m / s, minimum 0.13m / s);
Female expectation speed mean: 1.36m / s (maximum 3.286m / s, minimum 0.21m / s).
The simulation is shown in Figure 6 below:

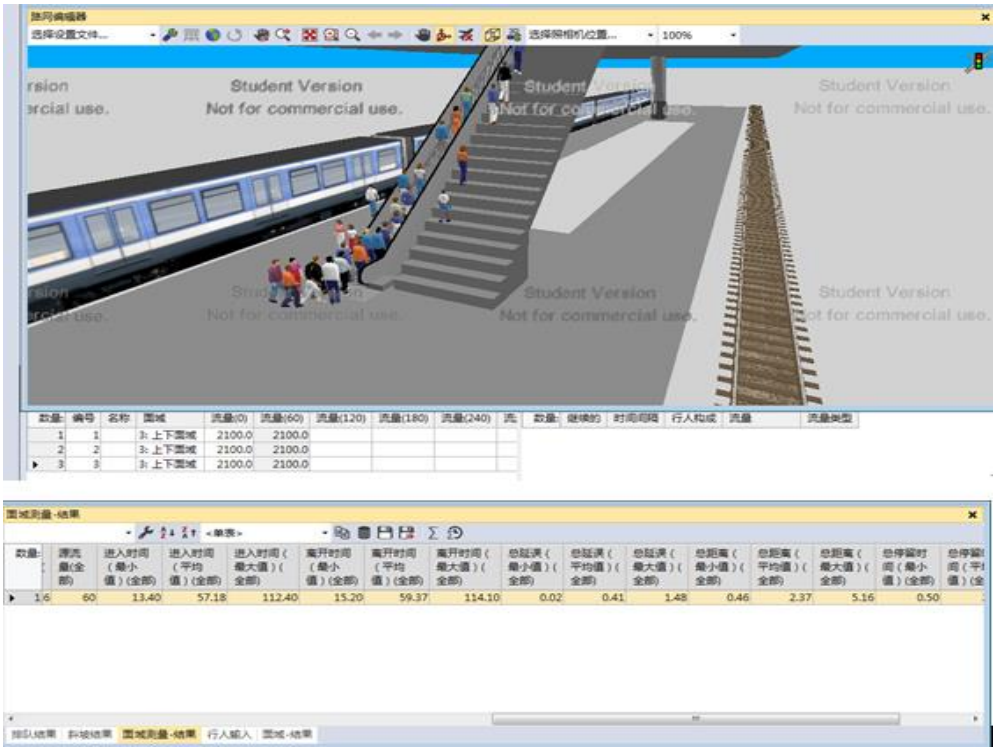


**Fig. 6** Emulation diagram and evaluation output list when 2100 people input per hour

As can be seen from the figure, the escalator basically does not exist in the case of queuing delay, through the surface area measurement to obtain the total delay of the maximum 1.48 simulation seconds, almost can be seen as no delay. This is in line with my situation at the subway track station field investigation (non-travel peak area). Kunming Dongfeng Square Metro Station as a future transfer hub (construction), only to meet the off-peak hours, non-holiday travel requirements is not enough. Through the relevant inquiry survey, access to relevant reports, in a reasonable flow forecast.Dongfeng Square subway station traffic flow can reach 60 people / min, or 3600 people / h, as pedestrian input, simulation analysis obtained by the simulation and evaluation results shown in Figure 7


**Fig. 5-7** Emulation diagram and evaluation output list when 3600 people input per hour

The results of the evaluation from the field measurements show that the maximum delay time is 5.58 simulation seconds. The figure can also clearly see the trend of waiting in line.

## VI. SUMMARIZATION AND OPTIMIZATION OF ESCALATOR SERVICE IN DONGFENG SQUARE STATION.

The simulation capability is 35 people / min in off-peak hours (excluding stair diversion).But also with the actual survey pedestrian traffic is not much difference. Based on the existing pedestrian flow, the escalator service capability of the station can meet the service requirements. Escalator queuing delay time less; when the peak hours of 75 people / min, queuing delay time is longer, and because the right side of the stairs of the diversion of the escalator to meet the requirements. Making the escalator not too congested[8].Therefore, for the Dongfeng Plaza subway station, when pedestrian traffic is too large, in order to meet the requirements of the pass, improve service levels, the specific optimization and improvement measures have the following two points:

(1)the existing escalator running speed of 0.5m / s, peak flow time can be appropriate to improve escalator speed, less than 0.65m / s;

(2)Arrange the associated subway staff to divert to the stairs to reduce queuing delays.

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*Authorzhouwei.“Analyzing A Railway Station of Shang Hai Pedestrian Transit Simulation Estimate And optimization Base on VISSIM Transportation Software.” International Journal of Research in Engineering and Science (IJRES), vol. 05, no. 09, 2017, pp. 43–48.