

PAPER • OPEN ACCESS

Research on the test method for composite threshold of subway platform door

To cite this article: Shuangchang Feng *et al* 2020 *IOP Conf. Ser.: Earth Environ. Sci.* **526** 012228

View the [article online](#) for updates and enhancements.

You may also like

- [Dynamic load test of full-scale pile for the construction and rehabilitation of bridges](#)
S T Noor, M S Islam, M Mumtarin et al.
- [Analysis of the static load test results referred to limit the bearing capacity of a pile](#)
Zygmunt Meyer and Kamil Stachecki
- [Bidirectional load test in HoChiMinh City: a case history and lessons learned](#)
Tan Nguyen and Jim Shiau



ECS
The
Electrochemical
Society
Advancing solid state &
electrochemical science & technology

DISCOVER
how sustainability
intersects with
electrochemistry & solid
state science research

Research on the test method for composite threshold of subway platform door

Feng Shuangchang^{1*}, Niu Kuangye¹, Zeng Xiaoyi² and Yang Yuqing¹

¹Shanghai Institute of Special Equipment Inspection and Technical Research, Shanghai, China

²SHANGHAI METRO NO.1 OPERATION CO., LTD, Shanghai, China

*Corresponding author's e-mail: fengsc2011@126.com

Abstract. At present, subway platform doors have become the standard configuration of Chinese subways due to the advantages of energy saving, environmental protection, passenger safety, and improvement of the waiting environment. In order to solve the problem of insulation failure of traditional platform door thresholds, threshold manufacturers use composite materials with their own insulating properties to manufacture composite thresholds. Instead of the aluminium alloy and stainless steel structures commonly used in the industry, the composite threshold uses polymer composite as the basic carrier, and then covers the aluminium alloy panel on the surface of the basic carrier. The non-metallic material of the composite threshold has a unique advantage in insulation, but its mechanical properties still need to be verified by experiments. In view of the lack of test method for the compound threshold of subway platform doors, this paper formulates the method for the composite threshold of platform door based on the test method of escalator steps. PWS-20 electro-hydraulic servo cascade fatigue testing machine was used as the test equipment. The static load test and dynamic load test were carried out on the composite threshold samples respectively. When a force of 1000N is applied for the static load test, the maximum deflection value is 0.919mm. After 1 million cycles of dynamic load test with a non-interfering resonance force wave with a frequency of 5 Hz and a pulsating load between 50N and 1000N, no cracks were observed in the sample. For the composite threshold made of other materials, this test method can also be used to carry out static load test and dynamic load test.

1. Introduction

At present, the subway has become an important means of transportation in the city, and thousands of people take the subway every day. At the same time, subway platform doors have become the standard configuration of Chinese subways due to the advantages of energy saving, environmental protection, passenger safety, and improvement of the waiting environment. The platform door is installed at the edge of the platform, very close to the train car body, and the door column and threshold are usually made of aluminium and stainless steel [1]. In order to solve the problem of insulation failure of traditional platform door thresholds, threshold manufacturers use composite materials with their own insulating properties to manufacture composite thresholds [2-3]. Instead of the aluminium alloy and stainless steel structures commonly used in the industry, the composite threshold uses polymer composite as the basic carrier, and then covers the aluminium alloy panel on the surface of the basic carrier [4]. The composite threshold consists of a basic carrier of non-metallic material and a panel of



aluminium alloy material. The non-metallic material of the composite threshold has a unique advantage in insulation, but its mechanical properties still need to be verified by experiments.

2. Test requirements

The length of the composite threshold is about 2m, and there are three support points: the left end, the middle, and the right end, as shown in figure 1. The test commissioner provided samples with a length of 1004mm, a width of 132mm, and a thickness of 28mm. The following two tests are required: (1) Static test for bending deformation: under the condition of 1000N static load test on the composite threshold, the surface of the threshold The deflection should not be greater than 1/1000; (2) Dynamic test: apply a pulsating load between 50N and 1000N on the composite threshold. After 1 million cycles of testing, there should be no cracks.

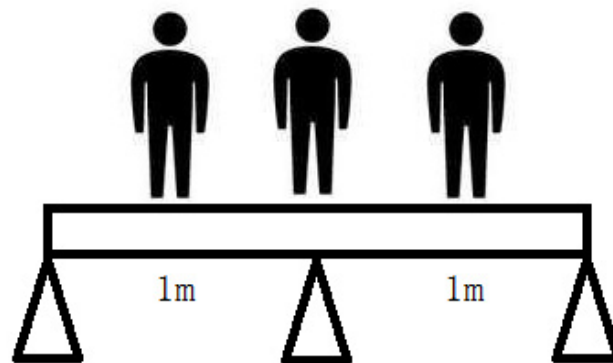


Figure 1. Schematic diagram of composite threshold force

3. Test methods

3.1. Test basis

There are no any relevant reports and research by conducted a domestic and international investigation on the test methods of the platform door threshold. The force of the platform door threshold and escalator step is very similar. There are detailed regulations about the static test and dynamic test of escalators on the GB16899-2011 Safety rules for the construction and installation of escalators and moving walk ways specifies. Therefore, the test method for the composite threshold of platform doors is formulated according to this standard [5].

3.2. Static test

The composite threshold shall be tested for bending deformation. The sample of the composite threshold shall be tested for deflection with a single force of 1000N (including weight of the plate) applied perpendicular to the tread surface on a steel plate 0.2m×0.3m in size and at least 25mm thick, in the center of the tread surface.

During the test, the deflection measured on the surface of the composite threshold shall not be greater than 1/1000.

3.3. Dynamic test

The composite threshold shall be subjected to a load pulsating between 50N and 1000N at one frequency 5HZ for at least 1 million cycles whereby an undisturbed sinusoidal force flow shall be achieved. The load shall be applied perpendicular to the composite threshold surface on a steel plate 0.2m×0.3m in size and at least 25mm thick, the plate should be placed in the center of the sample tread.

3.4. Test equipment

PWS-20 electro-hydraulic servo cascade fatigue testing machine was used as the test equipment. The equipment is mainly used for static loading test, torsion test, fatigue life test, etc. It can meet the test requirements of elevator steps in the GB16899-2011 Safety rules for the construction and installation of escalators and moving walkways specifies. Therefore, PWS-20 electro-hydraulic servo cascade fatigue testing machine can also meet the test requirements of the composite threshold.

4. Test process and results

The static load test and dynamic load test were carried out on the composite threshold samples respectively. Figure 2 shows the schematic diagram of the sample support point. Figure 3 shows the sample clamping and loading methods. According to the static load test, the deflection table (see table 1) and deflection curve (see figure 4) are obtained.

Test results: When a force of 1000N is applied for the static load test, the maximum deflection value is 0.919mm. After 1 million cycles of dynamic load test with a non-interfering resonance force wave with a frequency of 5 Hz and a pulsating load between 50N and 1000N, no cracks were observed in the sample.

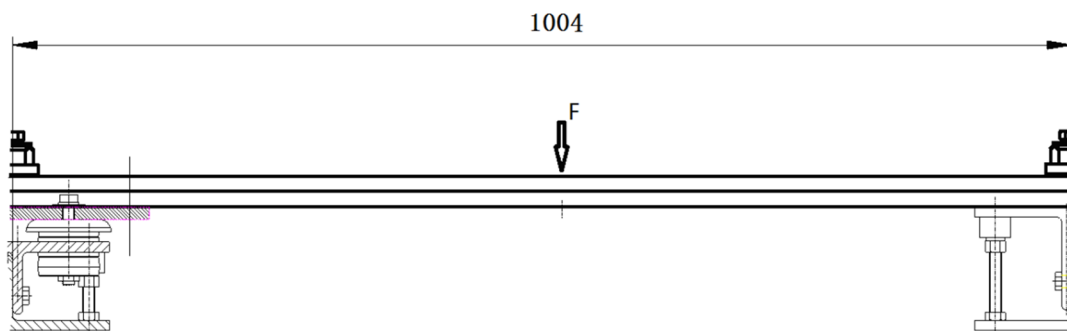


Figure 2. Schematic diagram of sample support points

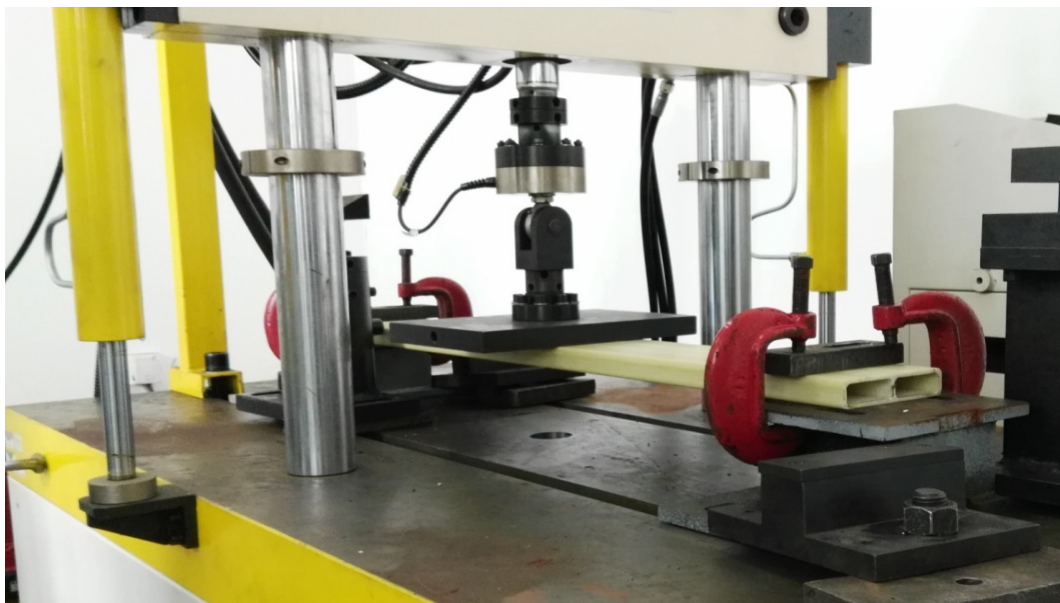


Figure 3. Sample clamping and loading method

Table 1. Static load deflection table

Serial number	Applied force (N)	Deflection before dynamic load test (mm)
1	16	0
2	100	0.107
3	133	0.199
4	275	0.399
5	403	0.511
6	564	0.611
7	686	0.711
8	829	0.811
9	988	0.911
10	1000	0.919

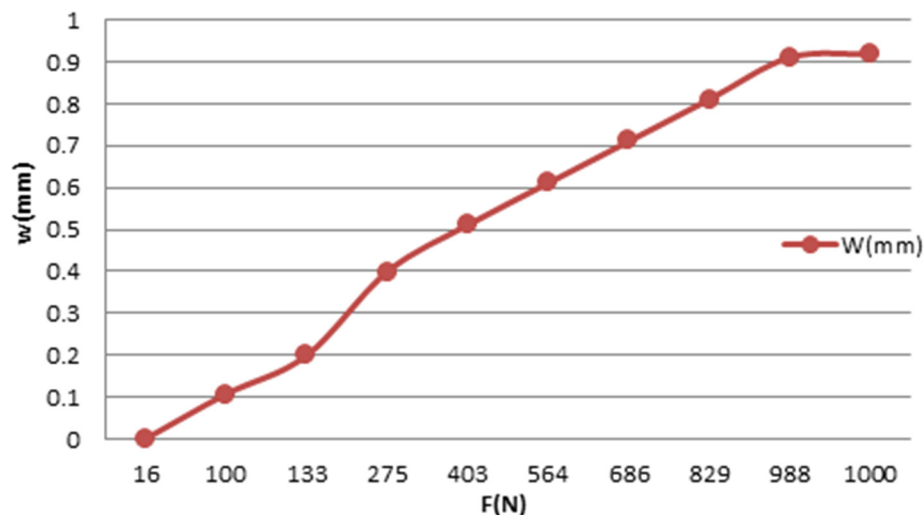


Figure 4. Curve of deflection change under static load

5. Conclusion

In view of the lack of test method for the compound threshold of subway platform doors, this paper formulates the method for the composite threshold of platform door based on the test method of escalator steps and carries out the field test. For the composite threshold made of other materials, this test method can also be used to carry out static load test and dynamic load test.

References

- [1] Ge Jianming, Ge Zewei, Wang Kai, et al. (2016) FRP composite threshold of subway station screen doors: China: 201620181612.X [P]. 08-03.
- [2] Chen Ming, Qi Fengyun, Luo Long. (2019) Development and New Solutions for Solving the Problem of Insulation of PED [J]. Urban Rapid Rail Transit, 32 (6): 21-25.
- [3] Zhang Junling. (2019) Research on the Insulation Scheme of Urban Rail Transit Platform Door Threshold [J]. Urban Mass Transit, (9): 71-73.
- [4] Zu Yu. (2016) A composite threshold for platform doors: China: 20487399.5 [P].

- [5] National Elevator Standardization Technical Committee. Safety rules for the construction and installation of escalators and moving walkways specifies: GB 16899-2011 [S]. Beijing: China Standard Press, 2011: 9.