Research on the law of reflection coefficient of reflective film of traffic sign based on Angle

Yu Meng[1], *Mengru* Sun[2,*], *Dan* Li[3] , *Yufeng* Shi[4] , *Cheng* Cheng[5], *Muyu* Qi[6], and *Ye* Yang[7]

[1,2]10 Yard, East Heping Li Street, Beijing CSTI Testing Technology (Beijing) Co., Ltd, China

Abstract. In this paper, a large number of digital printing reflective film retroreflectivity measurement. Based on the multi-angle test of the reflective film of the mainstream manufacturers in the market, the reverse reflection coefficient of the digital printing reflective film was obtained. Through the curve fitting of the measured values of the backreflection coefficient under different measuring angles by using the scatter plot, the variation law of the luminosity of the digital printing reflective film with incident Angle and observation Angle was obtained. The variation law of backreflection coefficient explored in this paper has certain significance to the application guidance of digital printing reflective film for traffic signs.

Keywords: Inverse reflection coefficient, Angle, Inverse reflection coefficient.

1 Introduction

Reverse reflection, also known as reflection, reflection, regression reflection, recovery reflection, directional reflection or reverse reflection, is a reflection of the reflected light from the opposite direction of the near incident light. This property can be maintained when the direction of the incident ray varies over a large area[1] [2].

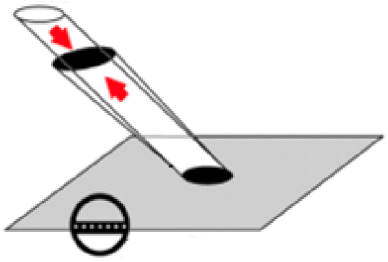

Fig. 1. Retreoreflection.

*Corresponding author: 411226370@qq.com

The technology, developed in the 1920s, involves shining a light on a cat's eyes at night, which emits a strong beam of light that clearly shows the cat's eyes[3]. Inspired by the cat's eyes, people began to study reflective science, in order to use it to reflect the lights of cars and solve the problem of traffic sign recognition[4].

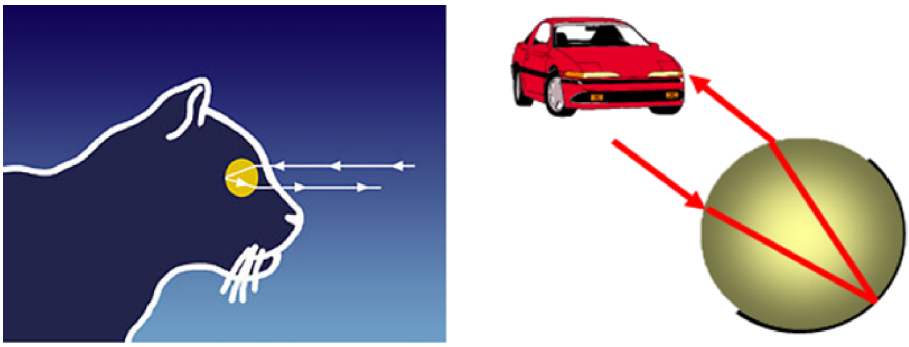

Fig. 2. Reverse reflection schematic diagram.

2 Retroreflection coefficient measurement

2.1 Get the date

In this paper, the research of traffic sign reverse reflection dynamic measurement based on absolute measurement method is adopted[5]. By analyzing the principle of reverse reflection measurement and combining with the relevant research of reverse reflection measurement at home and abroad, the key elements of traffic sign reverse reflection dynamic measurement are put forward: geometric system, light source and receiver. As for uncontrollable variables such as ambient light, signs to be tested and vehicle driving state, further research will be carried out in the following work. The reverse reflection coefficient of traffic signs is tested according to the method specified in "The Common Plane Geometry Method for Testing Method of Reverse Reflection Coefficient" (JT/T 689-2007) [6]. In general, the rotation Angle ε of test is 0° or 90°. Different rotation angles can also be selected for testing according to the requirements of the manufacturer or the entrusting party. The principle of measurement is shown in the figure below.

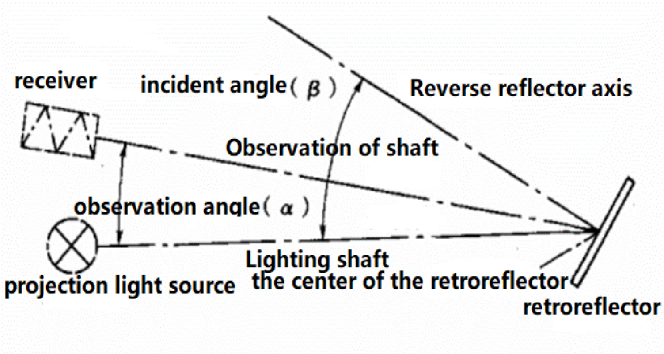

Fig. 3. Survey diagram.

In accordance with the current reflective film measurement standard requirements, we targeted at the current market mainstream reflective film manufacturers for sampling measurement. The selected samples are class IV digital printed reflective film, all of which are digitally printed. Under different observation Angle and incident Angle measurement conditions, the measurement data of white light and yellow light are obtained. The backreflection coefficient was sorted out from the measured data, and the sorting results were shown in Table 1*:*

Table 1. Label reflective film photometric performance test data processing table.

sequence number	observation angle	incident angle	testing result(white)			testing result(yellow)		
			brand1	brand2	brand3	brand1	brand2	brand3
1	0.2°	-4°	1123	705	468	762	444	349
2		15°	926	697	416	627	393	305
3		30°	615	419	354	418	228	252
4	0.5°	-4°	483	468	282	299	243	215
5		15°	510	406	285	314	232	202
6		30°	320	256	116	195	145	87
7	1°	-4°	126	96	63	68	47	49
8		15°	127	100	57	67	46	40
9		30°	112	72	35	65	35	26

2.2 Curve analysis

Through the white light, yellow light reflection coefficient measurement of reflective film produced by mainstream manufacturers in the market, the measurement data of the reflection coefficient under different observation Angle and incident Angle are made into a scatter diagram, curve analysis is carried out, and the influence law of different observation Angle and incident Angle on the photometric performance of reflective film is obtained.

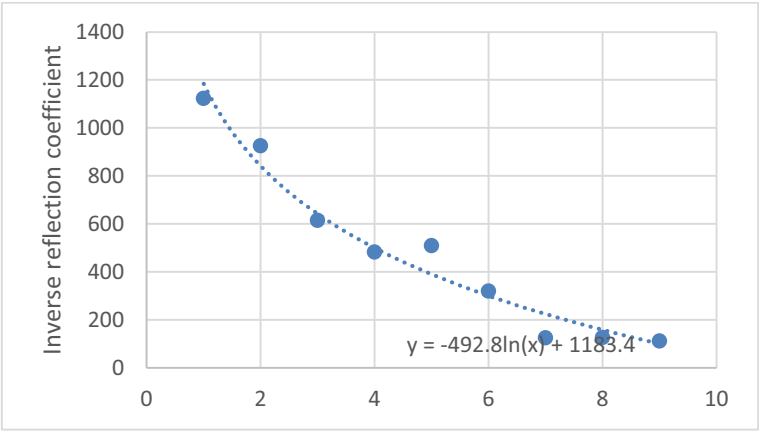

Fig. 4. Brand 1 reflective film photometric performance with the change of Angle(white).

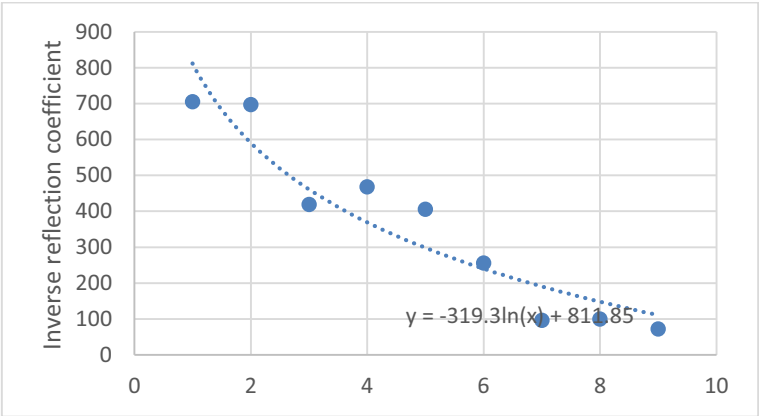

Fig. 5. Brand 2 reflective film photometric performance with the change of Angle(white).

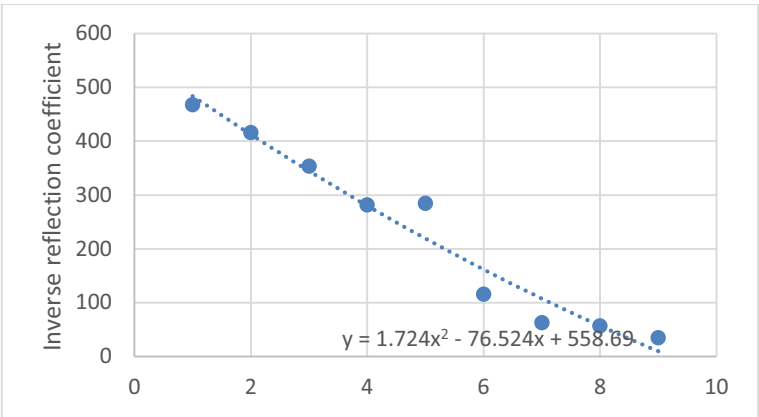

Fig. 6. Brand 3 reflective film photometric performance with the change of Angle(white).

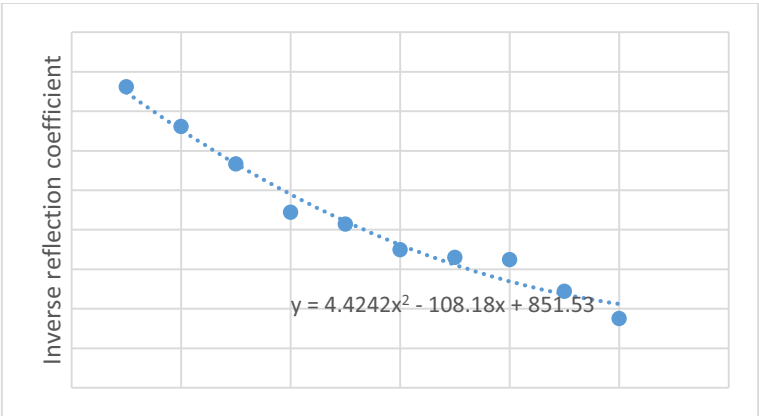

Fig. 7. Brand 1 reflective film photometric performance with the change of Angle(yellow).

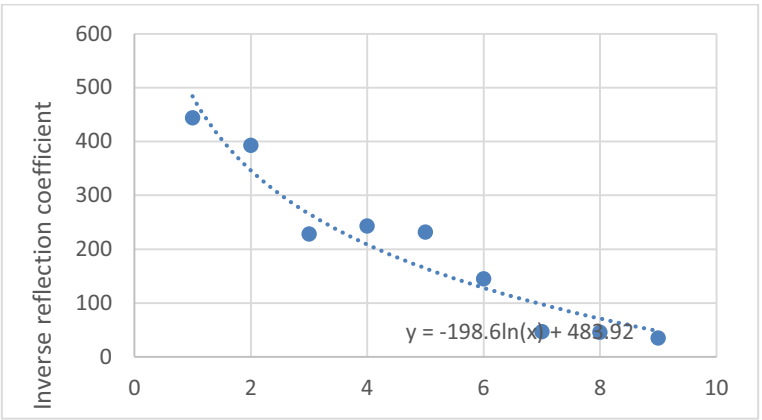

Fig. 8. Brand 2 reflective film photometric performance with the change of Angle(yellow).

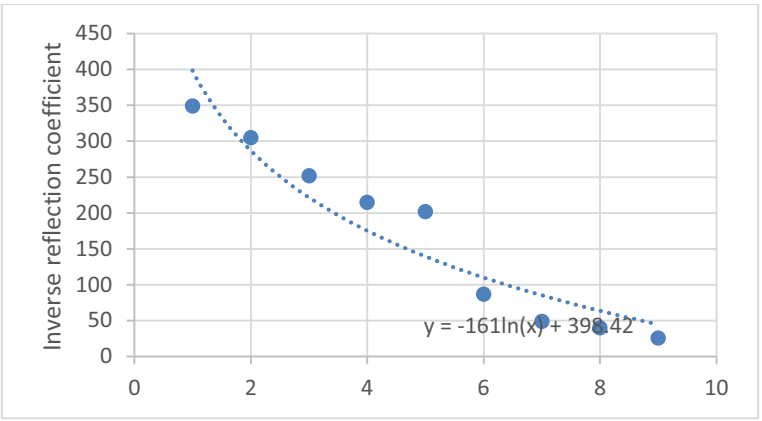

Fig. 9. Brand 3 reflective film photometric performance with the change of Angle(yellow).

It can be seen from several figures that the reflection coefficient of reflective film basically shows logarithmic decreasing trend with the change of observation Angle and incident Angle. From this we get the market mainstream manufacturers of digital printing reflective film photometric performance and observation Angle, incident Angle of the rough relationship, which has a certain significance for digital printing traffic sign reflective film application.

References

1.]Wen-ying Su, Hong-qin Li; Parse the line standard "terminology of reverse reflection" [J];Traffic standardi-zation;2007,06:53-57.
2. Shang-Wang. A little understanding of the standard value of the brightness coefficient of the reverse reflection after the implementation of the new national standard for traffic line marking [J]; Technology Wind,2011, 8:32-37.
3. Wei-Li;Chuan-zheng Zhu; The metrological verification technology of reverse reflection measurement system [J]; Highway Traffic Science and Technology;2012,02:25-28.
4. Wen-yuan Han. Evaluation of Uncertainty of Reverse Reflection Measurement System [J]; Highway Traffic Science and Technology;2006,08:17-21.

5. Wen-ying Su;Dan-Li; Reverse reflection performance and night visual recognition of road traffic signs [J]; Highway Traffic Science and Technology;2009,02:35-41.
6. JT/T 689-2007, Test method for coefndent of retrorehction of utilizing the coplanar geometry[S] . BeiJing: People's Communications Press,2007.