

Laboratory Method of Evaluating and Testing Raised Pavement Markers

SC T 111

1. Scope

This test method outlines the procedure for preparing and testing of raised pavement markers.

2. Referenced Documents

2.1. SCDOT Standard Specifications for Highway Construction

3. Apparatus

3.1. Fifty (50) foot long hallway

3.2. Two wooden platforms for light source

3.3. Photometer equipment

3.3.1. Spectra Pritchard Photometer

3.3.2. Advance Retro Technology-model 980 projection light source

3.3.3. SOLA transformer (used in conjunction with light source and photometer)

3.4. Abrasion testing

3.4.1. Steel wool (#3 Coarse)

3.5. Compression testing machine 2000 lbs. +cap

3.6. Impact test apparatus (18 inch/45.7 cm drop)

3.6.1. 0.42 lb (190 gm) dart weight

3.6.2. Convection oven (60°C/140°F) cap

3.6.3. 0.25 inch (0.64 cm) radius spherical head

4. Test Specimens

4.1. Typically, twenty-five (25) markers of each type selected at random from each shipment or lot will constitute a representative sample. The face to be tested must be clean and free of marks, scratches, and debris.

5. Procedure

The marker being tested shall be located base down with the center of the reflective face 50 feet from the calibrated light source with a blue/red ratio of 2856° Kelvin. The reflected light and the incident light shall be measured by means of a photometer. The "SI" formula shall be used to determine the specific intensity values for the reflective surface.

- 5.1. Optical: (Reflectance) Two platforms are set up with light source and photometer equipment 50 feet apart squared against a wall and aligned with each other. Black curtains are used at each end to create a controlled dark setting. The equipment is allowed to warm up for 30 minutes. The photometer is set on Cal.-Open. Zero readings are taken at: (1) Zero Amplifier (2) Auto zoom Dark Control (3) Internal Calibrate (set at 5:00) (4) Range Auto.
- 5.2. An initial light reading is taken after resetting the photometer to photopic-ND-4 and rechecking zero steps. Then the photometer is relocated back to the platform above the light source at the other end of the hallway. Marker number one is placed level on the test plate on the platform at the opposite end from the test equipment, aligned, and light source and photometer alignment are checked. Set the photometer at 0.2 degrees divergence angle, making sure the marker is level. Test 10 markers for reflectance this way at 0 degrees incidence angle. When these tests are completed, set the turntable to 20 degrees incidence angle and test all markers as above, checking all alignments in between the two angle changes. When testing is completed, remove the marker test plate. Place the photometer back on its platform at the opposite end of the hallway, align it with the light source and take zero readings at the four (4) settings used initially at the beginning of testing. Take a final light reading.
- 5.3. Abrasion: Form a 1-inch diameter flat pad using #3 coarse steel wool. Place the steel wool pad on the reflector, apply a pressure of 50 ± 0.5 pounds and briskly rub the entire reflective surface at least 50 times.
- 5.4. Impact: Condition the markers in a convection oven at 130°F for one hour. While at the elevated temperature, impact the reflective face by allowing a 0.42 lb. (190 gm) dart fitted with a 0.25 in. (0.64 cm) radius spherical head to drop 18 in. (45.7 cm) perpendicularly onto the center of the reflective surface. Cracks in the impact area shall be generally concentric in appearance.
- 5.5. Strength: The marker shall be centered base down over the open end of a vertically positioned hollow metal cylinder. The cylinder shall be one inch high with an internal diameter of three inches and a wall thickness of one-fourth inch. A load shall be applied to the top center of the marker by means of a 1-inch solid steel plug approximately 1 inch high. The rate of loading shall be approximately 2000 pounds per minute. Failure shall constitute either breakage or significant delamination of the shell and the filler material at a load less than 2000 pounds.

6. Calculations

Specific Intensity – The mean candlepower of the reflected light at a given incidence¹ and divergence² angle for each foot-candle at the reflector on a plane perpendicular to the incident light.

$$SI = \frac{R_L \times D^2}{}$$

I_L

Where: SI = Specific Intensity ($cd\ fc^{-1}$)
 R_L = Reflected Light
 I_L = Incident Light (Light Source)
 D = Test Distance

Notes: ¹ Angle of Incidence – The angle formed by a ray from the light source to the marker, and the normal to the leading edge of the marker face.

² Angle of Divergence – The angle formed by a ray from the light source to the marker, and the returned ray from the marker to the measuring receptor.

7. Report

7.1 Specific Intensity (nearest $0.1\ cd\ fc^{-1}$)

7.2 Abrasion resistance (report observation)

7.3 Impact testing:

7.4 Strength (whether less or greater than 2000 pounds)

Test results are reported on Lab Form TM 808.