Test Procedure for

MEASURING RETROREFLECTIVITY

TxDOT Designation: Tex-842-B

Effective Date: November 2004

1. SCOPE

1.1 Use this procedure for measuring the retroreflectance of any retroreflective material.

1.2 The values given in parentheses (if provided) are not standard and may not be exact mathematical conversions. Use each system of units separately. Combining values from the two systems may result in nonconformance with the standard.

2. SAMPLES

2.1 Sampling should follow the procedures outlined in the specification for that material being tested.

3. APPARATUS

3.1 Test room, light tight, painted flat black, measuring 16.75 × 1.5 m (55 × 5 ft.) to allow a 15.25 m (50 ft.) test distance. (See Figure 1.)

3.2 Tektronix J-16, 32-digit digital photometer.

3.3 Tektronix J-6503, foot-lambert probe.

3.4 Extension cable, 23 m (75 ft.), connecting J-16 and J-6503.

3.5 Viewlex Model V-35, modified 500-watt slide projector, with a mask for projecting a circle of light approximately 0.6 m (2 ft.) in diameter at 15.25 m (50 ft.); projector is capable of accepting either CZR or BTR projector lamps (both with color temperature of approximately 3000 K).

3.6 Automatic Line-Voltage Regulator, PVR 120 50 BV, STACO.

3.7 Goniometer, made from a modified surveying instrument transit head.

3.8 Crystal prismatic reflector units, 40 mm (1-5/8 in.) and 76 mm (3 in.) diameter, used as calibration standards in determining the incident light.

3.9 Holder for reflector buttons, made to fit on the goniometer and capable of spinning the buttons at approximately 300 rpm; holder made to accept buttons of any size.
3.10 Voltmeter, Triplet, Model 736C, range 0–150 volts.

3.11 Small rectangular mirror, approximately 50 × 75 mm (2 × 3 in.)

3.12 Trolley and track arrangement, used to move J-6503 probe relative to the light source, in order to set the proper divergence angle.

3.13 Front-surfaced mirror, mounted at 45 degrees to J-6503 probe, to conduct reflected light into the probe.

3.14 Small cooling fan, mounted beneath the projector, for extra cooling for the light source.

3.15 Flat black rigid metal mask, with a 305 × 305 mm (12 × 12 in.) hole or aperture centered in the mask; the mask must be of sufficient size to facilitate the spray apparatus described below.

**Figure 1—Darkroom Layout**

4. **PROCEDURE**

4.1 Calibrate:

4.1.1 Turn on the equipment and allow at least 15 minutes warm-up.
4.1.2 Mount the reflector button holder on the goniometer.

4.1.3 Set the divergence angle at 0.2° and the entrance angle at 0°.

4.1.4 Turn on the light source projector. All other lights in the corridor should be off, except the operator's light near the J-16 Photometer.

4.1.5 With the small mirror taped to the button holder, spin the holder slowly by hand and adjust the goniometer so that the reflective light from the mirror is returned directly back to the projector.

4.1.6 Remove the mirror from the button holder and place the prismatic standard in the holder. (Use the 75 mm [3 in.] standard for delineators and the 40 mm [1 5/8 in.] standard for any other material to be tested.)

4.1.7 Turn on the motor to spin the standard. Note the reading on the J-16 Photometer.

4.1.8 Remove the standard from the holder.

4.1.9 Turn on the spinner again and note the reading on the J-16 Photometer.

4.1.10 Subtract this reading from the reading obtained in Section 4.1.7 above.

4.1.11 Record this net value as Rstd under Section 5.

4.2 Measure Retroreflectivity:

4.2.1 Place material to be evaluated in or on the goniometer. If the material is not a prismatic reflector, remove the holder and spinning apparatus.

4.2.2 Set the appropriate divergence and entrance angles.

4.2.3 Read the indicated value from the J-16 Photometer.

4.2.4 Remove the test specimen from the goniometer and read the indicated value from the J-16 Photometer.

4.2.5 Subtract this value from the value obtained in Section 4.2.3.

4.2.6 Record this net value as R under Section 5.

4.2.7 Repeat Sections 4.2.2 through 4.2.6 for each set of required divergence and entrance angles.
5. **CALCULATIONS**

5.1 Calculate the specific intensity:

\[
SI = \frac{D^2 \cdot R}{A \cdot R_{std} \cdot K}
\]

Where:

- **SI** = Specific Intensity in units of candlepower per meter candle per square meter, or candlepower per meter candle per unit
- **D** = Distance in meters, 15.25 m (50 ft.)
- **R** = Light reflected by sample
- **A** = Area of sample, in square meters (if on a per unit basis, then A = 1)
- **R_{std}** = light reflected by standard during calibration
- **K_i** = Factor for incident light: amount of incident light projected on the standard / amount of light returned to the probe by the standard.

6. **REPORT**

6.1 See Tex-720-I.

<table>
<thead>
<tr>
<th>Test Sample Size</th>
<th>Criteria for Acceptance</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 Buttons</td>
<td>24 Pass</td>
</tr>
<tr>
<td>25 Buttons</td>
<td>24 Pass</td>
</tr>
<tr>
<td>25 Delineators</td>
<td>24 Pass</td>
</tr>
<tr>
<td>5 Markers</td>
<td>4 Pass</td>
</tr>
<tr>
<td>Each</td>
<td>Pass</td>
</tr>
<tr>
<td>5 Faces</td>
<td>4 Pass</td>
</tr>
</tbody>
</table>