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Standard Guide for Retroreflective Composite Optics Laboratory Procedures[1]

This standard is issued under the fixed designation D8424; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide presents a series of options for evaluating lot-to-lot consistency of retroreflective composite optics of the same type and form from the same manufacturer and does not recommend any specific course of action to be taken. This guide is meant to increase the awareness of information and approaches and is not meant to recommend any specific course of action per ASTM's Form and Style for ASTM Standards definition for a Guide.

1.1.1 This guide does not determine lab procedure selection or acceptance criteria for a specific retroreflective composite optics product for its intended use. It is the responsibility of the manufacturer and customer to negotiate these details based on their specific needs.

1.1.2 This guide is not intended to predict in-service performance levels.

1.1.3 This guide is not intended for comparison of different types of composite optics or manufacturers of composite optics.

1.2 *Units*—The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C702 Practice for Reducing Samples of Aggregate to Testing Size

D1921 Test Methods for Particle Size (Sieve Analysis) of Plastic Materials

D2486 Test Methods for Scrub Resistance of Wall Paints

D7428 Test Method for Resistance of Fine Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus

E1349 Test Method for Reflectance Factor and Color by Spectrophotometry Using Bidirectional (45°:0° or 0°:45°) Geometry

E1710 Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN-Prescribed Geometry Using a Portable Retroreflectometer

2.2 *AASHTO Standards:*[3]

AASHTO TP-130-18 Producing Draw Down Panels and Measuring the Coefficient of Retroreflected Luminance (R_L) of Pavement Markings in a Laboratory Panel

3. Terminology

3.1 *Definitions:*

3.1.1 *installed pavement markings, n*—pavement markings applied to a road surface for the purpose of guiding traffic.

3.1.2 *pavement marking material, n*—a pigmented binder system used for lane delineation for highways, parking lots, and other areas subject to vehicular traffic; applicable pavement marking materials include waterborne traffic paint, solvent borne traffic paint, thermoplastic, plural component such as epoxy, modified epoxy, polyurea, and methyl methacrylate.

3.1.3 *pavement marking sample, n*—a properly cured pavement marking of specified width, length, and thickness applied to an appropriate, substrate panel; the pavement marking has

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001, http://www.transportation.org.

drop-on particles embedded in the surface of the marking to provide various performance characteristics such as retroreflectivity, color, and skid resistance.

3.1.3.1 *Discussion*—For the purpose of measuring retroreflectivity after scrubbing procedures in this document, the size of the scrub area of the pavement marking sample needs to meet or exceed the dimensional requirements for the retroreflectometer and satisfy the minimum measurement area requirements of Test Method E1710 (50 cm^2). For practical purposes, an area 70 mm by 200 mm (2.8 in. by 7.9 in.) meets the requirements for most commonly used retroflectometers, and exceeds the minimum requirements of Test Method E1710. Refer to your retroreflectometer manufacturer for details.

3.1.4 *retroreflective composite optics, n*—a multi-component retroreflective optical construction including but not limited to:

(1) A core covered with a pigmented adhesive and small glass or ceramic optical beads.

(2) A cluster of optical ceramic or glass beads distributed in a polymeric matrix.

(3) An optical glass bead core, covered with a pigmented adhesive and small glass or ceramic optical beads.

3.1.5 *substrate panel, n*—a panel used for the application of a pavement marking material to produce a pavement marking sample; the panel should be flat, dimensionally stable, compatible with the pavement marking material, bonds adhesively to the pavement marking material, and a dimension which complies with the sample size of the washability tester (scrub tester) and the measurement profile of Test Method E1710 (100 mm (4 in.) minimum wide by 250 mm (10 in.) minimum long panel).

4. Summary of Guide

4.1 This guide provides laboratory procedures, for retroreflective composite optics to: (*1*) evaluate retroreflective composite optics as received by the purchaser in bulk form, and (*2*) evaluate retroreflective composite optics applied in a pavement marking sample.

4.2 Determining which lab procedures to select and the acceptance criteria is outside the scope of this guide.

5. Significance and Use

5.1 The nighttime retroreflective properties of pavement markings are known to improve driving safety. Retroreflective composite optics have been developed to improve retroreflectivity in dry and rainy wet conditions. For customers purchasing these materials it's important to verify the consistency and performance. This guide provides a set of laboratory procedures which can be selected individually or together to evaluate lot-to-lot consistency of composite optics of the same type and manufacturer. These are not in-service performance procedures and don't necessarily predict in-service performance.

6. Sampling and Sample Preparation

6.1 To obtain representative samples from packaged containers, blenders, or storage tanks, sampling methods outlined in Practice C702 should be followed.

6.2 Isolate a retroreflective composite optics sample large enough for all lab procedures.

7. Retroreflective Composite Optics Lab Procedures

7.1 *Bulk Retroreflective Composite Optics Procedures*—These procedures are intended for lot-to-lot comparison of retroreflective composite optics for purposes of ensuring consistency. These lab procedures are not intended to predict on-road retroreflectivity performance as on-road retroreflectivity performance is impacted by many application and environmental factors.

7.1.1 *Retroreflective Composite Optics Bulk Color*—This is a lab procedure for measuring the color of the retroreflective composite optics in bulk form. A sample of retroreflective composite optics is placed in a small container and the color is measured using a handheld spectrophotometer per Test Method E1349 using a 0/45, 45/0 instrument with CIE illuminant D65 and 2° observer.

7.1.1.1 Into a petri dish approximately 12.7 mm (½ in.) deep and 88 mm (3½ in.) diameter, add about 50 g or approximately 40 mL of retroreflective composite optics.

7.1.1.2 Tap and shake the petri dish to level the layer of optics in the dish.

7.1.1.3 Place the port of the handheld spectrophotometer on the horizontal surface of retroreflective composite optics.

7.1.1.4 Take a measurement.

7.1.1.5 Record *Y*, *x*, *y*.

7.1.2 *Retroreflective Composite Optics Roller Mill Performance (Weight Retention)*—This is a lab procedure for measuring retroreflective composite optics performance in a roller mill as it relates to crushing and grinding. A retroreflective composite optics sample of known weight is placed in a ceramic ball mill with grind media and rolled at a specified rate for a specified number of revolutions. The sample is sieved, cleaned, dried, and weighed. The result is reported as percent weight (% wt.) retention compared to the original sample weight.

7.1.2.1 Measure a 250 mL sample of retroreflective composite optics.

7.1.2.2 Weigh the 250 mL sample and record the weight.

7.1.2.3 Place retroreflective composite optics in a ceramic ball mill jar with outside dimensions approximately 15.2 cm long by 15.2 cm diameter, excluding the mouth and neck.

7.1.2.4 Carefully place 1000 g of 19 mm (¾ in.) diameter clean ceramic balls into the ceramic ball mill jar with the sample.

7.1.2.5 Put the lid on the ball mill and secure.

7.1.2.6 Put the ball mill on a jar roller.

7.1.2.7 Roll the ceramic ball mill jar containing retroreflective composite optics and ceramic balls for 1500 revolutions at 100 rpm.

7.1.2.8 Pour the contents of the ball mill jar into a #3 sieve to separate the ceramic balls from the sample.

7.1.2.9 Sieve the retroreflective composite optics to remove fines and debris generated by milling. A sieve with opening size approximately half the diameter of the smallest retroreflective composite optics in the sample is recommended.