Standard Practice for

Determination of Size and Shape of Glass Beads Used in Traffic Markings by Means of Computerized Optical Method

AASHTO Designation: R 98-20[1]

Technical Subcommittee: 4c, Markings and Coatings

Release: Group 2 (June)

American Association of State Highway and Transportation Officials
444 North Capitol Street N.W., Suite 249
Washington, D.C. 20001

Standard Practice for

Determination of Size and Shape of Glass Beads Used in Traffic Markings by Means of Computerized Optical Method

AASHTO Designation: R 98-20[1]

Technical Subcommittee: 4c, Markings and Coatings

Release: Group 2 (June)

1. SCOPE

1.1. This practice describes measuring size and shape of translucent glass beads used in traffic markings with computerized optical equipment. This practice is intended for glass beads from 0.15 mm to 2.35 mm in diameter.

1.2. *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to its use.*

2. REFERENCED DOCUMENTS

2.1. *AASHTO Standards*:

- M 247, Glass Beads Used in Pavement Markings
- R 76, Reducing Samples of Aggregate to Testing Size

2.2. *ASTM Standards*:

- B215, Standard Practices for Sampling Metal Powders
- C670, Standard Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials
- D1155, Standard Test Method for Roundness of Glass Spheres
- D1214, Standard Test Method for Sieve Analysis of Glass Spheres

2.3. *ISO Standards*:

- ISO 14488, Particulate Materials—Sampling and Sample Splitting for the Determination of Particulate Properties
- ISO 3252, Powder Metallurgy—Vocabulary

2.4. *Other Reports:*

- NCHRP Web-Only Document 156, *Optical Sizing and Roundness Determination of Glass Beads Used in Traffic Markings,* http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_w156.pdf

- NCHRP 20-07 (364) Final Report, Revision of AASHTO PP-74 Test Method for Optical Sizing and Roundness Determination of Glass Beads Utilized in Traffic Markings, http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP20-07(364)_FR.pdf

3. TERMINOLOGY

3.1. *Definitions*:

3.1.1. *vibrating feeder*—vibration unit for control of particle delivery and for dispersing particles.

3.1.2. *funnel (hopper)*—for feeding the glass beads to the device.

3.1.3. *measurement shaft*—volume through which particles fall and their images are captured.

Note 1—Two methods can be employed to capture optimum orientation of particles as they tumble through the sensing zone. One is to use a guide plate and the other is to use three-dimensional (3D) measurement of all particles.

3.1.4. *guide plate*—particles fall through an adjustable-width set of guide plates to keep particles focused but randomly oriented to show all possible projections to the camera. This provides a two-dimensional (2D) measurement of at least one orientation of each particle measured. Size (width and length) and shape (aspect ratio and form factor) are measured from the images taken.

3.1.5. *three-dimensional (3D) measurement*—multiple images of single particles falling through the sensing zone will be captured. In the case where the particles are tumbling and turning in an optimum way, the largest (length, L) and smaller (width, W) dimensions can be estimated from the largest projected area captured. In addition, the third major dimension of the particle (thickness, T, reported as the smallest dimension) is measured and reported from the smallest projected area image. SPHT (Section 3.2.1) is calculated from the largest projected area image. Figure 1 shows a row of images from different views of the same particle captured multiple times as it tumbles (optimum case). This allows views of both the largest and smallest projected areas to be measured.

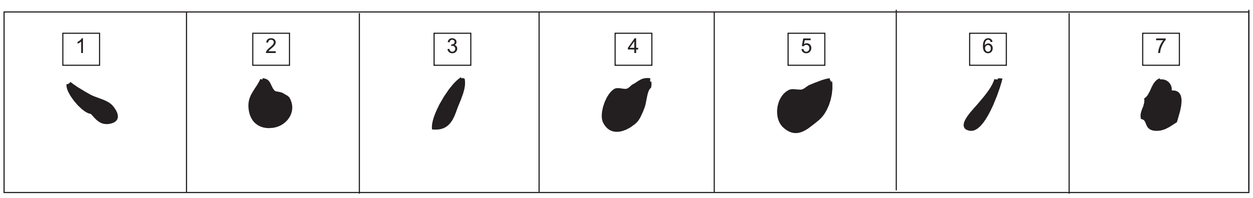

Figure 1—Schematic Diagram of Particle as It Falls through the Measurement Zone of the 3D Digital Particle Analyzer. The camera recognizes and follows every particle by taking multiple pictures when particles fall through the imaging zone. The 3D software uses the particle marked "3" for the measurement of thickness and the particle marked "5" for the measurement of length and width.

3.1.6. *image capturing device*—digital cameras with lenses to capture free-falling particles.

Note 2—Two methods of image focus and capture can be employed. The images from the two methods are used for 2D or 3D (multiple 2D images) analysis of the particles. The 2D method requires one or more fixed-position cameras and the 3D analysis requires one adjustable-position camera.

3.1.7. *one or two fixed-position cameras (2D)*—the high-resolution digital cameras provide two different levels of magnification, the higher magnification to measure the smaller particles, in a smaller frame area, and the lower resolution to measure larger particles in a larger frame area. This method uses a normalization algorithm to put together two distributions of sizes and shapes of particles captured at two different magnifications. Because of this algorithm, the higher-magnification