Designation: D 3319 – 00

Standard Practice for the Accelerated Polishing of Aggregates Using the British Wheel[1]

This standard is issued under the fixed designation D 3319; 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 practice covers a laboratory procedure by which an estimate may be made of the extent to which different coarse aggregates may polish.

1.2 *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 and health practices and determine the applicability of regulatory limitations prior to use.*

1.3 The values stated in inch-pound units are to be regarded as the standard.

2. Referenced Documents

2.1 *ASTM Standards:*

C 778 Specification for Standard Sand[2]

D 75 Practice for Sampling Aggregates[3]

D 1415 Test Method for Rubber Property—International Hardness[4]

E 303 Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester[3]

E 501 Specification for Standard Rib Tire for Pavement Skid-Resistance Tests[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *initial friction value*, *n*—the initial British Pendulum Tester readings on the test specimens before they are polished in the accelerated polishing machine.

3.1.2 *polish value*, *n*—a measure of the state of polish reached by a test specimen subjected to accelerated polishing using the materials, equipment, and procedures described in this method. The measurement is made using the British Pendulum Tester as described in 5.3 and Test Method E 303.

4. Significance and Use

4.1 This practice simulates the polishing action of vehicular traffic on coarse aggregates used in bituminous pavements.

4.2 A polish value is determined that may be used to rate or classify coarse aggregates for their ability to resist polishing under traffic.

5. Apparatus

5.1 *Accelerated Polishing Machine*[5]—An accelerated polishing machine, also known as the British Wheel, and based upon a 1958 design by the Road Research Laboratory of Great Britain. This machine shall be mounted on a firm, rigid, and level base. The equipment shall include the following:

5.1.1 *Cylindrical Wheel*, hereafter referred to as the road wheel, and having a flat-surface periphery and of such size and shape as to permit 14 specimens described below to be clamped onto the periphery to form a continuous surface of aggregate particles, 1¾ in. (44.45 mm) wide and 16 in. (406.4 mm) in diameter.

5.1.2 A means of rotating the road wheel about its own axis at a speed of 320 ± 5 rpm.

5.1.3 A means of bringing the surface of a rubber-tired wheel 8 in. (203.2 mm) in diameter and 2 in. (50.8 mm) wide to bear on the aggregate specimens mounted on the surface of the road wheel with a total load of 88 ± 1 lbf (391.44 ± 4.45 N). The tire shall be treated, if necessary, to obtain a true running surface. The tire shall be free to rotate about its own axis, which should be parallel to the axis of the road wheel. The plane of rotation of the tire shall coincide with that of the road wheel. Before a new tire is used on a test, it shall be conditioned by a preliminary run of 6 h with a 150-grit silicon carbide using dummy specimens (extra or used) on the road wheel.

5.1.3.1 *Alternate Tire No. 1*—An industrial 8 by 2 pneumatic smooth-tread handtruck tire (Note 1). The tire rubber hardness shall be 55 ± 5 IRHD measured in accordance with Test Method D 1415. The tire shall be inflated to a pressure of 45 ± 2 psi (310.26 ± 13.79 kPa).

[1] This practice is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.51 on Aggregate Tests.

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[2] *Annual Book of ASTM Standards*, Vol 04.01.

[3] *Annual Book of ASTM Standards*, Vol 04.03.

[4] *Annual Book of ASTM Standards*, Vol 09.01.

[5] Available from Wessex Engineering and Metal Craft Co., Ltd., Merchants Barton, Frome, Somerset, England.

NOTE 1—This is the tire originally supplied with the Accelerated Polishing Machine[5] and known by the tire manufacturer's designation Dunlop RLI 8 by 2. Dunlop discontinued manufacturing of this tire in February 1979. It is retained as an alternate in this practice for those users who may still have a supply and in the event that Dunlop should resume manufacturing it in the future.

5.1.3.2 *Alternate Tire No. 2*—An industrial 2.80 by 4 (8 in. OD by 4 in. ID), 4 NHS-4 ply, cross-hatch pattern tread hand-truck tire (Note 2). The tire shall be inflated to a pressure of 35 ± 2 psi (241.32 ± 13.79 kPa).

NOTE 2—When it became known that the Dunlop tire (5.1.3.1) was no longer being manufactured, the necessity of finding a replacement tire for the practice was evident. A search and study by the Texas State Department of Highways and Public Transportation culminated in finding this tire, a Goodyear Industrial All Weather Hand-Truck tire size 2.80 by 4 (Goodyear Product Code 202-008-002), to give Polish Values equal to those obtained with the Dunlop tire.[6] A suitable inner-tube such as Goodyear G250-4 (Product Code 199-010-700) is necessary. It was also found necessary to modify the 4-in. wheel furnished with the Accelerated Polish Machine[5] to facilitate mounting the Goodyear tire. Approximately 0.10 in. should be removed from the wheel diameter and a larger hole provided for the value stem. This did not affect mounting and use of the Dunlop tire.

5.1.4 A means to feed the 150-grit silicon carbide abrasive at the rate given in 8.5. The grit shall be fed continuously and with a uniform distribution across the width of the specimens. The grit shall be applied directly onto the road wheel surface ahead of the point of contact with the rubber-tired wheel.

5.1.5 A means to feed the water at the rate given in 8.5 in such a way that the water is spread continuously and uniformly over the surface of the road wheel ahead of the point of contact with the rubber-tired wheel.

5.2 *Metal Molds*—A number of accurately machined metal molds for preparing specimens. The specimen formed is 3.5 by 1.75 by 0.63 in. (88.90 by 44.45 by 16.0 mm) and shall be curved to fit on a surface having an 8-in. (203-mm) radius of curvature.

5.3 *British Pendulum Tester*—A friction-measuring device. The British Pendulum Tester used shall conform to Method E 303.

5.3.1 The slider contact path shall be 3 ± 1/16 in. (76.20 ± 1.59 mm).

5.3.2 The slider width shall be 1¼ in. (31.75 mm).

5.3.3 The rubber that is bonded to the slider shall be ¼ by 1 by 1¼ in. (6.35 by 25.4 by 31.75 mm).

5.3.4 The rubber shall meet the requirements of Specification E 501.

5.3.5 The zero adjustment shall be checked before and after testing the specimens and as often as the operator deems necessary.

5.3.6 The calibration procedures of Test Method E 303 shall be used. However, after calibration the small slider shall be inserted.

6. Materials and Supplies

6.1 *Water*—A supply of tap water for use where water is required for any purpose in this method.

6.2 *Fine Sand*—A supply of fine sand for sifting into the interstices of the aggregate prior to placing of the bonding material. Standard sand conforming to Specification C 778 has been found suitable for this purpose.

6.3 *Mold Release Agent*—The use of a mold release agent is optional. A mold release agent may be used to prevent bonding between the mold and the bonding material. Silicon release agent and paste wax as used for automobiles and floors has been found suitable. The user should use care to prevent this agent from being absorbed by the aggregate as it could affect the measured polish value.

6.4 *Silicon Carbide Grit*—A supply of silicon carbide grit (150-grit size) to be used as the polishing agent. Grit should be checked for gradation using Nos. 100 (150 µm), 140 (106 µm) and 200 (75 µm) sieves and separated if necessary to maintain a uniform gradation passing the 100 (150 µm) sieve and retained on the 200 (75 µm) sieve.

6.5 *Bonding Agent*—A supply of polyester resin and catalyst (or another suitable bonding material, such as an epoxy resin) having a pot life of 20 to 30 min and a curing time of 3 to 6 h. This bonding agent shall not be so fluid as to flow through the fine sand.

6.5.1 An optional bonding agent may be used to eliminate use of the fine sand. This bonding agent must be quite viscous so that it will not flow completely around the aggregate particles and become part of the surface of the test specimen. Examples of suitable materials are given in Appendix X1.

6.5.2 Follow the manufacturer's precautions concerning storage and use of resin and catalyst.

6.6 *Coarse Aggregate*—Approximately a ½ ft^3 (0.014 m^3) supply of coarse aggregate to be tested and sampled in accordance with Practice D 75. The aggregate shall be normal plant run but laboratory-crushed material may be tested, if so identified.

7. Test and Control Specimens

7.1 At least five test specimens for each coarse aggregate shall be tested.

7.2 Laboratories evaluating only a few coarse aggregates each year shall include standard laboratory control specimens in each run. Two sets containing five test specimens each will allow the inclusion of four control specimens. With an accumulation of polish value history, the control specimens may be eliminated. This will allow an increase in the number of the coarse aggregate test specimens for the two sets.

7.3 The aggregate to be tested shall pass the ½-in (12.7-mm) sieve and shall be retained on a ⅜-in. (9.5-mm) sieve.

NOTE 3—Aggregate gradation may be varied to meet the needs of the user if reported with the test results. However, aggregates larger than ½ in. (12.7 mm) may not be accommodated by the mold, and aggregates smaller than ⅜in. (9.5 mm) may not be adequately bonded in the specimen molding process to be retained for the duration of the test.

7.4 Thoroughly wash and dry the aggregate to be tested at 100 to 110°C to essentially constant weight.

7.5 Coat the mold with mold-release agent.

7.6 Each specimen shall contain a single layer of dry aggregate placed by hand as densely as possible with a flat

[6] Supporting Data are available from ASTM Headquarters. Request RR: D04-1002.