Designation: E660 – 90 (Reapproved 2021)

Standard Practice for Accelerated Polishing of Aggregates or Pavement Surfaces Using a Small-Wheel, Circular Track Polishing Machine[1]

This standard is issued under the fixed designation E660; 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.

INTRODUCTION

The Small-Wheel Circular Track Wear and Polishing Machine[2] is a device developed to rate aggregates and paving mixtures on their skid resistance after exposure to wearing and polishing. It is a small-diameter, circular track machine capable of accelerated wearing and polishing of pavement specimens. Correlation and comparison can be accomplished through the use of control specimens that are tested simultaneously with regular test specimens. Track capacity is twelve individual specimens per test run.

The actual wearing and polishing for bituminous pavement specimens and exposed aggregate specimens are provided by the action of four smooth pneumatic tires to eliminate, as much as possible, the variables associated with tire tread pattern effects. The wheels are adjusted for camber and for toe-out to provide scrubbing action for polishing without the aid of water or grinding compounds.

To provide accelerated wear sufficient to remove the top textured layer from portland cement concrete pavement specimens and to expose the coarse aggregate, as often encountered on worn pavements that have been in use for substantial periods of time, the wear and polish procedure can be modified by use of steel wheels having studs mounted in the periphery. The procedure for concrete specimens consists of a period of operation with four smooth pneumatic tires to polish the as-built surface, followed by a period of accelerated wear using the steel wheels to expose the coarse aggregate, followed by a final polishing cycle using the four rubber tires again to polish the exposed aggregate.

1. Scope

1.1 This practice describes a laboratory procedure for estimating the extent to which aggregates or pavement surfaces are likely to polish when subjected to traffic. Specimens to be evaluated for polishing resistance are placed in a circular track and subjected to the wearing action of four small-diameter, pneumatic tires without use of abrasive or water. Terminal polish is achieved after approximately 8 h of exposure.

1.2 *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:*[3]

C192/C192M Practice for Making and Curing Concrete Test Specimens in the Laboratory

D2240 Test Method for Rubber Property—Durometer Hardness

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E274/E274M Test Method for Skid Resistance of Paved Surfaces Using a Full-Scale Tire

E303 Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester

[1] This practice is under the jurisdiction of ASTM Committee E17 on Vehicle - Pavement Systems and is the direct responsibility of Subcommittee E17.23 on Surface Characteristics Related to Tire Pavement Slip Resistance.

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[2] Mullen, W. G., Whitfield, J. K., Gibson, D., and Matlock, T. L., "Implementation for Use of Variable Speed Friction Tester and Small Wheel Circular Track Wear and Polishing Machine," Highway Research Program Project ERSD 110-76-2, Final Report; Available from National Technical Information Service, Springfield, VA 22161.

[3] 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.

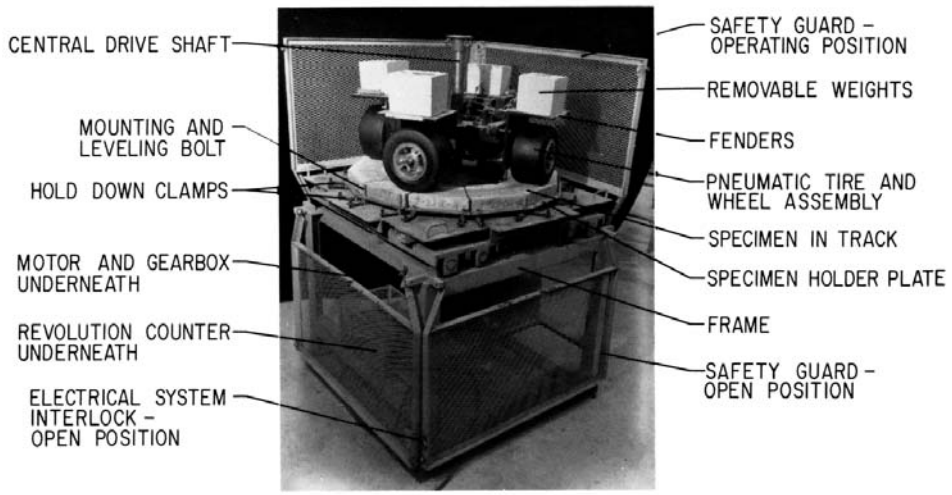

FIG. 1 NCSU Wear and Polishing Machine—Mark II

E707 Test Method for Skid Resistance Measurements Using the North Carolina State University Variable-Speed Friction Tester (Withdrawn 2006)[4]

3. Summary of Practice

3.1 The circular track is fitted with twelve specimen holders that can be adapted to specimens of various shapes and thicknesses, but when mounted in the track, form a continuous plane running surface for the polishing wheels. A complete set of twelve specimens exposed to wear and polishing at the same time is counted as a round of testing. Usually specimens are tested in sets of three per variable per round of test with three control specimens of a standard surface included in each round to allow comparison between rounds of testing. It is recommended that each variable be repeated in three separate rounds, making a minimum of nine specimens per variable to obtain an average polishing curve.

3.2 To obtain a polishing curve, specimens are subjected to polishing action in the track until friction measurements show no substantial decrease in level with continued polishing effort. Measurements are recorded at the beginning of the test and periodically throughout the test cycle to establish the shape of the polishing curve. Usually 8 h of exposure on the track at 30 r⁄min or 7200 wheel passes per hour is sufficient to complete the polishing cycle for bituminous bound mixtures and exposed aggregate specimens. For portland cement concrete bound mixtures, it is recommended that a polish curve be obtained on the original textured surface followed by removal of the surface to expose the coarse aggregate using the steel-studded abrading wheels. A polishing curve is then obtained for the exposed aggregate surface.

3.3 Friction measurements can be obtained for bituminous plant mix type surfaces using the British Pendulum Tester in accordance with Test Method E303. The British Pendulum Tester has been found to be ineffective in obtaining friction measurements on highly textured surfaces such as bituminous surface treatments and portland cement concrete surfaces. Therefore, it is recommended that the North Carolina State University Variable-Speed Friction Tester[2] be used in accordance with Test Method E707 as the friction measurement device on highly textured surfaces. With the Variable Speed Friction Tester, speed gradients are obtainable in the laboratory.

3.4 Interpretation of the laboratory polishing curves for field application is not included as part of this practice.

4. Significance and Use

4.1 The use of laboratory-obtained polishing curves and speed gradients on proposed aggregate combinations and pavement mixtures are helpful tools in predicting the polishing characteristics of these surfaces if placed in field service.

5. Apparatus

5.1 *Small-Wheel Circular Track*[2]—A power-driven device consisting of four equally spaced wheels, independently suspended, on each of which may be mounted a smooth-tread pneumatic tire, operating over a circular track that holds specimens to be polished (Fig. 1).

NOTE 1—Construction plans are published in the reference cited in footnote 2.

5.1.1 *Rotating Wheel Assembly*—Four individually mounted wheel assemblies, free rolling, attached to the central shaft. Tires are 11 × 6.00 × 5 nylon smooth no-pattern tread tires, two-ply rating.[5] Each wheel may be individually adjusted for distance from center shaft, plane of rotation (camber), and toe-in or toe-out. Tire pressure is maintained at 20 psi (138 kPa) resulting in 13 psi (90 kPa) average contact pressure under normal 72-lbf (320-N) wheel loading. Each wheel

[4] The last approved version of this historical standard is referenced on www.astm.org.

[5] The sole source of supply of the apparatus known to the committee at this time is Goodyear Tire and Rubber Co., Akron, OH 44316. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.