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Standard Test Method for Electrical Resistivity of Membrane-Pavement Systems[1]

This standard is issued under the fixed designation D3633/D3633M; 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 test method covers the measurement of the electrical resistivity of water-barrier membrane-pavement systems when applied to concrete bridge decks.

1.2 Measurements shall be performed on the bituminous pavement surface covering the water-barrier membrane.

1.3 This test method utilizes a measure of electrical resistance between the saturated top surface of the water-barrier membrane and the reinforcing steel embedded in the concrete bridge deck.

1.4 The values measured represent the electrical resistance obtained with the equipment and procedures stated herein and do not necessarily agree or correlate with those using other equipment or procedures.

1.5 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

1.6 The text of this standard references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.7 *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.*

1.8 *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]

C670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials

D8 Terminology Relating to Materials for Roads and Pavements

D3666 Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials

[1] This test method is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.32 on Bridges and Structures.

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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.

D3743 Terminology Relating to Bridge Deck and Substructure Protection (Withdrawn 2004)[3]
~~D4071 Practice for Use of Portland Cement Concrete Bridge Deck Water Barrier Membrane Systems~~
E105 Guide for Probability Sampling of Materials

3. Terminology

3.1 For definitions of terms used in this test method, refer to ~~Terminology~~Terminologies D3743 and D8.

4. Significance and Use

4.1 This test method for measuring the electrical resistivity of water-barrier membrane-pavement systems may be interpreted to indicate the effectiveness of such systems.

4.2 This test method is predicated on the fact that an electrical connection between the surface of the pavement and the reinforcing steel in the concrete pavement cannot be made through an impermeable water-barrier membrane.

4.3 This test method may be used for acceptance when the accepting agency specifies the minimum resistance value desired.

NOTE 1—The quality of the results produced by this standard are dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used. Agencies that meet the criteria of Specification D3666 are generally considered capable of competent and objective testing, sampling, inspection, etc. Users of this standard are cautioned that compliance with Specification D3666 alone does not completely ensure reliable results. Reliable results depend on many factors; following the suggestions of Specification D3666 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.

5. Apparatus

5.1 *Ohmmeter,* dc, 20 000 Ω/V rating connected to a double-pole, double-throw switch box or ac ohmmeter (switch box not required).

NOTE 2—When this test method is used for acceptance, the accepting agency should specify the type of ohmmeter to be used.

5.2 *Insulated Wire,* No. 18, Belden test probewire or equivalent. Two spools, minimum 38 m [125 ft].

5.3 *Copper Plate,* 305 by 305 by 3.0 mm [12 by 12 by ⅛ in.], with the means for connecting the ohmmeter lead and a wooden handle approximately 1 m [39 in.] in length.

5.4 *Polyurethane Sponge,* 305 by 305 by 13 mm [12 by 12 by ½ in.], to be attached to the copper plate with rubber bands or other suitable means. When assembled, this apparatus is called the probe.

5.5 *Pressure Spray Can,* ~~12-L [3-gal]~~ 12 L [3 gal] capacity, with a hose and spray nozzle.

5.6 *Pachometer,* suitable for detection of embedded reinforcement in concrete.

5.7 *Rotary Impact Hammer,* to remove concrete and expose steel reinforcement for testing.

6. Reagent

6.1 A wetting agent which, when added to the water, will break the surface tension and promote the penetration of the water through the bituminous pavement.

NOTE 3—An example of a wetting agent is a super-saturated solution of cupric sulfate crystals in warm water to which is added 19 mL/gal of dioctyl sodium ~~sulfo-succinate (tradename "Aerosol" OT Clear, 10 %).~~ sulfo-succinate. When ambient test site temperature is below 50 °F [10 °C], add 15 % by volume of either isopropyl or denatured alcohol to prevent clouding of the wetting agent. Clouding of the wetting agent may inhibit penetration.

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

7. Sampling

7.1 Determine locations on the bridge deck to be tested by using either a grid pattern similar to that illustrated in Fig. 1 or by a random location system, based upon Practice E105 or a similar method, that will ensure that the bridge deck area to be tested will be adequately represented.

8. Procedure

8.1 Prepare the surface to be tested by removing all foreign material by sweeping or scraping, or both. Do not use water to clean. The surface shall be dry and clean before testing.

8.1.1 Locate the reinforcing steel with a pachometer. Drill with a rotary impact hammer at selected locations to expose the reinforcing steel to allow attachment of ohmmeter leads. Alternately, drill until the drill bit contacts the steel firmly to allow ohmmeter lead attachment.

8.2 Uncoil an ample length of wire to reach all areas to be tested, attach the minus (−) jack of the ohmmeter to the reinforcing steel and the plus (+) jack to the 305 by 305 by ~~3.0-mm~~ 3.0 mm [12 by 12 by ⅛ ~~in.~~] in.] copper plate of the probe. Then saturate the sponge with water containing the wetting agent.

NOTE 4—A direct connection from the ohmmeter to the top layer of reinforcing steel in the deck is desirable. However, if it is not practical to do this, the bridge railing, expansion joints, light standards, drainage scuppers, or other exposed steel, that is known to have contact with the top mat of reinforcing steel, may be used to provide this connection.

8.2.1 Check the ohmmeter battery for satisfactory charge, then zero the ohmmeter dial indicator. Connect the two wire leads to the ohmmeter and check for circuit continuity.

8.2.2 Check for overall equipment operation and satisfactory circuit by placing the probe on exposed concrete deck curbing and observing the resistance reading on the ohmmeter. This reading will normally range from 1000 to 3000 Ω for various bridge decks.

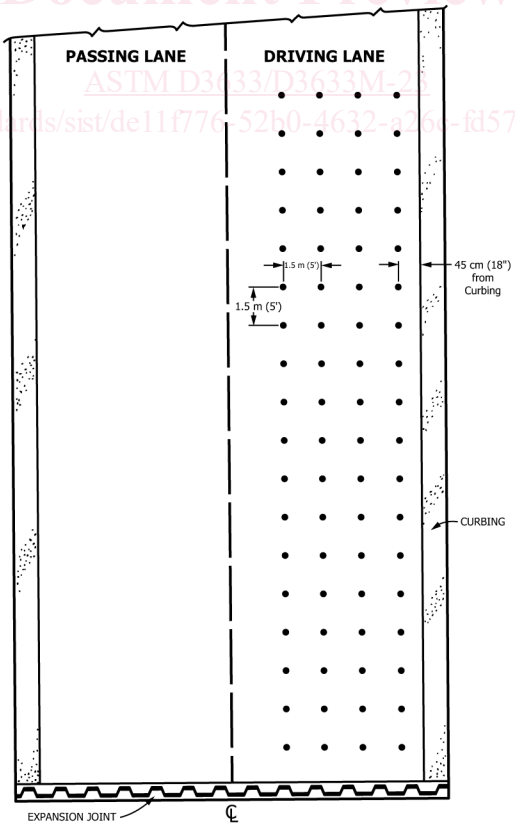

FIG. 1 Layout for Test Grid