## Standard Method of Test for

# Electrical Resistivity of a Concrete Cylinder Tested in a Uniaxial Resistance Test

**AASHTO Designation: TP 119-21**[1]

**Technically Revised: 2021** **Editorially Revised: 2021**

**Technical Subcommittee: 3c, Hardened Concrete**

AASHTO

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## 1. SCOPE

1.1. This test method covers the determination of the electrical resistivity of concrete to provide a very rapid indication of its resistance ionic transport (e.g., the penetration of chloride ions). This test method is applicable to types of concrete where correlations have been established between this test procedure and long-term durability performance.

1.2. The values stated in SI units are to be regarded as the standard.

1.3. *This standard does not purport to address all of the safety problems, 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.*

1.4. *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 R 18 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with R 18 alone does not completely assure reliable results. Reliable results depend on many factors; following the suggestions of R 18 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.*

## 2. REFERENCED DOCUMENTS

2.1. *AASHTO Standards*:

- R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
- R 39, Making and Curing Concrete Test Specimens in the Laboratory
- R 100, Making and Curing Concrete Test Specimens in the Field
- T 22, Compressive Strength of Cylindrical Concrete Specimens
- T 24M/T 24, Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
- T 277, Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration
- TP 135, Standard Method of Test for Determining the Total Pore Volume in Hardened Concrete Using Vacuum Saturation

2.2. *ASTM Standards*:

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

- C1202, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration
- C1556, Standard Test Method for Determining the Apparent Chloride Diffusion Coefficient of Cementitious Mixtures by Bulk Diffusion

2.3. *Other Documents*:

- Coyle, A., R. Spragg, P. Suraneni, A. Amirkhanian, and W. J. Weiss. Comparison of Linear Temperature Corrections and Activation Energy Temperature Corrections for Electrical Resistivity Measurements of Concrete. *Advances in Civil Engineering Materials*, Vol. 7, No. 1, 2018, pp. 174–187. Available from doi.org/10.1520/ACEM20170135
- Hamilton, H. R., A. J. Boyd, and E. A. Vivas. *Permeability of Concrete—Comparison of Conductive and Diffusion Methods.* Final Report (Contract No. BD536) submitted to Florida Department of Transportation, Tallahassee, FL, June 2007.
- Newlands, M., R. Jones, S. Kandasami, and T. Harrison. "Sensitivity of Electrode Contact Solutions and Contact Pressure in Assessing Electrical Resistivity of Concrete." In *Materials and Structures*, Vol. 41, No. 4. International Union of Laboratories and Experts in Construction Materials, Systems and Structures (RILEM), Bagneux, France, 2007, pp. 621–632.
- Snyder, K. A. "The Relationship between the Formation Factor and the Diffusion Coefficient of Porous Materials Saturated with Concentrated Electrolytes: Theoretical and Experimental Considerations." In *Concrete Science and Engineering*, Vol. 3, No. 12. International Union of Laboratories and Experts in Construction Materials, Systems and Structures (RILEM), Bagneux, France, 2001, pp. 216–224.
- Spragg, R. P., Y. Bu, and W. J. Weiss. *Electrical Testing of Cement Based Materials: Role of Testing Techniques, Sample Conditioning, and Accelerated Curing*. Final Report (Contracts SPR-3509 and SPR-3657) submitted to the Indiana Department of Transportation, Indianapolis, IN, July 2013.
- Spragg, R. P., J. Castro, T. E. Nantung, M. A. Paredes, and W. J. Weiss. Variability Analysis of the Uniaxial Resistivity Measured Using Concrete Cylinders. *Advances in Civil Engineering Materials*, Vol. 1, No. 1. Hindawi Publishing Corporation, New York, NY, 2012.
- Spragg, R. P., C. Villani, K. Snyder, D. P. Bentz, J. W. Bullard, and W. J. Weiss. Factors that Influence Electrical Resistivity Measurements in Cementitious Systems. In *Transportation Research Record 2342*, Transportation Research Board, National Research Council, Washington, D.C., 2013, pp. 90–98. Available from doi.org/10.3141/2342-11
- Weiss, W. J., T. J. Barrett, C. Qiao, and H. Todak. Toward a Specification for Transport Properties of Concrete Based on the Formation Factor of a Sealed Specimen. *Advances in Civil Engineering Materials*, Vol. 5, No. 1, 2016, pp. 179–194. Available from doi.org/10.1520/ACEM20160004
- Weiss, W. J., K. Snyder, J. W. Bullard, and D. P. Bentz. Using a Saturation Function to Interpret the Electrical Properties of Partially Saturated Concrete. *Journal of Materials in Civil Engineering*, Vol. 25, No. 8, 2013, pp. 1097–1106. Available from doi.org/10.1061/(ASCE)MT.1943-5533.0000549

## 3. TERMINOLOGY

3.1. *electrical resistivity*—an intrinsic property that quantifies how strongly a material resists the flow of an electric current.