Standard Method of Test for

Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration

AASHTO Designation: T 277-23[1]

Technically Revised: 2023 **Editorially Revised: 2023**

Technical Subcommittee: 3c, Hardened Concrete

ASTM Designation: C1202-22$^{\varepsilon 1}$

American Association of State Highway and Transportation Officials
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1. SCOPE

1.1. This test method covers the determination of the electrical conductance of concrete to provide a rapid indication of its resistance to 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 chloride ponding procedures such as those described in T 259. Examples of such correlations are discussed in Berke et al. (1988), Ozyildirim and Halstead (1988), Whiting (1981 and 1988), and Whiting and Dziedzic (1989).

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

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

1.4. *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.*

1.5. 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.

1.6. *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*:

- M 339M/M 339, Thermometers Used in the Testing of Construction Materials

- R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
- R 39M/R 39, Making and Curing Concrete Test Specimens in the Laboratory
- R 100M/R 100, Making and Curing Concrete Test Specimens in the Field
- T 24M/T 24, Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
- T 259, Resistance of Concrete to Chloride Ion Penetration

2.2. *ASTM Standards*:

- C670, Standard Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials
- C802, Standard Practice for Conducting an Interlaboratory Test Program to Determine the Precision of Test Methods for Construction Materials
- C1542/C1542M, Standard Test Method for Measuring Length of Concrete Cores
- E1, Standard Specification for ASTM Liquid-in-Glass Thermometers
- E230/E230M, Standard Specification for Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples
- E2877, Standard Guide for Digital Contact Thermometers

2.3. *International Electrotechnical Commission Standard:*

- IEC 60584-1:2013 Thermocouples - Part 1: EMF Specifications and Tolerances

2.4. *Other Documents*:

- Berke, N. S., D. W. Pfeifer, and T. G. Weil. Protection against Chloride-Induced Corrosion. *Concrete International*. Vol. 10, No. 12, December 1988, pp. 45–55.
- Bouzoubaa, N., A. Bilodeau, S. Vasanthy, B. Fournier, and D. Golden. Development of Ternary Blends for High-Performance Concrete. *ACI Materials Journal*, Vol. 101, No. 1, 2004, pp. 19–29.
- Obla, K. H. and C. L. Lobo. Acceptance Criteria for Durability Tests. *ACI Concrete International*, Vol. 29, No. 5, May 2007, pp. 43–48.
- Ozyildirim, C. Effects of Temperature on the Development of Low Permeability in Concretes. VTRC R98-14. Virginia Transportation Research Council, Charlottesville, VA, 1998.
- Ozyildirim, C. and W. J. Halstead. *Use of Admixtures to Attain Low Permeability Concretes*. Final Report No. FHWA/VA-88-R11. Virginia Transportation Research Council, NTIS No. PB 88201264, February 1988.
- Whiting, D. *Rapid Determination of the Chloride Permeability of Concrete*. Final Report No. FHWA/RD-81/119. Federal Highway Administration, NTIS No. PB 82140724, August 1981.
- Whiting, D. Permeability of Selected Concrete. *Permeability of Concrete*. SP-108, American Concrete Institute, Detroit, MI, 1988, pp. 195–222.
- Whiting, D. and W. Dziedzic. *Resistance to Chloride Infiltration of Superplasticized Concrete as Compared with Currently Used Concrete Overlay Systems*. Final Report No. FHWA/OH-89/009. Construction Technology Laboratories, May 1989.

3. SUMMARY OF TEST METHOD

3.1. This test method consists of monitoring the amount of electrical current passing through 50-mm (2-in.) thick slices of 100-mm (4-in.) nominal diameter cores or cylinders during a 6-h period. A potential difference of 60 V dc is maintained across the ends of the specimen, one of which is immersed in a sodium chloride solution and the other in a sodium hydroxide solution. The total