Standard Method of Test for

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

AASHTO Designation: T 277-15 (2019)

Technical Subcommittee: 3c, Hardened Concrete

Release: Group 1 (April)

ASTM Designation: C1202-12

AASHTO

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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 References 15.1 through 15.5.[1]

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.*

2. REFERENCED DOCUMENTS

2.1. *AASHTO Standards*:

- R 39, Making and Curing Concrete Test Specimens in the Laboratory
- T 23, 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 Standard*:

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

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 charge passed, in coulombs, has been found to be related to the resistance of the specimen to chloride ion penetration.

4. SIGNIFICANCE AND USE

4.1. This test method covers the laboratory evaluation of the electrical conductance of concrete samples to provide a rapid indication of their resistance to chloride ion penetration. In most cases, the electrical conductance results have shown good correlation with chloride ponding tests, such as T 259, on companion slabs cast from the same concrete mixtures (References 15.1 through 15.5).

4.2. This test method is suitable for evaluation of materials and material proportions for design purposes and research and development.

4.3. Sample age has significant effects on the test results, depending on the type of concrete and the curing procedure. Most concretes, if properly cured, become progressively and significantly less permeable with time.

4.4. This test method was developed originally for evaluation of alternative materials, but in practice its use has evolved to applications such as quality control and acceptance testing. Factors such as ingredient materials used in concrete mixtures and the method and duration of curing test specimens affect the results of this test (see Note 1). When this method is used for mixture qualification and acceptance testing, it is imperative that the curing procedures and the age at time of testing be clearly specified.

Note 1—When using this test for determining acceptability of concrete mixtures, statistically based criteria and test age for prequalification or for acceptance based on jobsite samples should be stated in project specifications. Acceptance criteria for this test should consider the sources of variability affecting the result and ensure balanced risk between supplier and purchaser. The anticipated exposure conditions and time before a structure will be put into service should be considered. One approach to establishing criteria is discussed in Reference 15.6.

4.5. Table 1 provides a qualitative relationship between the results of this test and the chloride ion penetrability of concrete.

4.6. The numerical results (total charge passed, in coulombs) from this test method must be used with caution, especially in applications such as quality control and acceptance testing. The qualitative terms in the right-hand column of Table 1 should be used in most cases unless otherwise noted by the specifying agency.

Table 1—Chloride Ion Penetrability Based on Charge Passed

Charge Passed, C	Chloride Ion Penetrability
>4000	High
>2000–4000	Moderate
>1000–2000	Low
100–1000	Very low
<100	Negligible

4.7. Care should be taken in interpreting results of this test when it is used on surface-treated concretes; for example, concretes treated with penetrating sealers. The results from this test on some such