Standard Method of Test for

Determination of Composite Activation Energy of Aggregates due to Alkali–Silica Reaction (Chemical Method)

AASHTO Designation: T 364-17 (2021)[1]

First Published: 2017 **Reviewed but Not Updated: 2021** **Editorially Revised: 2021**

Technical Subcommittee: 3c, Hardened Concrete

AASHTO

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1. SCOPE

1.1. This test method covers chemical determination of the reactivity of an as-received fine and coarse aggregate in terms of measuring composite activation energy of alkali–silica reaction (ASR), where aggregate reacts with an alkaline solution having chemistry similar to the pore solution chemistry of a conventional portland cement concrete.

1.2. *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. A specific precautionary statement is given in the section on reagents.*

Note 1—The values stated in SI units are to be regarded as standard. The values in inch-pound units are shown in parentheses and are for informational purposes only.

1.3. *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 6, Fine Aggregate for Hydraulic Cement Concrete
- M 43, Sizes of Aggregate for Road and Bridge Construction
- M 80, Coarse Aggregate for Hydraulic Cement Concrete
- M 231, Weighing Devices Used in the Testing of Materials
- R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
- R 76, Reducing Samples of Aggregate to Testing Size
- R 90, Sampling Aggregate Products
- T 11, Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

- T 19M/T 19, Bulk Density ("Unit Weight") and Voids in Aggregate
- T 27, Sieve Analysis of Fine and Coarse Aggregates
- T 303, Accelerated Detection of Potentially Deleterious Expansion of Mortar Bars Due to Alkali–Silica Reaction

2.2. *ASTM Standards:*

- A182/A182M, Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
- B21/B21M, Standard Specification for Naval Brass Rod, Bar, and Shapes
- C125, Standard Terminology Relating to Concrete and Concrete Aggregates
- C1260, Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
- D1193, Standard Specification for Reagent Water

3. SIGNIFICANCE AND STANDARD USE

3.1. This test is intended to offer a rapid and reliable ASR standard test method. The as-received aggregate is immersed in an alkaline solution and allowed to react at different temperatures (i.e., 60, 70, and 80°C (140, 158, and 176°F)). The test measures solution volume change (i.e., volume contraction) in a closed system over time (96 to 100 h) as the reaction between aggregates and solution proceeds.

3.2. The test method determines the aggregate composite activation energy (CAE) of ASR. CAE is a measure of the aggregate alkali–silica reactivity of an aggregate. For example, the lower the CAE, the higher the reactivity and vice versa. CAE is used to develop an ASR aggregate classification system, which can be used as an effective screening parameter to categorize aggregates based on their reactivity.

3.3. The test method reliably predicts aggregate alkali reactivity in a short period of time (within 5 days) and can effectively be used as an alternative to the current test method(s) (e.g., T 303 or ASTM C1260).

4. APPARATUS

4.1. *Scales*—The scales and weights used for weighing materials shall conform to the requirements prescribed in M 231.

4.2. *Crushing Equipment*—It is recommended to collect aggregates from stockpile with 1-in. maximum size in order to avoid crushing. However, if any coarse aggregate contains particles with maximum size ≥37.5 mm (≥1.5 in.) then crush using suitable crushing equipment (e.g., a hand hammer) material larger than the 37.5-mm (1.5-in.) sieve to pass the 37.5-mm (1.5-in.) sieve.

4.3. *Sieves*—A 25.4-mm (1-in.), 12.5-mm ($^1/_2$-in.), 4.75-mm (No. 4), 2.36-mm (No. 8), 1.18-mm (No. 16), 600-µm (No. 30), 300-µm (No. 50), or 150-µm (No. 100) sieve.

4.4. *Vacuum Pump*—A small vacuum pump or other suitable equipment capable of applying a vacuum pressure of 76.2 cmHg (30 in.Hg).

4.5. *Vibrating Table*—The use of a vibrating table with variable-speed operation facilitates removal of air bubbles from solution through agitating aggregate particles during vacuuming (see Section 4.4).