
Standard Method of Test for

**Determining the Potential Alkali–
Silica Reactivity of Coarse
Aggregates (TFHRC-TFAST)**

AASHTO Designation: TP 144-21¹

First Published: 2021

Technical Subcommittee: 1c, Aggregates



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1. SCOPE

- 1.1. This test method allows for the detection of coarse aggregates that have the potential to form expansive alkali–silica reaction (ASR) gels if used in concrete. This method represents a completely new approach. Unlike current standard tests like ASTM 1260, ASTM 1293, and T 380, this test method relies on purely chemical tests rather than measurement of the physical expansion of mortar and concrete specimens. No concrete or mortar specimens are required. The test is also conducted in a sealed environment inside a test tube which overcomes the alkali leaching problems of some current test methods. The test is completed in 21 days compared to 16 days for ASTM C1260, 56 days for T 380, and 365 days for ASTM C1293.
- 1.2. *Units*—The values stated in SI units are to be regarded as standard except for sieve sizes where the more familiar non-SI units are used.
- 1.3. *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all safety concerns associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and to 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.*
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2. REFERENCED STANDARDS

- 2.1. *AASHTO Standards:*
- R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
 - R 76, Standard Practice for Reducing Samples of Aggregate to Testing Size
 - R 90, Standard Practice for Sampling Aggregate Products

- T 380, Standard Method of Test for Potential Alkali Reactivity of Aggregates and Effectiveness of ASR Mitigation Measures (Miniature Concrete Prism Test, MCPT)

2.2. *ASTM Standards:*

- C702, Standard Practice for Reducing Samples of Aggregates to Testing Size
- C1260, Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
- C1293, Standard Test Method for Determination of Length Change of Concrete due to Alkali-Silica Reaction
- D75, Standard Practice for Sampling Aggregates
- E11, Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

3. TERMINOLOGY

- 3.1. *Buchner Funnel*—A ceramic funnel for the support of filter media used in vacuum filtration.
- 3.2. *Inductively Coupled Plasma (ICP)*—A spectroscopic analytical technique for the accurate quantitative analysis of chemical elements present in aqueous solutions.
- 3.3. *Polytetrafluoroethylene (PTFE)*—A plastic polymer inert to reaction with the alkalis used in the test.
- 3.4. *Reactivity Index*—The ratio of the concentrations in millimoles per liter of silicon divided by the concentrations of calcium plus aluminum.

4. SUMMARY OF TEST METHOD

- 4.1. A sample of coarse aggregate is crushed until sufficient material retained on the No. 50 and No. 100 sieve is generated. The resultant crushed aggregate is placed into PTFE test tubes along with calcium oxide, and 1N sodium hydroxide per the method. The tubes are placed vertically in an oven for 21 days. Immediately after cooling, the contents of the test tubes are homogenized. A vacuum filtration is performed on the contents of each tube. Within 12 hours, the filtrates are analyzed for silicon, calcium, and aluminum. Using the results, it is possible to determine the alkali-silica reactivity of the coarse aggregate.

5. SIGNIFICANCE AND USE

- 5.1. Alkali-silica reaction (ASR) is the reaction between alkalis in the pore solution of concrete, principally sodium (Na⁺) and potassium (K⁺) ions which are present in the portland cement, and the silica present in the aggregate.
- 5.2. The test method is intended to determine the propensity for a given coarse aggregate to form expansive ASR gels if used in concrete.
- 5.3. The T-FAST test was developed as an alternative to ASTM C1260 and ASTM C1293, two widely used test methods that tend to both over- and underestimate aggregate ASR reactivity.