ASTM C1260: An Accelerated Screening Test for Alkali-Silica Reactive Aggregates

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Why it Matters

Alkali-silica reaction (ASR) is a slow chemical reaction between the alkali hydroxides in concrete pore solution and certain unstable forms of silica in aggregate. The reactive forms include opal, chalcedony, chert, cristobalite, tridymite, volcanic glass, and cryptocrystalline or strained quartz, which occur in rock types including greywacke, argillite, quartzite, and gneiss. The reaction produces an alkali-silica gel that absorbs water and expands, generating internal tensile stress. Because concrete is relatively weak in tension, continued expansion can lead to cracking.[2,3]

Once ASR is active in a structure, it can be managed but not stopped. Prior to construction, aggregate reactivity can be determined to assess potential susceptibility to ASR, and deterioration can be avoided. ASTM C1260 is the fastest standard way to find out.

What is ASTM C1260?

ASTM C1260, Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method), is a screening test used to evaluate whether an aggregate is susceptible to alkali-silica reaction (ASR).[1] Commonly referred to as the accelerated mortar bar test (AMBT), the method is based on the test developed by Oberholster and Davies at the National Building Research Institute in South Africa and provides an assessment within weeks rather than the year or more required for longer-term concrete testing.[3] The aggregate is crushed and sieved to a prescribed gradation and is then used to cast mortar bars measuring 25 by 25 by 285 mm, with a 250 mm effective gauge length. The bars are demolded at 24 hours, immersed in tap water, and held at 80°C for another 24 hours. A zero reading is taken at that point, and the bars are transferred to a 1N sodium hydroxide solution at 80°C. Length readings are taken periodically over the following 14 days using a length comparator (Figure 1), and expansion is reported as a percentage of the effective gauge length. Because of the two days of preconditioning, the 14-day expansion corresponds to 16 days after casting. The soak solution supplies its own alkalis, so the alkali content of the cement has little influence on the result.[1]



Figure 1. Mortar bar seated in the length comparator during a periodic length change reading.

Determination of Potential Reactivity

ASTM C1260 provides a quantitative indication of an aggregate's potential reactivity before the concrete is placed. ASTM C1778, Standard Guide for Reducing the Risk of Deleterious Alkali-Aggregate Reaction in Concrete, is the industry guide that ties the individual ASR test methods together, explaining how to interpret their results, classify aggregate reactivity, and select preventive measures. It classifies reactivity primarily from one-year concrete prism (ASTM C1293) expansion, with 14-day C1260 expansion used when prism data are not available (Table 1). Aggregates expanding 0.10 percent or more in C1260 should be confirmed with C1293 and supporting information such as petrographic examination or documented field performance.[2]

Table 1. Aggregate reactivity classes and expansion limits from ASTM C1778.2

Reactivity Class	Description	C1293 1-Year Expansion	C1260 14-Day Expansion
R0	Non-reactive	< 0.04%	< 0.10%
R1	Moderately reactive	≥ 0.04% to < 0.12%	≥ 0.10% to < 0.30%
R2	Highly reactive	≥ 0.12% to < 0.24%	≥ 0.30% to < 0.45%
R3	Very highly reactive	≥ 0.24%	≥ 0.45%

Interpreting the Results

C1260 is a severe test that imposes conditions intended to accelerate any ASR-related phenomena to occur in the testing time frame, and the results should be read with that in mind. The high temperature and alkalinity of the soak solution used for this accelerated test cause a number of aggregates with satisfactory field histories to expand past the limit, which is why ASTM C1778 states that C1260 results alone should not be used to reject an aggregate. The test can also miss reactive aggregates, particularly slowly reactive sources and those exhibiting a pessimum effect. When C1260 and concrete prism results do not agree, ASTM C1778 considers the C1293 result the more reliable of the two. This provides important context about the complementarity of the two tests rather than highlighting a shortcoming of C1260, which remains the most practical path for early identification of aggregates that warrant further evaluation.[2,3]

Implications of a Reactive Result

A reactive result for C1260 does not mean an aggregate cannot be used; possible paths to implementation are:

Confirm Reactivity—Petrographic examination (ASTM C295) identifies potentially reactive constituents in the aggregate, and the one-year expansion in the concrete prism testing (ASTM C1293), which ASTM C1778 describes as considered by many researchers to be the most reliable laboratory test for predicting field performance, determines the degree of reactivity.[2]

Mitigate the Reaction—ASTM C1778 allows reactive aggregate to be used with preventive measures, selected either prescriptively or by performance testing.[2]

Use an Alternative Source—Where the aggregate is highly reactive, or where the required preventive measures are impractical, a non-reactive aggregate from another source can be selected, ideally one confirmed by testing and field performance.[2]

Complementary Analyses to Aid in Interpretation

C1260 results are often interpreted alongside supporting analyses. When expansion is 0.10 percent or greater, ASTM C1778 recommends confirming that the expansion is due to ASR using petrographic examination of the aggregate (ASTM C295) to identify potentially reactive constituents, examination of the tested specimens (ASTM C856) to identify ASR reaction products, and field service or previous test records where available. Scanning Electron Microscopy with Energy-Dispersive Spectroscopy (SEM/EDS) can supplement the C856 examination by characterizing the composition of the reaction products. Where supplementary cementitious materials (SCMs) are proposed as a preventive measure, ASTM C1567 evaluates the combination of cementitious materials and aggregate using the accelerated mortar bar procedure. Expansion below 0.10 percent at 14 days is considered acceptable. ASTM C1778 also recommends comparing the C1260 and C1293 results for the aggregate to confirm that the aggregate test provides a reliable indication of its reactivity. ASTM C1293 can also be used to evaluate the SCM-aggregate combination, with expansion below 0.04 percent at two years considered acceptable.[2]

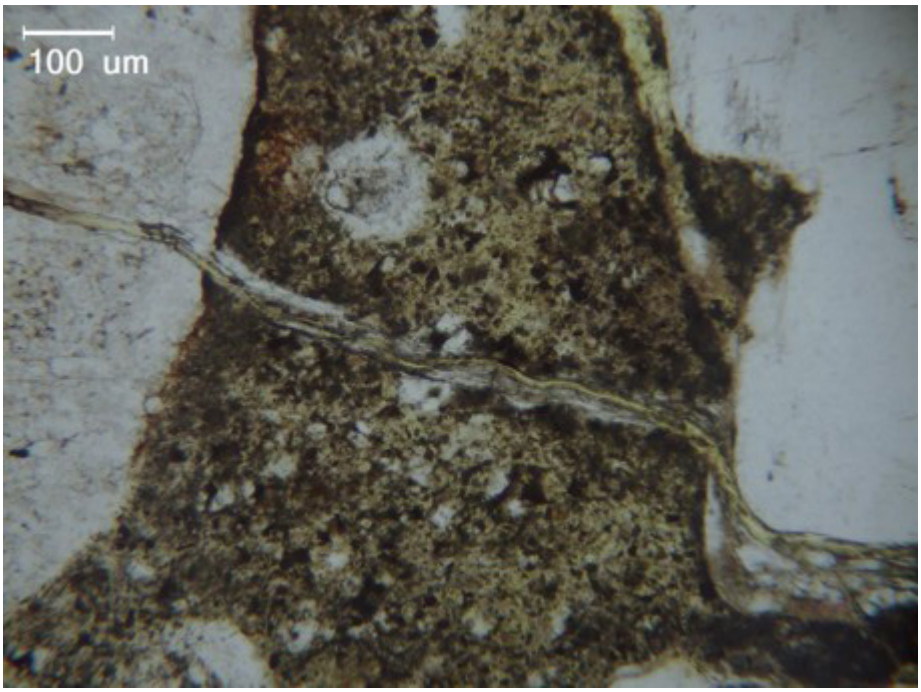


Figure 2. Photomicrograph in plane polarized light showing alkali-silica gel filling a crack in a reacted aggregate and the adjacent paste.

Authors

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Michael Baker is the department manager of RJ Lee Group's Concrete Materials Laboratory, with nearly a decade of experience in concrete petrographic studies and forensic investigation. He specializes in identifying failure and distress mechanisms in concrete and cementitious materials—including cracking, scaling, spalling, and coating failures—using petrographic evaluation and Scanning Electron Microscopy with X-ray Energy Dispersive Spectroscopy (SEM/EDS), with experience spanning structures such as roadways, bridges, parking garages, and marine wharves. A graduate of Clarion University of Pennsylvania with a degree in environmental geoscience, he is a registered member of the Society of Concrete Petrographers and the American Concrete Institute (ACI).

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