

Minimum Fly Ash Cement Replacement To Mitigate Alkali Silica Reaction

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ABSTRACT

Alkali silica reaction (ASR) in concrete results in deleterious expansion and deterioration. For a given aggregate and a given cement, the potential for deleterious expansion can be assessed using ASTM C 1260. While recent specifications already address ASR prevention using recycled products, such as fly ashes, as cement replacement, the restrictions on the ashes may be too conservative and prevent further savings during the replacement process by preventing the use of local ashes that do not meet current requirements. If a local fly ash is available, whether or not it meets ASTM or CSA requirements, the current study details a method to determine how much cement replacement would be needed to prevent significant expansion.

Data from previous research studies were used to assess the effectiveness of various fly ashes in preventing ASR, based on their chemical composition, the composition of the cement, and the reactivity of the aggregates. A chemical index was derived to characterize the fly ash and cement based on their chemical constituents, which was optimized to maximize the correlation with the test data. For the fly ashes, this index, C_{fa} , correlated well with the ASTM C 618 and CSA A3001 classifications. This index was also used to assess the efficiency of other ashes that did not meet either specification.

For a given aggregate reactivity, a given cement, and a given ash, it was possible to derive the minimum cement replacement that is needed to insure a 90% confidence that the 14-day ASTM C 1260 expansion would remain below 0.08%.

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