

Evaluating the Performance of Binary and Ternary Fly Ash-Based Cementitious Systems to Control Expansion Due to ASR in Concrete

Benoit Fournier¹ and Ken Ladwig²

¹ ICON-MTL/CANMET, 405 Rochester Street, Ottawa, ON, Canada, K1A 0G1; ² Electric Power Research Institute, 3412 Hillview Av., Palo Alto California, 94304 USA.

KEYWORDS: alkali-silica reaction, fly ash, preventive measures, silica fume

ABSTRACT

This paper reports the results of a comparative field and laboratory study to evaluate the effectiveness of binary (fly ash) and ternary (fly ash + silica fume) cementitious systems to control expansion due to ASR in concrete. In this study, six low- to high-calcium fly ashes representative of the geographical and compositional diversity observed in the U.S.A. and Canada were selected. These ashes were used in mortar and concrete mixtures incorporating six selected moderately- and highly-reactive aggregates from the U.S.A. The accelerated mortar bar test (ASTM C 1260) was used as a screening test for evaluating the effectiveness of the various combinations of fly ash and silica fume (binary and ternary systems) in reducing expansion due to ASR. A selected number of those combinations were then tested in the Concrete Prism Test (ASTM C 1293) using the following storage conditions, i.e. 38°C, R.H. > 95% (standard test method) and 60°C, R.H. > 95% (new test method). Field specimens consisting of concrete blocks, 15 x 15 x 28 inches in size, were also made and placed at the CANMET outdoor exposure site in Ottawa, Canada. Also, since this project is performed as part of a larger effort carried out in collaboration with the University of Texas in Austin and the University of New Brunswick, selected blocks were also be placed at the University of Texas in Austin outdoor exposure site and at the US Army Corps of Engineers outdoor exposure site for marine environment at Treat Island, Maine.

Submitted for consideration in the 2005 World of Coal Ash, April 11-15, Lexington, Kentucky, USA)