

THE DETERIORATING IMPACT OF ALKALI-SILICA REACTION ON CONCRETE EXPANSION AND MECHANICAL PROPERTIES

Rita Esposito, MSc.

*Delft University of Technology
The Netherlands*

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The assessment of concrete structures affected by alkali-silica reaction (ASR) is a complex problem due to the multiscale nature of this long-term phenomenon. The reaction starts within the concrete constituents with the formation of an expansive alkali-silicate gel at reaction products level. Being the expansive gel confined within the concrete micro-structure, an internal pressure is built up that induces damage at aggregate level. This micro-cracking affects the mechanical characteristics of the material at concrete level. The experimental in-

vestigation, which includes laboratory tests supplemented with literature data, shows a statistically relevant relationship between the concrete expansion and the degradation of mechanical properties of ASR-affected concrete samples stored in free-expansion conditions. Unaffected and affected concrete experimentally appear as substantially different materials at concrete level. An analytically solved micro-poro-fracture-mechanical model, which is based on a limited number of input parameters, is developed to explain the experimental observations.

