

Moisture transport and shrinkage in new generation concretes

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Abstract

New generation concretes such as self compacting concrete (SCC) and enhanced self consolidating concrete (ESCC) are self flowable which possesses superior flowability under maintained stability (i.e. no segregation) thus allowing self compaction even in areas of congested reinforcement. The research reported in this thesis examined the moisture transport, shrinkage and associated cracking of SCC and ESCC and compared with silica fume concrete (SFC) (Reference Concrete, used by major companies in Saudi Arabia).

To attain above properties the effect of hot and arid environment of Saudi Arabia characterized by high ambient temperature, wind speed and varying humidity, is investigated on the coefficient of moisture diffusivity (D) and convective transfer coefficient (hf) respectively, for SCC, ESCC and SFC. The compressive strength, tensile strength, shrinkage behavior and cracking tendency by using Banziger system are also determined for above concretes. A combine experimental-numerical approach is adopted involving experimental investigation of moisture loss evolution under controlled environmental conditions in conjunction with an existing finite element based model DIANA-2D to calibrate values of D and hf .

A five stage experimental program was carried out:

- (1) Designing the mix for SCC and ESCC to attain self compactability.
- (2) Test on fresh concrete is done to determine slump of all concretes.
- (3) Compressive strength and tensile strength tests are performed on all concretes at different ages.
- (4) Moisture diffusion and shrinkage tests were performed in two different environmental chambers with relative humidity 40% which replicate the extreme temperatures of Saudi Arabia.
- (5) Laboratory and field studies on Banziger mould to find cracking tendency of SCC, ESCC and SFC.