DESIGN OF BEAMS AND SLABS OF SELF-COMPACTING CONCRETE FITTINGS WORKING TO FLEXION

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Slab Design:

The greatest number of applications of SFRSCC has occurred in slabs, bridges, pavements of airports, car parks and concrete located in areas with problems of cavitation and erosion. Some of these applications have been referenced by Hoff [1]

Fissures have occurred in the concrete as a cause of retraction of the upper slab of SFRSCC where water reducing additives are used, and to which the slab significantly benefits. Even so, there have been many cases in which reinforced concrete and conventional concrete offer the same benefits with thicknesses of 60-70% lower. [2]

There are some SFRC design methods, which vary from conventional ones in the SFRC bending properties, that are much better. [3]. The SFRClayers are thinner and perform well under applied loads (from 20% to 60% thinner) [4].

From the thicknesses of less than 125 mm the cases with curvatures in corners are accentuated, which has been produced by the increase of the tensions of the lower layers. In order to minimize this curvature [4], it is recommended to reduce the cement content, the cement water ratio and the use of water reducing agents and setting retarders. Another option is to act in the curing of the concrete and also in the realization of the joints.

The usual values of SFRC that have been used for pavements are: bending strength = 6.2 to 7.6 MPa, compressive strength = 41MPa, Poisson coefficient = 0.2 modulus of elasticity = 27600 MPa. Resistance to fatigue is greater thanks to the steel fibers. In conventional concretes it is between 50% and 55%, whereas the HRFAs between 65% and 95%

Bending design:

Various procedures have been developed to estimate the flexural behavior of reinforced beams with steel fibers [4]. In some cases these methods are based on empirical data obtained from experimental experiments performed in the laboratory. In other cases they are based on theoretical considerations based on the law of mixtures and data, as the unitary resistance of the tensile fibers.

The following equations obtained by Swamy are based on experimental values and a subsequent regression analysis of the obtained data. A correlation coefficient was obtained for the regression analysis of the data analyzed in the laboratory of 0.98.

$\sigma_{cf} = 0{,}843\, f_r\, V_m + 425\, V_f\, l/d_f$ $\sigma_{cu} = 0{,}97\, f_r\, V_m + 425\, V_f\, l/d_f$

These equations correlate very well with the experimental work. However, if they are used to predict resistances in works the previous values must be reduced by 50% (ACI, ...).

Shear design:
Numerous experimental studies indicate that addition of fibers substantially increases the shear strength of concrete and mortar beams, and that stirrups and reinforcing fibers combination can be really effective. When steel fibers are used as a supplement or substitute for vertical stirrups or folded bars, we obtain the following characteristics: The fibers are distributed randomly by the volume of the concrete with a closer separation than can be achieved with the Armor; The tensile strength at first crack, the ultimate tensile strength and the shear friction resistance are increased.

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