TÍTOL: ESTUDI RELATIU A L'EFECTE DE LA INCORPORACIÓ DE FIBRES SINTÈTIQUES POLIMÈRIQUES D'ALT MÒDUL ELÀSTIC EN EL FORMIGÓ PROJECTAT PER VIA HUMIDA

AUTOR: GUILLEM CANALS i LLOPART

TUTOR: LLUÍS AGULLÓ FITÉ
TOMÀS GARCÍA VICENTE

ABSTRACT

Concrete, due to its excellent performance, is the most commonly material used in construction. Trying to find new applications, new construction techniques have been developed parallelly to concrete technology. From this point of view, the high spraying speed of the material onto a surface is a very productive technique since it combines two stages of the process (placing and compacting) in a single action.

Since its creation in 1910 in the United States, shotcrete has been increasingly used for such applications as support in tunnels, mines, excavations, and rock slopes due to its excellent properties.

Un-reinforced shotcrete, like concrete, is a relative brittle and under low tensile stress non cracking nor breaking capacity material. The concept of reinforcing shotcrete with discreet, discontinuous elements was developed in the early 1970's, and it had led to the term: steel fiber reinforced shotcrete (SFRS).

Previous studies have shown that steel fiber reinforced shotcrete, at fiber addition rates now commonly used, can provide equivalent or even superior performance than that provided by standard wire mesh reinforcement, when properties such as residual load-carrying capacity after first crack are compared (toughness). Steel fibers improve material properties such as ductility, flexural resistance, impact resistance, fatigue resistance, and reduce shrinkage and control cracking. However, steel fibers present several problems such as corrosion, high maintenance spray machine costs, and rebound, what induced that new ways of investigation about the application of synthetic materials in shotcrete construction techniques were performed.

In the early 1990's, new synthetic fibers were commercially available, that were called: synthetic fiber reinforced shotcrete (SnFRS). Previous studies had shown its good performance when these were used as a secondary reinforcement with plastic shrinkage reduction function, but, on the other hand, they showed a poor performance in toughness terms when these were compared to steel fibers.

As a result of the last investigations a new high modulus polymeric synthetic fiber has been obtained, a blend of polypropylene and polyethylene with structural function, potentially competitor of steel fiber.

In order to evaluate the performance of these new fibers, a comparative study has been conducted in order to prove the benefits that these fibers give to the brittle matrix of wet-mix shotcrete, compared to steel fibers. Toughness, known to be the property that differences reinforced shotcrete of those ordinaries shotcretes, has been the axis of this study.

A variety of different empirical tests for evaluating toughness have been developed, but only one beam test and two plate tests (EFNARC Plate Bending Test and Australian Round Determinate Plate Test) were selected in order to find out which one was more reliable for fiber reinforced shotcrete performance.