ABSTRACT

"INFLUENCE OF THE AMOUNT OF LONGITUDINAL REINFORCEMENT IN THE SHEAR BEHAVIOR OF SIMPLY SUPPORTED PRESTESSED BEAMS"

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The shear formulas that appear in the Spanish Structural Concrete code (EHE), as well as most of the codes about design of concrete structures, are conservative and all of them come from experimental test results. For this reason, these formulas do not have any physical sense. In spite of this, they are used continuously when the design of concrete elements under shear loads is required.

Self-Compacting Concrete (SCC) has been increasingly used in the construction industry during the last few years to reduce the execution deadlines, since the concrete compacting process is not needed. However, no references about how to work with this type of concrete appear in the current codes. It is also known that SCC could have a different behavior from the conventional concrete, as it has less shear strength than the value for conventional concrete suggested by the EHE. This is due to the fact that SCC experiments a loss of bond strength and tensile strength, wich reduces concrete resistance to strains that generate shear cracking.

The aim of this research is to contribute in the improvement of the EHE shear strength formulas, especially when it is necessary to calculate the influence of the longitudinal reinforcement, as well as to enhance the understanding of the behavior of self-compacting and conventional concrete beams failing in shear. In order to achieve this objective, an extensive review of the state-of-the-art in shear strength for both conventional and self-compacting concrete beams was made, and the main tests to characterize SCC were described briefly.

An experimental programme involving the testing of three conventional concrete beams and other three self-compacting concrete beams under an eccentric point load was performed (this work has been made entirely at the Structural Technology Laboratory of the Escuela de Caminos in Barcelona). All these specimens have the same characteristics with respect to web reinforcement and geometrical forms and dimensions. The main design variable is referred to the amount of the longitudinal reinforcement, making two specimens with only passive frame as longitudinal reinforcement, two more specimens with this passive frame and some active frame, and the last two specimens, that are similar to the second pair but prestressed. The concrete compressive strength of the beams at the age of the tests ranged from 26 to 32 MPa.

The results obtained experimentally were analyzed to study the influence of the prestessed reinforcement in the beam failure, specially comparing the final load values. Other data of great interest are cracking appears, or the deformed shape of each type of frame (stirrups to shear, passive longitudinal reinforcement and active longitudinal reinforcement).

In each cases, every different event, that appeared during the campaign test has been explained, refering to previous hypothesis or theories, and comparing between similar specimens, trying to give the best answer to any question that came up since this investigation started.

Finally, the conclusions obtained from this research are discussed, and as a natural corollary to the evolution of the knowledge on this field, some recommendations for future research are made.