SHEAR CAPACITY OF PRESTRESSED, HIGH-STRENGTH SELF-COMPACTING CONCRETE BEAMS

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Self-compacting concrete represents one of the most outstanding advances in concrete technology during the last decade due to a significant improvement of the quality of concrete structures. Besides of getting more durable concrete structures, self-compacting concrete offers other benefits like to increase productivity and to improve construction systems, to facilitate complex element design, and to improve surfaces quality and working conditions. It is in concrete product plants where the employment of self-compacting concrete may imply larger additional benefits.

Despite of these advantages, it will be necessary to verify if basic structural properties differ in a self-compacting concrete. It is presumable that using this concrete implies a diminution of shear capacity towards normal vibrated concrete due to a reduction of mesh in cracks. It may be the result of smaller aggregate size and smoother cracked surfaces.

Owing to its recent development, Spanish Standard EHE, like standards of other countries, does not consider the employment of self-compacting concrete and excludes structures built with special concretes. Probably it is one of the main reasons not to employ this concrete, so it is probably not to get a wide use of self-compacting concrete until a new standard proposes specific expressions.

The fundamental objective of this task is to study the shear behaviour of prestressed, high-strength concrete beams. To this end, some tests have been carried out at Laboratorio de Tecnología de Estructuras of UPC. Four ten-meter-long beams have been tested, being one of them of standard concrete and the other ones of self-compacting concrete. Carrying out the tests has been also utilized to study how other factors influence on shear capacity, like prestressing forces or longitudinal web reinforcement.

After getting experimental results, these have been analysed to settle the type of failure produced and resistant mechanisms developed during testing. These experimental results are also compared with theoretic values from standards and other expressions, and influence of other quoted factors is analysed. The correlation of EHE-99 and other expressions with the empirical tests is studied to realize, if necessary, how to improve the theories to correlate better with real results.

As a result of the analysis, some comments to the Spanish Standard EHE-99 are given. Among these comments, it is detached the necessity of including specific expressions to take account diminution of shear capacity because of using self-compacting concrete. In the same manner, it should incorporate size effect related to the distance between longitudinal web reinforcement after verifying experimentally its influence. Other factor to detach is the need to study shear capacity in beams without shear reinforcement and high-prestressing forces. In the same way, the values given for beams with shear reinforcement are also preservative, being probably the problem the estimation of concrete contribution to shear capacity.
These tests are the starting point of new researches to know more about shear resistant mechanisms and structural properties of self-compacting concrete in order to employ this concrete as a standard concrete with absolute certainty in the future. Following this objective, recommendations about future investigations are given.