ABSTRACT

In Spain, the release of the Concrete Code EHE-99 has introduced major changes in the design of members subjected to shear. In fact, some members without web reinforcement beam or slabs (floating boxes, underground passage, etc) that could resist a certain load level with the previous EH-91 need now a minimum amount of shear reinforcement to resist the same load. Besides, the Spanish Code EHE-99 is mainly aimed at beam type concrete reinforced members, directly extending its application to element of one-way working slab type, being this aspect also different in EH-91 code.

This situation provoke to the engineer an unsaved and unknowledge situation about the real behaviour of this kind of structure, that in a first approach it is assumed equal to a beam. But going more deeply into that, it can be foreseen a different behaviour depending on various design parameters of the slab. For this reason, it was started in Construction Engineering Department of the Universidad Politécnica de Catalunya, the investigation here proposed under the supervision of Professor Antonio R. Marí Bernat, planning within it a series of experimental campaign of slabs testing in the Structure Technology Laboratory.

The equations proposed by current instructions for the calculation of shear strength of beams and slabs, working one-way, are based in equation obtained experimentally in test campaigns using beam of reinforced concrete. Recently are applied also formulations obtained analytically by mean of models that describes that phenomenon in beams. In these models are considered the known five mechanism of shear transfer once the structural member is cracked: compressed area, friction shear, dowel action, arch action and residual tensile stress which are transmitted directly across cracks.

In the case of this Thesis, it can be foreseen a different behaviour of one-way working slabs in some of the already considered mechanisms or even any new one due to three-dimensional effects as a multiaxial compressed state in compressed area, that would provide a bigger shear strength to slab comparing to a beam.

Therefore, the main objectives of the thesis are to clarify, by mean of testing, the main mechanisms of shear transfer for members of one-way working slab type without shear reinforcement, to verify the current EHE shear design provisions for this kind of slabs, to study the effect of the various selected design parameters, standing out the longitudinal reinforcement spacing.

The proposal defines, at least, two experimental campaigns. The first campaign, already finished, comprises shear tests of four solid slabs and a reference beam, whose primary design variables are the spacing of longitudinal reinforcement, and the presence or not of sharing transversal reinforcement in the shear area. The main objective is to study the influence of that spacing in the internal and transversal behaviour of the slab when shear strength is resisted. The outcomes show evidences of a 'slab effect' with a positive influence of the maximum spacing as a transversally irregular breakage surface is created, with a form of two waves, and not a straight surface as it is the case of the slab with the minimum spacing and the reference beam in which similar behaviour and results are obtained. Concerning the parameter of presence or not of sharing transversal reinforcement, its presence improves clearly the behaviour at least of the slab with maximum spacing of longitudinal reinforcement.

The second experimental program, that comprises the testing of six slabs (2 continuous), will try to confirm the preliminary conclusions obtained in the first campaign and also to study the shear phenomenon in negative moment situation in continuous slabs.