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Application of NBR 14861: 2011 for the Design of Prestress Hollow Core Slabs Subjected to Shear

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Abstract : The purpose of this research i to study the behavior of precast prestressed hollow core slabs subjected to shear. In order to achieve this goal, shear tests were performed using hollow core slabs 26,5cm thick, with and without a concrete cover of 5 cm, without cores filled, with two cores filled and three cores filled with concrete. The tests were performed according to the procedures recommended by FIP (1992), the EN 1168:2005 and following the method presented in Costa (2009). The ultimate shear strength obtained within the tests was compared with the values of theoretical resistant shear calculated in accordance with the codes, which are being used in Brazil, noted: NBR 6118:2003 and NBR 14861:2011. When calculating the shear resistance through the equations presented in NBR 14861:2011, it was found that provision is much more accurate for the calculation of the shear strength of hollow core slabs than the NBR 6118 code. Due to the large difference between the calculated results, even for slabs without cores filled, the authors consulted the committee that drafted the NBR 14861:2011 and found that there is an error in the text of the standard, because the coefficient that is suggested, actually presents the double value than the needed one! The ABNT, later on, soon issued an amendment of NBR 14861:2011 with the necessary corrections. During the tests for the present study, it was confirmed that the concrete filling the cores contributes to increase the shear strength of hollow core slabs. But in case of slabs 26,5 cm thick, the quantity should be limited to a maximum of two cores filled, because most of the results for slabs with three cores filled were smaller. This confirmed the recommendation of NBR 14861:2011which is consistent with standard practice. After analyzing the configuration of cracking and failure mechanisms of hollow core slabs during the shear tests, strut and tie models were developed representing the forces acting on the slab at the moment of rupture. Through these models the authors were able to calculate the tensile stress acting on the concrete ties (ribs) and scaled the geometry of these ties. The conclusions of the research performed are the experiments results have shown that the mechanism of failure of the hollow-core slabs can be predicted using the strut-and-tie procedure, within a good range of accuracy. In addition, the needed of the correction of the Brazilian standard to review the correction factor σcp duplicated (in NBR14861/2011), and the limitation of the number of cores (Holes) to be filled with concrete, to increase the strength of the slab for the shear resistance. It is also suggested the increasing the amount of test results with 26.5 cm thick, and a larger range of thickness slabs, in order to obtain results of shear tests with cores concreted after the release of prestressing force. Another set of shear tests on slabs must be performed in slabs with cores filled and cover concrete reinforced with welded steel mesh for comparison with results of theoretical values calculated by the new revision of the standard NBR 14861:2011.

Keywords : prestressed hollow core slabs, shear, strut, tie models
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