SUMMARY OF DOCTORAL THESIS

Damian Szczech, M.Sc. Eng

Analysis of the effect of the type of reinforcement on the shear strength of the concrete beams with transverse reinforcement

The subject of the dissertation is the analysis of shear in concrete beams with transverse reinforcement and the effect of the type of reinforcement on the shear strength. Glass fiber reinforced polymer bars (GFRP) and steel bars were used in the beams.

The author developed a thorough review of the literature on the study of shear in the elements reinforced with FRP bars, created his own research program, precisely selected the variable parameters, and specified the 4 theses. The test program included 10 beams reinforced with GFRP bars and 8 beams reinforced with steel bars.

The main purpose of the study is detailed analysis of the behaviour and failure of beams reinforced in bending and shear with GFRP bars compared to beams without transverse reinforcement, as well as to comparison of the load carrying capacity of beams reinforced with GFRP bars to that of beams reinforced with conventional steel. Another point was to analyse the impact of the main variable parameters on the shear capacity of beams. To analyse the influence of the amount of longitudinal reinforcement on shear, 2 longitudinal reinforcement ratios were assumed: ρ_l = 2.9% (5 ϕ 25) and ρ_l = 3.7% (5 ϕ 28). To analyse the effect of the amount of GFRP transverse reinforcement on the shear capacity of the beams, 3 different transverse reinforcement ratios were adopted, modifying the spacing of stirrups while maintaining a uniform stirrup diameter ϕ 8: ρ_w = 0.16 % (250 mm), ρ_w = 0.20 % (200 mm) and ρ_w = 0.33 % (120 mm). The last variable parameter was the influence of the localization of transverse reinforcement on load carrying capacity. In this regard, the diameter and spacing of stirrups were changed from ϕ 8 every 120 mm to ϕ 12 every 270 mm, thus keeping the transverse reinforcement ratio the same ρ_w = 0.33 %.

The paper includes an extensive description of the test elements, the geometry and reinforcement of the beams, the test stand, and the adopted measurement methodology. Experimental results of author's tests of the beams are presented, and observations made during the tests are described. The PhD thesis presents an exhaustive investigation of the results of author's tests and the influence of the variable parameters on the shear strength.

In the last part of the thesis, selected foreign standard codes and theoretical models for determining shear resistance were analysed. Then, the results of author's research were compared in relation to the predicted shear capacity. The results of foreign research from the state of the art were also analysed. The dissertation includes a comparison according to the American ACI 440.1R-15, Italian CNR DT-203/2006, Canadian CAN/CSA-S806-12 and Japanese JSCE 1997 standards, as well as comparison according to selected calculation models such as Nehdi's, Fico's, Hegger's and Oller's models.

The discourse was summarized with thorough final conclusions. The effect of the type of reinforcement, the longitudinal reinforcement ratio, and the transverse reinforcement ratio on the shear capacity of beams was confirmed, as well as the influence of the arrangement of stirrups (the difference in diameter and spacing of transverse reinforcement).

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