Jordan University of Science and Technology

Influence of synthetic fibers on the shear behavior of lightweight concrete beams

Authors: Ayman Ababneh, Rajai Al-Rousan, Mohammad Alhassan and Mohammed Alqadami

Abstract: Incorporating discontinuous structural synthetic fibers in general enhances the performance of concrete and increases its durability by minimizing its potential to cracking and providing crack arresting mechanism. Synthetic fibers are non-corrosive, alkali resistant, simple to apply, and added in small quantities due to their low density; thus, a substantial number of uniformly distributed fibers are added. In this research, an experimental program was undertaken to investigate the shear behavior of lightweight concrete beams containing discontinuous structural synthetic fibers. The studied parameters include fiber content and shear reinforcement. The tests were conducted under four-point loading in a simply supported span of 0.85 m. The beams were divided into three groups based on shear reinforcement. Group 1 was designed without shear reinforcement, Group 2 with closed vertical stirrups placed at d/4 spacing (where d is the effective depth), and Group 3 with closed vertical stirrups placed at d/2 spacing. Each group contains four identical specimens except in terms of the fiber content: 0, 3, 5, and 7 kg/m3 equivalent to fiber volume fractions of 0%, 0.33%, 0.55%, and 0.77%, respectively. The experimental results showed that the discontinuous structural synthetic fibers improve the ultimate shear strength, ductility, stiffness, and toughness of lightweight concrete beams significantly. Therefore, design codes are encouraged to consider their contribution to shear strength and revise the maximum stirrups spacing when discontinuous structural synthetic fibers are used. The results also showed that addition of discontinuous structural synthetic fibers reduces the crack width of lightweight reinforced concrete beams. The effectiveness of the discontinuous structural synthetic fibers decreases as the stirrups spacing decreases.