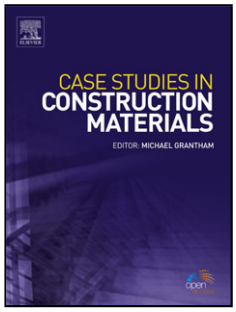

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Flexural Behaviour and Theoretical Prediction of Lightweight Ferrocement Composite Beams

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Abstract

Sixteen full-scale simply supported composite beams of the same dimensions, breadth=100 mm, thickness, 200 mm, and length of 2000 mm, subjected to flexural loading, were experimentally tested and their structural parameters, namely, pre-crack stiffness, serviceability loads, post-cracking loads, energy absorption, ultimate load-to weight ratio, and compressive strains were investigated. In addition, theoretical prediction of ultimate loads was carried out to adopt a theoretical approach as a design methodology for ferrocement elements. Experimental results showed that pre-crack stiffness, maximum service loads, maximum values of energy absorption and ultimate loads to weight ratios of ferrocement beams are higher than that of lightweight control beam by up to 46%, 32%, 64.4% and 32.8%, respectively. Higher post-cracking loads were exhibited by beams reinforced by expanded metal mesh, compared to those reinforced by welded wire mesh regardless of the core filling type. For post cracking load indicator, confinement with expanded metal mesh was the decisive factor affecting the post-cracking load capacity. Beams reinforced with expanded metal mesh showed higher energy absorption than those of the other beams reinforced with welded wire mesh or fiberglass mesh. Increasing the amount of mesh reinforcement results in higher energy absorption for beams made of Autoclaved Aerated Lightweight Brick Core (AAC). Generally, the maximum compressive strains of the ferrocement composite beams were generated at higher loads compared to those of the control beams. Theoretical calculations, based on the assumption of strains and forces distribution block, results in acceptable prediction of the ultimate loads. The ratio of experimental to theoretical ultimate loads ranges from 0.91 to 1.26. This study showed that ferrocement composite beams may be used as an alternative to traditional reinforced normal or lightweight concrete beams after careful choice of the combination of core and mesh types to suit the application in question.