

Flexural behavior of ferrocement I-beams and box-beams.

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Abstract

Ferrocement (FC) is considered as wire mesh reinforcement impregnated with mortar to produce elements of surprisingly small thickness and when properly shaped high strength and rigidity; these elements can be shaped to produce structural members such as I-beams and hollow Box-beams which could be used in the construction of light structures such as low cost housing units, light industrial buildings, bus stop sheds etc. A study is undertaken to examine the flexural behavior of FC I-beams and Box-beams and their adoptability to precasting techniques. The experimental program consisted of casting and testing a group of FC I-beams and Box-beams with the following parameters: number of wire mesh layers in flanges and web(s); effect of skeletal steel; effect of web stiffeners; effect of beam length; effect of wire mesh reinforcement in web(s); effect of wire mesh opening and diameter and the effect of skeletal steel in compression flange. All beams are tested as simple beams under two point loads applied at the third points. The study included: cracking and ultimate loads; cracking, yielding and ultimate deflections and curvatures; stiffness and rigidity of FC beams during pre-cracking; post-cracking and ultimate stages and cracking behavior.

Tests have shown that the load-deflection and moment-curvature curves of FC beams exhibit three stages of behavior i.e, uncracked, cracked and ultimate stage. The strength of FC can be considerably increased by the proper choice of cross-section. The ultimate moment capacity is directly proportional to the number of wiremesh layers. Skeletal steel plays an important role in increasing the ductility and significantly increasing the ultimate moment capacity. Wiremesh reinforcement in the web(s) increases the ultimate moment capacity and safe guards against shear failure. It is concluded that the FC can be treated as a hybrid material between reinforced concrete (material exhibiting cracking --- etc.) and steel (homogeneous material with large ductility).

Mathematical models are presented to predict the first crack stress, Ultimate moment and flexural rigidity in the cracked range and the results are compared with the experimental findings. The intend of this study is to arrive at analytical means of designing FC I-beams and Box-beams which could be used effectively as precast units in the construction of light structures.