

On void structure and strength of foamed concrete made without/with additives

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Abstract

A study has been undertaken to investigate the effect of different additives on the strength of foamed concrete by characterising air-void size and shape parameters and identifying the influence of these parameters and changes to cement paste microstructure on strength. Nine different mixes, made using a preformed foam, were investigated with varying density (nominally 1300, 1600 and 1900 kg/m³) without/ with additives (silica fume, fly ash and superplasticizer), used either individually or together. Optical microscopy and scanning electron microscopy were used in this investigation. Compared to the conventional mixes, inclusion of additives (individually or in combination) helped to improve both the cement paste microstructure and air-void structure of foamed concrete. For a given density, although the additives in combination led to increased void numbers, higher strength was achieved due to reduced void size and connectivity, by preventing their merging and producing a narrow void size distribution.

Furthermore, superplasticizer has the most beneficial influence on voids when used alone and it further improves void structure (smaller and number voids) when used in combination with other additives. Not only enhancement of void structure but also improved cement paste microstructure both contribute to the strength of the foamed concrete.