Investigation of the Structural Performance of Pozzolan - Lime Cement for Low Cost Housing Construction in Uganda.

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Abstract

Adequate housing is considered one of the basic human rights. However, many people lack access to adequate housing and decent shelter due to cost limitations. Construction materials constitute a significant component of the cost. Portland cement is one of the costly materials used even in applications that do not require its high strength grades. The use of natural pozzolan - lime cement as an alternative to Portland cement to reduce the cost is hindered by limited information. Research on pozzolans has focussed mainly on addressing their negative effect of decreasing the strength of concrete, rather than cost saving benefits if used in low strength construction applications.

This research examined the structural performance of natural pozzolans mixed with lime as a potential substitute to Portland cement in low-strength construction applications to reduce the cost of housing construction. The research approach was experimental. Trial mixes were prepared for nine different pozzolan particle sizes, and five different pozzolan contents. Strength development was monitored over a period of ninety days and compressive strength tests performed at 7 days, 28 days and 90 days.

It was established that compressive strength of the pozzolan–lime cement increases with pozzolan content up to a certain point where it begins to reduce. On the other hand, the peak compressive strength was confirmed to be inversely proportional to the particle size of the pozzolans. The research also established that the effect of the particle size on compressive strength depended on the pozzolan content at which it occurred, and vice versa. The optimum pozzolan content that gives peak compressive strength development was predicted to be between 54% and 60% irrespective of the pozzolan particle size. Similarly, the most consistent effect was established with predominant pozzolan particle size of at least 125μm.

The peak compressive strength values attained from the pozzolan–lime cement were found to be inferior to those obtained from the Portland cement system, but adequate for a number of low-strength construction applications. Addition of small quantities of Portland cement or

chemical activators may be necessary to enhance the performance of the material. Effective use of the material requires further investigations on appropriate production processes and methods, and carrying out a cost-benefit analysis of using the material for low-cost housing.

Keywords: Pozzolan, Lime Cement, Construction materials, Low Cost Housing, Cement System, Uganda