

# **Evaluation of ternary cements for improving concrete durability**

**Mohammed Azhar**

Civil Engineering

May 2007

Abstract

Though silica fume blended cement has been specified to combat the deterioration of reinforced concrete structures in the aggressive environment of the Arabian Gulf, several problems have been noted with the use of silica fume alone in concrete, namely cracking of concrete due to plastic and drying shrinkage, particularly when concrete has not been adequately cured and low early strength in concrete when fly ash is used. Due to these problems, there is a worldwide trend towards using ternary cements in concrete. Limited literature is available on the performance of concrete prepared utilizing ternary cements, particularly in the climatic and aggressive exposures of the Arabian Gulf. Research work on this aspect is yet to be conducted in the Arabian Gulf.

The broad objective of this research was to assess the properties of concrete prepared with ternary cements. The specific objectives were as follows: (i) to evaluate the mechanical properties and shrinkage characteristics of ternary cement concrete, (ii) to assess the durability characteristics of ternary cement concretes, and (iii) to provide recommendations on the optimum composition of ternary cement for use in the hot weather conditions.

The results obtained for the mechanical properties and durability characteristics of ternary cement concrete were in line with the literature; however, the drying shrinkage increased with the increase in the ternary cement content. Correlations between the compressive strength and other properties with the composition of ternary cements were reported. Recommendations for the further study in this area have been stated.