PROPERTIES OF CONCRETE AND PLASTER MADE USING ALTERNATIVES FOR RIVER SAND

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DECLARATION

I herewith declare that the work included in the thesis in part or whole, has not been submitted for any other academic qualification at any institution.

07/03/2007
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Abstract

This research was done to find an alternative for river sand for concrete, mortar and plaster. Offshore sand, quarry dust and manufactured sand were considered as alternatives and offshore sand was taken as the most suitable alternative for Sri Lanka. The major difference between river sand and offshore sand is the absence of shells and chloride in river sand, not like in offshore sand. In addition to a literature review various study programmes and test methods were followed to come to a conclusion.

ICTAD Specifications (1980) were used to choose appropriate volume batched proportions for both mortars and plasters and tested according to BS 4551 (1980). A 2m high sand column was fabricated to check the effects of natural drainage and simulated rain on the chloride levels in offshore sand. Also, special moulds were fabricated to produce corrosion test specimens having low (i.e. 20 mm) covers of concrete made with normal sized (i.e. 20 mm) aggregate. A figure of 0.075% by weight of the sand was arrived at as a conservative limit for allowable Cl^- ions in offshore sand for OPC based reinforced or metal-embedded concrete. The accelerated corrosion tests were carried out in a 5% NaCl bath and a carbonation chamber. Half-cell potential measurements were taken to detect corrosion activity.

Offshore sand saturated with sea water had a Cl^- content of around 0.3%. It reduced to around 0.075% (i.e. allowable content) when the sea water is gravity drained. The action of even 80 mm of rain reduced Cl^- contents to below acceptable levels, even at the top of a 2m high stockpile (which may be subject to evaporation) and the bottom (which may trap sea water by capillary action). The corrosion performance of grade 20 concrete (i.e. the most critical grade) with the allowable Cl^- content in the sand is satisfactory and similar to a chloride free control mix; on the other hand, a mix with 0.3% Cl^- in the sand shows clear evidence of early corrosion. Shell content of offshore sand did not impair the engineering properties of concrete.

Offshore sand was found to be better than manufactured sand for concrete. Both offshore sand and manufactured sand were found to be satisfactory for both mortars and plasters and reasonably acceptable to masons.

Table of contents

List of tables

List of figures