SOME STUDIES ON THE BEHAVIOUR OF CEMENT CONCRETE IN OCEAN ENVIRONMENTS

BY

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To

MY PARENTS

CERTIFICATE

This is to certify that thesis entitled "SOME STUDIES ON THE BEHAVIOUR OF CEMENT CONCRETE IN OCEAN ENVIRONMENTS" being submitted by Mr. Krishna G. Kawadkar to the Indian Institute of Technology, New Delhi, India, for the award of the "DOCTOR OF PHYLOSOPHY IN CIVIL ENGINEERING", is a record of bonafide research work carried out by him under my guidance and supervision.

To the best of my knowledge the thesis has reached the requisite standard. The material presented in this thesis has not been submitted in part or full to any other university or institution for award of a degree or diploma.

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(K.G. KAWADKAR)

ABSTRACT

The behaviour of low and medium grades of concretes has been studied when under the effects of aggressive media, namely, artificial sea water (with five times the concentrations of its principal salts), individual solutions of the sodium chloride (1,36,050 ppm), magnesium chloride (19,050 ppm) and magnesium sulphate (8300 ppm), both at atmospheric pressure for periods upto 15 months, and at pressures equivalent to 50,100 and 210 meters of water for 3 months. Small-sized specimens of concrete have been subjected to such attacking media at an early age after casting. Seven mixes of concrete with different water-cement and aggregate-cement ratios have been used.

The specimens have been tested for compressive and tensile strengths, modulus of elasticity, modulus of rupture, dynamic modulus of elasticity, ultrasonic pulse velocity, bond strength, permeability to water and pH value.

Small-sized reinforced concrete beams have also been tested for failure.

Scanning electron micrographs and x-ray diffractographs obtained on hardened cement paste samples of similar water-cement ratios, which had been cured in

identical manners, are also presented to appreciate the causes of deterioration and possible chemical and morphological changes.

Hydrostatic pressures of the deep sea environment were simulated in specially designed and fabricated pressure vessels.

A quick permeability test for'deteriorated' samples has been devised. All properties (except permeability) show reductions in their values with age and pressure in all the media. The role of pressure has been to cause an accelerated effect of deterioration of concrete. All the reagents react with cement paste and produce such products which cause changes in the microstructure of the paste and in the engineering properties of concrete.

Appropriate conclusions have been drawn on the behaviour of cement concrete when it is likely to be subjected to the salts of the ocean environment.

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