A STUDY ON THE CORROSION POTENTIAL OF STEEL EMBEDDED IN CONCRETES MADE OF DIFFERENT CEMENTS

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C E R T I F I C A T E

This is to certify that thesis entitled "A STUDY ON THE CORROSION POTENTIAL OF STEEL EMBEDDED IN CONCRETES MADE OF DIFFERENT CEMENTS" being submitted by Mr. Darshan Singh Sidhu to the Indian Institute of Technology, New Delhi, India for the award of the "DOCTOR OF PHILOSOPHY 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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ABSTRACT

The corrosion potential of steel embedded in concretes made of different types of cements and exposed to different curing media upto 18 months have been studied. The cements are: 1) Ordinary portland cement (OPC), with a high C_3S content ; 2) Portland blast furnace slag cement (PBFC), containing about 31% silica; 3) High alumina cement (HAC), containing about 41% alumina and 4) Blended cement (BC), made by replacing 20% of OPC with 27.5% flyash; the flyash used contained about 50% silica and 25% alumina. In order to appreciate the relative effect of permeability, two mixes have been studied, one with a higher W/C ratio (0.60) and the other with a low W/C ratio (0.48). The curing media were; potable water, 3% and 9% sodium chloride solutions and artifical sea water.

Various electrochemical, chemical and electrical tests have been conducted on concrete specimens. The electrochemical tests carried out on steel embedded in concrete specimens are: Open circuit potential measurements, linear polarization and anodic polarization measurements. The material removed from around the steel bars was analysed for chloride content and its pH value was also determined at the end of the exposure period. Electrical resistivity of concrete was determined at regular intervals using cubical specimens.

Electrochemical, chemical and electrical studies have a useful role to play to study the corrosion process of steel in concrete. The interaction diagram between the parameter Cl^{-}/OH^{-} and open circuit potential of steel, has been found to be of considerable use for corrosion assessment of steel in existing concrete structures. Blended cement of the type used in this study have been found to be best cement from protection against corrosion of steel point of view, for exposure to curing media used in this study.

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