



The role of supplementary cementing materials on durability and sustainability of concrete structures

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Abstract

The use of supplementary cementing materials and durability of concrete structures are the main issues for sustainability. Concrete deterioration and corrosion of reinforced concrete structures is a major problem in many countries. However, there is a substantial need for the construction of concrete structures in very severe environments. Survey of newly and old concrete structures in such regions show that many of these structures are not able to satisfy their minimum service life.

The use of special cements and pozzolans in corrosive regions has shown desirable performance of reinforced concrete and enhanced the durability of concrete. Results of accelerated and long term tests in simulated environments show that supplementary cementing materials can enhance the durability of concrete.

In this research work, concrete specimens containing different natural pozzolans have been thoroughly investigated. Test conducted include, compressive strength, permeability, chloride ion diffusion, corrosion of reinforcing bars, and carbonation all at different ages. The variables were the type of supplementary cementing materials and water cement ratio in concrete mixtures.

Test results at various ages are presented in this paper. The performance of concrete mixtures depends upon the type of pozzolan and their water cement ratios. Concrete mixtures containing natural pozzolans showed better performance in terms of chloride permeability and corrosion when compared with the control concrete mixtures.

Keywords: sustainable, durability, natural pozzolan, corrosion, permeability

1. INTRODUCTION

Sustainability has been an important issue for the last decade. On the other hand, CO₂ emission has been a serious problem in the world due to the greenhouse effect. Today many countries agreed to reduce the emission of CO₂ [1]. Many phases of cement and concrete technology can affect sustainability. The use of supplementary cementing materials (SCM), design of concrete mixtures with optimum content of cement and enhancement of concrete durability are the main issue towards sustainability in concrete industry.

Durability of concrete structures in the severe environments is a major problem all over the world. The hot and aggressive condition of the Persian Gulf region has caused severe corrosion in the concrete structures. Survey of newly built and old concrete structures in the Persian Gulf region show that many of these structures are not able to satisfy their minimum service life [2]. However, the use of special cements and pozzolans in corrosive regions, has shown desirable performance of reinforced concrete and enhanced the durability of concrete [3-6]. Results of accelerated tests in simulated environments show that supplementary cementing materials can enhance the durability of concrete [7]. Attempt has been made to investigate the long term performance of concretes containing supplementary cementing materials in severe environments. The objective of these investigations is to create models for the prediction of service life of concrete structures and establish a model code for design [8-9].

The aim of this work is to evaluate durability performance of concretes containing supplementary cementing materials which remained for four years in the marine environment of the Persian Gulf