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CORROSION OF STEEL REINFORCEMENT EMBEDDED

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ABSTRACT

The corrosion of the reinforcement embedded in concrete is extremely complicated and is influenced by numerous factors, both external and internal. The nonhomogeneities in the metal surface due to difference of chemical composition over the surface ,discontinuous surface layers or differences in texture tend to increase the probability of corrosion due to the development of potential difference.

INTRODUCTION

In the basic concrete-steel system, electro-chemical cells are set up by heterogeneities of the concrete media. Reaction variables influencing electro-chemical corrosion are the moisture content, pH at the concrete-steel interface and the amount of available oxygen. When moisture is present, concrete medium becomes an electrolyte containing mainly calcium hydroxide.

FACTORS ASSOCIATED WITH CONCRETE

Effects of PH : Corrosion is more rapid in acidic solutions than in neutral solutions (pH=7).Steel becomes passive in alkaline solutions due to the formation of an impervious layer of ferric products on the steel surface.

Influence of Oxygen : Oxygen is primarily responsible for the corrosion. Oxygen acts as a depolarizer at the cathode and consequently tends to increase the rate of corrosion. Dissolved oxygen alone will accelerate corrosion in acid, neutral or slightly alkaline electrolytes.

Influence of moisture: As the corrosion reactions occur only if moisture is present,all corrosive factors become ineffective in its absence. In addition ,the moisture penetration is the means whereby any exterioir substances, such as chloride salts, carbon dioxide and dissolved oxygen may gain access to the reinforcement.

Influence of chloride ion concentration: The presence of salts provided two opposite effect:

1.It increase the conductivity of the electrolyte, thus raising the corrosion rate.

2.At high concentration it diminishes the solubility of oxygen,thereby lowering corrosion rate.

Influence of carbonation: The carbon dioxide absorbed into the concrete may convert the calcium hydroxide into calcium carbonate thereby reducing the pH value and,consequently, the protective value of the concrete.Carbonation also tends to increase the shrinkage of concrete and thus promotes the development of cracks.

Influence of the Quality of concrete: Permeability of concrete is probably the most important single factor affecting the corrosion of reinforcement.Concrete of high permeability will have a high electrical conductivity and allow the penetration of deleterious substances to the reinforcement.

EFFECTS OF CORROSION

In most cases, the corrosion rate is extremely slow and the normal life span of a structure is not largely affected. However ,if the external and internal conditions, are such that a corrosive environment exists,a destructiveaction may take place at an increased rate and create serious problems.

Reinforces concrete members totally immersed on sea-water, the cover should be increased by 40mm beyond that specified for normal conditions. However, for the members periodically immersed in the sea-water, this increase in cover should be raised to 50 mm. In the case of high strength concretes of grade M25 or above, the additional thickness of cover specified above may be reduced to half.

CONTROL OF CORROSION

To reduce the corrosion of reinforcement, the chloride ions in the concrete should be limited to its threshold or critical value.IS :456-2000 has prescribed the limit of total amount of chloride in concrete at 0.15 per cent by mass of cement. However, for prestressed concrete,the total amount of chloride ions in concrete should be limited to 0.06 per cent.

The use of special steels to overcome the problem of corrosion of reinforcement is a costly solution. However, the sacrificial protection provided by coating the reinforcement with either a metallic or non-metallic material has been found to be satisfactory.

Irrespective of the type, it is essential that the coating should completely envelope the bar and should remain unbroken.

The concrete surface coatings providing a barrier at the surface which penetrate and seal the pores of concrete are popular for this type of protection, waterproof membranes are also being extensively used.

CONCLUSION

Concrete of suitable quality, corrosion of steel can be prevented provided the structure is properly designed for the intended environmental exposure.In instance of very severe exposure, the use of other protective measures such as corrosion inhibitors ,coatings on steel or concrete or cathodic protection may be utilized .However,corrosion of steel and accompanying distress can result if the concrete is not of suitable quality,the structure is not properly designed for the anticipated environment or the actual environment or other factors were not as anticipated or changed during the life of the structure.

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