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Corrosion of Concrete Reinforcing Steel Bars Tested and Compared Between Various Protection Methods

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Abstract : This paper analyses how concrete reinforcing steel bars corrode and how it can be minimised through the use of various protection methods against corrosion, such as metal-based paint, alloying, cathodic protection and electroplating. Samples of carbon steel bars were protected, using these four methods. Tests performed on the samples included durability, electrical resistivity and bond strength. Durability results indicated relatively low corrosion rates for alloying, cathodic protection, electroplating and metal-based paint. The resistivity results indicate all samples experienced a downward trend, despite erratic fluctuations in the data, indicating an inverse relationship between electrical resistivity and corrosion rate. The results indicated lowered bond strengths when the reinforced concrete was cured in seawater compared to being cured in normal water. It also showed that higher design compressive strengths lead to higher bond strengths which can be used to compensate for the loss of bond strength due to corrosion in a real-world application. In terms of implications, all protection methods have the potential to be effective at resisting corrosion in real-world applications, especially the alloying, cathodic protection and electroplating methods. The metal-based paint underperformed by comparison, most likely due to the nature of paint in general which can fade and chip away, revealing the steel samples and exposing them to corrosion. For alloying, stainless steel is the suggested material of choice, where Y-bars are highly recommended as smooth bars have a much-lowered bond strength. Cathodic protection performed the best of all in protecting the sample from corrosion, however, its real-world application would require significant evaluation into the feasibility of such a method.

Keywords : protection methods, corrosion, concrete, reinforcing steel bars
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