Durability assessment criterion for concrete and reinforcement exposed to simulated environmental conditions of Saudi Arabia

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Abstract

Concrete subjected to cyclic heating simulating fluctuations of temperature typical of the ambient conditions during summer months in the Gulf region shows a deterioration of its internal structure due to differential thermal strains of coarse aggregate and cement paste. The direct consequence of this microcracking is significantly enhanced permeability of concrete causing an acceleration of the rebar corrosion process and a reduction of the tensile strength resulting in early cracking and spalling. The results show definite advantages of using low W/c ratio of 0.4 in terms of damage to the internal structure of concrete. The durability of concrete in terms of cracking resistance against rebar corrosion can be expressed by a factor termed "Coefficient of resistance against cracking".

Of the four steels tested in terms of their corrosion sensitivity, the stainless clad steel showed the best durability performance against corrosion, followed by epoxy coated, galvanized and mild steel. The corrosion in the epoxy rebars was extremely localized to locations where the epoxy coating was damaged during the casting process.