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Experimental assessment of corrosion influence in reinforced concrete by GPR

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Corrosion is one of the most critical issues leading to damage in reinforced concrete structures. In most cases, the detection of corrosion damage is performed by visual inspection. Other techniques (drilling cores with petrography or chemical examination, potential measurements, and resistivity measurements) require minimum destruction since they can be utilized by reaching the reinforcement bar [1]. Recently, there has been an increasing trend to use Ground Penetrating Radar (GPR) as one of the emerging non-destructive testing (NDT) techniques in the diagnosis of corrosion [2].

This paper focuses on a series of GPR tests on specimens constructed from poor-quality concrete and plain round bar. These specimens were subjected to accelerated corrosion tests under laboratory conditions. The corrosion intensity of those specimens is non-destructively assessed with GPR, by collecting data before and after corrosion tests. For GPR tests, the IDS Aladdin system was used with a double polarized 2 GHz antenna. Based on GPR measurement, Relative Dielectric Permittivity (RDP) values of concrete, are calculated based on the known dimension of specimens and two-way travel time (twt) values obtained from A-scans. The change in RDP values of specimens before and after exposure to corrosion is then computed. Moreover, amplitude change and variation in frequency spectrum before and after corrosion exposure are analyzed.

The results of this experimental study thus indicate that corrosion damage in reinforced concrete can be determined by using several GPR signal attributes. More laboratory tests are required for better quantification of the impact of the corrosion phenomenon in reinforced concrete.

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