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Strategies to detect corrosion through the combination of GPR and IRT methodologies

Mercedes Solla (1,2), Javier Vidal (3), Susana Lagüela (4,2)

(1) Defense University Center, Spanish Naval Academy, Marín, Spain (merchisolla@cud.uvigo.es), (2) Applied Geotechnologies Research Group, University of Vigo, Vigo, Spain (merchisolla@cud.uvigo.es, sulaguela@usal.es), (3) PhD Program in Geotechnologies Applied to Construction, Energy and Industry, University of Vigo, Vigo, Spain (javiervidal.geomatica@gmail.com), (4) Department of Cartographic and Terrain Engineering, University of Salamanca, Ávila, Spain (sulaguela@usal.es)

Corrosion is one of the pathologies with higher affection on the strength of reinforced concrete. There are numerous ancient structures still in use affected by corrosion that need proper evaluation and remedial treatment for their maintenance. The methods more commonly used for the investigation of the subsurface are local drilling and sampling, which are often aggressive and affect the integrity of the structure. In this context, further efforts should focus on the development of efficient and non-invasive protocols of surveying for the characterization and monitoring of the subsurface structures.
This work proposes the combination of two complementary non-destructive testing methods, Ground-Penetrating Radar (GPR) and Infrared Thermography (IRT), to detect and evaluate corrosion in reinforced concrete. Particularly, the case study of an old construction that belongs to the abandoned Military Battery of Cabo Udra (Galicia, Spain) is herein presented. With the GPR method, corrosion was interpreted through the analysis of signal properties such as dielectric constant, reflection patterns, intensity of the reflected waves and travel time-distance. Regarding the IRT method, corrosion was interpreted through the analysis of patterns in the thermal infrared band (thermal footprint) and the temperature distribution on the concrete surface. Finally, the combination of both GPR and IRT data allowed to differentiate between corroded and moist areas while identifying the presence of internal anomalies (such as cracking or detachments). Although the GPR method have demonstrated its capabilities to detect inner changes in material (e.g. moisture), the IRT method was crucial to identify the presence of air (e.g. cavities, cracking, etc.) because of the thermal footprint generated by the defects during heat transfer to the surface.
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