Imaging performance comparison in reinforced concrete pillars using Ground Penetrating Radar and Radio Frequency Tomography

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We compare two approaches for imaging reinforced concrete pillars to assess their structural health: Ground Penetrating Radar (GPR) and Radio Frequency Tomography (RFT).

This investigation is motivated by the fact that the US Department of Transportation indicated that more than 60,000 bridges around the country are structurally deficient. The corrosion of metal rebars in concrete structures is one of the primary causes of structural weakening due to the important role of rebars, which provide ductility and structural strength. Corrosion eventually leads to the presence of cracks in reinforced concrete structures.

GPR is a well-assessed tool for structural monitoring which transmits wideband electromagnetic pulses in the subsurface and collects data in a multimonostatic configuration. The usage of wideband signals originates from the necessity to achieve depth resolution. On the other hand, RFT is based on a multiview/multistatic configuration where narrowband pulses are sufficient for target imaging since the necessary resolution is provided by the spatial (illumination and observation) diversity.

A comparison between GPR and RFT has been performed in the case of columns (R. Persico *et al.*, "GPR prospecting on circular surfaces: preliminary results," *Ground Penetrating Radar (GPR), 2014 15th International Conference on*, Brussels, 2014, pp. 79-82) and it was found that RFT yields superior resolution than GPR.

In this work, we consider pillars made of reinforced concrete and examine the advantages and disadvantages of GPR and RFT when imaging metallic rebars. In addition, we analyze how the methods behave in the presence of cracks to investigate the effects of corrosion.