Geophysical Research Abstracts
Vol. 16, EGU2014-16422, 2014
EGU General Assembly 2014

A GPR system for the high-resolution inspection of walls and structures

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Nowadays GPR systems are used in a broad range of applications, including the non-destructive inspection of man-made concrete structures such as pillars and bridge decks.

Concrete inspection involves several aspects including: location of reinforced bars in walls and floors, concrete condition assessment, concrete cover detection, etc. These surveys are very demanding as far as the system is concerned, because of the strict requirements in terms of resolution and accuracy.

Specifically, a key GPR application concerns the condition assessment of a structure that has undergone rehabilitation (e.g. for the removal of architectural barriers or new openings); in this case, the current practice requires to re-check the stability of the entire structure that includes the identification of the number of rebars in reinforced concrete beams location of pre-tensioned cables and early detection of corrosion. This can be done by verification holes (coring) that is costly and intrusive practice or by using a pachometer, but this tool has a limited field of investigation (up to 7-8 cm from the surface). GPR can instead be a useful investigative tool especially when the surface of the beam is not accessible because it is covered by screed or floor.

The need of detecting rebars with diameter in the millimeter range as well as the identification of small cavities and cracks, require the development of GPR antennas featuring linear phase and constant polarization, and capable to radiate a very short pulse (i.e. with a duration in the order of few hundreds of picosecond) with no ring-down in order to achieve a high range resolution. A novel 3 GHz center frequency antenna has been recently developed and tested; it has been found capable of providing a very clear image of the concrete internal structure that helps in locating targets and enables an early detection of damages, thus providing a fast and efficient maintenance of the structure itself.

The Authors thank COST for funding COST Action TU1208 "Civil Engineering Applications of Ground Penetrating Radar".