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## GPR Activities in Italy: a Review

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Ground-penetrating radar has been increasingly played an important role over the last 15 years in Italy due to its high reliability in assisting the assessment of the built environment for civil engineering purposes, and in being used for geophysical investigations within many other fields of application. In line with this, original works involving fundamental aspects of this technique and implementing its use more practically in a number of interesting projects have been developed over years, both under a research and an enterprise point of view. This paper will endeavour to review the current status of ground-penetrating radar activities in Italy. Efforts have been devoted to single out the most interesting national research projects, both recent and ongoing, involving ground-penetrating radar in Italy, such as the ARCHEO project in the 90s, funded by the Italian Ministry for Universities, wherein a stepped frequency ultra-wide band radar suited for archaeological surveys was manufactured. In this framework, it is worth citing another important and more recent project, European Community funded, namely, ORFEUS, which started in the late 2006 with the overall aim of providing the capability to locate buried infrastructure accurately and reliably by means of a bore-head ground-penetrating radar for horizontal directional drilling. A review on the main use of this non-destructive technique in management activities of national resources and infrastructures has been also performed, ranging from the applications made by Anas S.p.A., i.e. the main management authority for the Italian road and motorway network, up to private enterprises specialized in both services providing and ground-penetrating radar manufacturing such as, to cite a few, Sineco S.p.A. and IDS Ingegneria dei Sistemi S.p.A., respectively. Current national guidelines, rules or protocols to be followed during radar surveys have been also reviewed. Unlike well-established international standards such as the ASTM D 4748-98 and the ASTM D 6432-99 dealing with, respectively, thicknesses evaluation of bound layers in road pavements, and equipment, field procedures and data-interpretation for the electromagnetic evaluation of subsurface materials, it has to be noted that the Italian body of laws and rules tackles the ground-penetrating radar applications under an indirect and partial approach. Despite of such situation, national guidelines concerning utilities-detection activities as well as other theoretical and practical guidelines established by the major Italian private enterprises on this field can be also considered highly relevant. Moreover, a further focus on the activities and main devices of the major Italian ground-penetrating radar manufacturers have been thoroughly described. Under a research and innovation perspective, the most important test sites, such as the site of the University of Salento to reconstruct archaeological and urban subsurface scenarios have been listed along with the main advances reached in integrating ground-penetrating radar with other non-destructive techniques, to inform and potentially improve the possibility of new developments and collaborations.

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