Geophysical Research Abstracts
Vol. 13, EGU2011-4546, 2011
EGU General Assembly 2011

New sensing technologies to analyze engineering structures in a validation test site: Hydrogeosite laboratory

Enzo Rizzo (1), Romeo Bernini (2), Francesco Soldovieri (2), Jean Damoulin (3), and Stefano Pignatti (1)
(1) CNR-IMAA, Tito Scalo, Italy (rizzo@imaa.cnr.it), (2) CNR-IREA, Napoli, Italy, (3) IFSTTAR, Bouguenais Cedex, France

In the framework of the EC-FP7 funded research project ISTIMES (Integrate System for transport Infrastructures surveillance and Monitoring by Electromagnetic Sensing), a particular attention is given electromagnetic sensing technologies with a low-cost and non-invasive characteristics to observe subsurface change of engineering infrastructures. In order to reach the aims of the project, several validation tests are necessary. Therefore, different EM sensing techniques will be validated to develop a non invasive monitoring strategies able to monitor and analyze important infrastructures with different resolutions.
In order to validate these techniques, several tests will be done in controlled conditions. One of them was the Hydrogeosite Laboratory of CNR-IMAA, where several EM techniques (Hyperspectral spectroscopy, Fiber Optic Sensors, Electrical Resistivity Tomography, Ground Penetrating Radar and Infrared Thermography) were used on a simulated bridge back desk. It has been made up of different layers, rebar and utilities (metallic and non-metallic pipes). In details, the simulated bridge back desk was characterised by 60cm of sand, 30cm of conglomerate, 10cm of reinforced concrete and 5cm of asphalt. A plastic and a metallic tube were installed inside the sand layer. During the construction of the bridge back desk, some optic sensors were installed with a grid shape inside the sand layer and in the reinforced concrete.
The experiments were performed in different stages. The first stage was consisted in applying the different electromagnetic sensing techniques to image the structure whit different humidity degrees, increasing the water level inside the structure. The used techniques were able to detect the rebar and the different humidity degrees in the sand and conglomerates. Moreover, the GPR and ERT were able to detect the buried utilities (metal and plastic tube). In a second phase some water was injected inside the concrete by small plastic tube previously performed and in this case the electromagnetic sensors were able to define the wet zone.
The last stage was characterised by a deformation of the simulated back desk by means of a mechanical stress producing a relative displacement of a part of the asphalt/concrete with respect to the other one.
In this case, the measurements evaluated the capability of each sensing techniques to detect and characterize the different levels of the deformation size. Finally, some asphalt levelled the deformed site and electromagnetic sensors defined the new conditions. The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under Grant Agreement n° 225663.