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A mobile GPR system for evaluating road landslide damage and effectiveness of the restoration works at Potenza District scale

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Basilicata Region (Southern Italy) is affected by a large amount of landslides due to its geological structure and orogenic history. In particular, due to its location in the Italian Apennine chain, the District of Potenza is particularly affected by this natural hazard, which threatens private buildings and public infrastructures. In this framework, the transport infrastructures result greatly exposed to this kind of damage since there is a great probability that a road intercepts a landslide in its path. In addition, this can have relevant "social and economic" effects at large distance from the landslide due to the interconnected character of the road network.
A classical remediation strategy for a damaged road, especially when affected by a localised landslide, consists in restoring its planarity by filling the depression induced by the damage. Moreover a such intervention often causes the recurrence of the damage since it results in a weakness zone in the road section. The result is that there is always an interrupted road somewhere in Basilicata.
In order to design an effective remediation strategy at the scale of the district road network, a fast low-cost diagnosis method is needed in order to:
• Detect damaged/restored treats of roads;
• Characterize previous restoration intervention quality;
• Provide a geo-database reporting all at-risk road sections;
• Predict which road sections might be damaged with the upcoming rainfall events.

In this framework, the Institute of Methodologies for Environmental Analysis (IMAA-CNR), also thanks to the cooperation of the Institute for Electromagnetic Sensing of the Environment (IREA-CNR) has equipped a van with a high-resolution Ground Penetrating Radar and differential GPS instrumentations so to achieve a mobile GPR system.
The main elements of the GPR are the control unit IDS DAD MCH Fast-Wave, horn antenna air-launched IDS HN-1000b and high speed encoder, differential GPS 1200 Leica.
Main feature of this system regards its high sampling speed allowing to gather a radargram with velocities greater than 50 Km/h. The system is able to acquire up to 100 Km per day of geo-referred radargrams.
In order to test the system and the automatic processing routines needed in order to process a huge amount of data, several surveys have been preformed on few roads affected by landslides. The results of the GPR mobile system have been compared and integrated with the outcomes of surveys performed by a GSSI SIR 3000 System with a 400 MHz ground coupled antenna so to achieve information about the section of the road to depths significant for a reliable monitoring and in this work some acquisition examples are described and discussed.

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