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Good practices for the operational safety management in the early recovery phase of a seismic event using GPR

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This study deals with a case report about the planning and the performance of GPR surveys carried out in the town of Amatrice, in the district of Rieti, Italy.
As sadly known, the town has been hit by a 6.9 magnitude earthquake in the nighttime of August 24th 2016. The strength of the seism, along with the age and the deterioration rate of the structural asset, have caused the razing to the ground and the critical damaging of the majority of the buildings within the "red zone area", corresponding to the historical town center.
In the early recovery phase taking place afterwards, the strong seismic swarm subsequent the main shake has sensitively slowed down the rescue and rehabilitation operations. Moreover, the main issue was related to the unsafety operational conditions of volunteers and firemen. To this effect, the geotechnical stability of the roads and the large operational areas represented critical issues, as up to 40 tons crane trucks were needed to put in safety the highest buildings, such as three-floor buildings and historical towers.
In this framework, ground-penetrating radar (GPR) provided a valuable help in preliminary assessing the stability of the areas where the crane trucks were planned to operate as well as to be parked over. The main objective of the GPR tests was to verify the absence of possible cavities beneath the ground surface that could undermine the strength of the surface under heavy loadings. To that effect, a multi-frequency ground-coupled GPR system was used. This radar system can simultaneously collect data at both the frequencies of 600 MHz and 1600 MHz. Four different sites were surveyed, namely, two sections of the main road passed on by the cranes, and two machinery depot areas down by the towers. In the former case, the surveys were performed by parallel longitudinal scans, due to the significant longitudinal length of the sections, whereas in the latter, two grids with differing sizes were realized and scanned for producing horizontal tomographic maps.
In both the cases, useful insights have been pointed out, and relevant critical areas of possible weaknesses in the soil strength, where to focus further and more specialist analyses, have been detected. It is important to emphasize on the details provided about the working procedures in such a complex environment.

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