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Impact shock damage assessment on a beam and its foundation soil by using Ground Penetrating Radar and Electrical Resistivity Tomography

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During an impressive experiment carried out at the test site of Montagnole (French Alpes) owned by Laboratoire Central des Pont et Caussées (LCPC), a series of impacts on the ground and on a 16.0 m x 1m x 0.5 m reinforced concrete beam appositely built has been carried out by using two spherical metal masses of 2.5 tons and 10 tons respectively. The energy of the impacts has been tuned for each mass by varying the height of drop. In order to assess the possible damages, an extensive Ground Penetrating Radar (GPR) and an Electrical Resistivity Tomography (ERT) surveys have been carried out on the limestone foundation soil and directly on the surface of the beam. Concerning the foundation soil inspection, both GPR and ERT surveys have been carried out along a 47 m long survey line close and parallel to the beam. The GPR data have been gathered by using a GSSI SIR3000 georesistivimeter equipped with a 400 MHz antenna. The ERT data have been collected by using an IRIS Syscal R2 system equipped with multicore cables at 48 electrodes 1m spaced. Both Wenner-Schlumberger and dipole-dipole arrays have been used. The GPR direct beam inspection needed the use of a 1.5 GHz central frequency antenna equipped with encoder. Several transversal and a longitudinal survey lines have been scanned on a frontal face of the beam. Moreover, near the impact point, a 0.75 m x 2 m 3D survey area has been scanned with 16 horizontal and 41 vertical radargrams 0.05 m spaced. In order to carry out the ERT directly on the beam surface, the georesistivimeter has been equipped with 48 electrocardiographic electrodes put on the upper surface of the beam each 0.1 m. The electrical contact between concrete and electrodes has been improved by using medical electroconductive gel. In order to establish a “zero-time” condition, the GPR and ERT surveys have been carried out on the ground and on the beam before any impact. Then, a series of impacts on the ground and on the beam with increasing energy has been carried out. After main impacts, the GPR and ERT surveys have been repeated on the described survey lines. The experiment ended with the damaging of the beam realized by releasing a 2.5 tons mass from an height of 5 m. The GPR data have been processed by using both a commercial processing software and the Microwave Tomography approach (Soldovieri and Solimene, 2010). The ERT data have been inverted by using the commercial software Res2DInv (Loke and Barker, 1996). In this work we present and discuss the preliminary results by comparing the data obtained at each stage of the experiment in order to check possible changes in the ground and in the beam structure respect to the pre-impact condition.

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