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Imaging of Internal Structure of Concrete Constructions by Non Destructive Geophysical Methods

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Geophysical methods are increasingly used by civil engineers for non-destructive testing (NDT) explorations. Concrete quality is the most important parameter for in-situ construction. Furthermore, estimation of conditions of steel bar is important for buildings' earthquake resistance. Concrete quality is mostly determined by core samples and triaxial compression test method.They only indicate the core samples, not all construction. However, geophysical methods help to find out not only the core samples but also all features of the structure. The conventional methods take time to do, waste to money and also damages constructions.
In this study, ground penetrating radar (GPR), micro-resistivity method and ultrasonic measurements were used to determine the physical characterization of concrete, depths of steel bars into the concrete, cracks which could not be seen on the surface of the concrete sample and the effect of concrete moisture on concrete laboratory slab. These measurements were designed as two parts. The strength and behaviour of the concrete sample were investigated by applying stress in the laboratory. First measurements were taken on concrete laboratory slab before shaking table. The second part was scanned after the shaking table. GPR measurements were performed to with 2.7 GHz ground-coupled antennas. Intervals of profiles are as 5 cm for GPR. Data processing is controlled and 2-D sections were prepared by RADAN-7 software. Electrical resistivity method utilized resistivity profile measurement using Wenner electrode array configuration on the slab. The electrical profiles entailed 1-D vertical probing of the surface. Pulse velocity measurements (ultrasonic) were done for every each 5 cm on the prepared concrete sample. Graphs of electrical resistivity and ultrasonic longitudinal wave velocity were plotted by SURFER 8.0 software for same directions.
Estimation of concrete strength from pulse velocity measurement, the degree of corrosion estimated from electrical resistivity measurements, existing and depths of steel bars and cracks from GPR profiles on laboratory sample of construction were compared each other before and after shaking table in this study. These results will be used by structural design against the earthquakes.