Locating grouting defects in prefabricated structures

Prefabricated, Prefinished Volumetric Construction (PPVC) is a relatively new prefabrication construction technique and it is becoming increasingly popular. One example is Singapore where the technique is being used for both government and private housing construction projects. In fact, the adoption of PPVC is imposed on selected Government Land Sale sites [1].

PPVC involves fabricating and finishing 3D modules (usually rooms) off-site. By moving a lot of the work off-site, there are several advantages including improved productivity, better construction environment, improved site safety and tighter quality control [2].

Challenge

PPVC modules (rooms) are constructed away from the construction site. At the construction site they need to be assembled together to form the complete building e.g. a block of flats. In dual wall design, the gap between the two prefabricated concrete walls is grouted. Liquid grout is injected on site.

The final strength of the structure depends on checking the quality of the grouting, which should be free of voids and delaminations. The total thickness of the two walls and the grouting is approximately 20cm. A quick, non-destructive method to check the grouting is required.

Solution

The Pundit PD8000 hardware is an ultrasonic pulse-echo array. Electromagnetic techniques such as Ground Penetrating Radar (GPR) cannot detect delaminations nor voids. Traditional ultrasonic pulse velocity (UPV) measurement methods are an option but they are slow, and require a lot of preparation work and analysis work. The latter is often done offsite so immediate evaluation is impossible.

Pundit PD8000 provides images of the interior of the structure so it is possible to “see” the grouting condition. The image clarity is superb and any defects in the grouting can be clearly identified. It is possible to view 2D, 3D and even Augmented Reality images on-site, so evaluation can be done immediately. All data is backed up on a cloud server and can be accessed and processed securely from remote locations. HTML reports can also be automatically generated. These features are essential when working on large construction projects involving long time periods and many stakeholders.

Since this ultrasonic pulse-echo array is dry-coupled to the concrete surface, no couplant gel is required, making testing quicker and cleaner. By use of laser and special measuring tape, the Pundit PD8000 automatically identifies the test location. This means that the inspector can collect data from different points on the concrete without tedious measurement and marking. All the data is stitched together to form a so-called panoramic scan, that can be up to 15m long. Testing with Pundit PD8000 requires access to one side (wall) only.

To complete the end-to-end inspection process, the Screening Eagle INSPECT software captures and geolocates all your inspection data - from visual inspection to sensor measurements - into a centralized cloud platform for collaboration, analysis, and customized reporting. This powerful solution eliminates the painful consolidation of disparate inspection inputs such as notetaking, photographs and sketches, and sensor data - your all-in-one platform for inspection data.

The combination of powerful hardware and intuitive software makes Pundit PD8000 the tool of choice for this revolutionary construction technique.
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References