Testing the setting and hardening of concrete using the prism technique

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Abstract : In non-destructive testing of concrete, the ultrasonic pulse-echo technique has proven to be a reliable method for locating cracks and other internal defects. An electro-mechanical transducer is used to generate a short pulse of ultrasonic stress waves that propagate into the object being inspected. Reflection of the stress pulse occurs at boundaries separating materials with different densities and elastic properties. The reflected pulse travels back to the transducer that also acts as a receiver. The received signal can give many insights to the properties of materials under test.The question arises how the setting and hardening of cement paste, mortar, and concrete can be measured continuously. Continuous measurement ask sfor non destructive methods. The current testing method such as the vicat needle for cement paste and penetration resistance test for concrete methods measure at intervals.These methods can be applied before the end of setting. All these methods do not allow continuous measurements and are partly destructive. In this paper a special pulse-echo technique called prism technique is used to evaluate the evolution of proprieties of concrete over time. For that, an automatic system has been developed with labview program in order to monitor the time of flight of the reflected p-wave. Two mixtures of mortar are made using different proportions, of water, cement, and sand. The mortar is poured into a mould that has a form of a prism. Measurements are taken every 10 minutes over a period of 24 hours. This enabled us to plot the evolution of p-wave velocities over time for the samples and compare the results.

Keywords : hardening of concrete, p-wave velocity, prism technique, ultrasonic system, Setting of concrete