



Impact-echo *Testing*

The impact-echo technique is one of several nondestructive test methods that CTLGroup specialists use for existing condition assessment, material property evaluation, and quality assurance testing. The impact-echo method employs transient stress waves and their reflection to rapidly detect, locate, and classify flaws within hardened concrete.

Applications

The impact-echo technique can serve as a very effective tool when there is a need to:

- Evaluate thickness of a concrete member
- Locate poor consolidation and voiding in reinforced concrete
- Detect areas of delamination in concrete
- Detect debonding of an overlay
- Detect degree of grouting in post-tensioning ducts

Equipment

The equipment is portable, self-contained and AC/DC power operated.

The equipment consists of the following:

- Impactor
- Accelerometer
- High speed data acquisition computer



All data is stored on a digital storage device by the analyzer medium and can be transferred to computer for further analysis. Each data point is obtained in approximately 15 to 30 seconds.

Principles of Operation

The impact-echo nondestructive technique employs low frequency mechanical energy to rapidly detect, locate, and classify discontinuities within hardened concrete, detect voids and delaminations, and measure thickness of concrete elements. The test method is based on physical laws of elastic stress wave propagation in solids.

A mechanical impactor source and an electromechanical receiving transducer/accelerometer are positioned on the same face of the test object. The impactor generates a broad band stress pulse. Waves of mechanical energy propagating through the concrete are reflected from the opposite boundary of the test object and the reflected energy is detected by the transducer. The time-voltage responses of the receiving transducer are averaged for two to three impacts with Fast Fourier Transform (FFT) frequency analysis algorithms by a dynamic signal analyzer. Reflections or “echoes” are indicated by frequency peaks in resultant spectral plots of displacement amplitude versus frequency.

Since amplitude, phase, and direction of mechanical energy are modified by interfaces between materials of different density and stiffness, location and characterization of internal discontinuities such as defects in concrete are possible. As the wave passes through the interface at a discontinuity, part of the energy is reflected from the interface back to the transducer and the remainder continues forward to the back boundary of the member where virtually all wave energy is reflected by the air interface. The location of the discontinuity is evaluated by noting the echo frequency peaks. The frequency peak for the intermediate echo is inversely proportional to the depth of the discontinuity in the concrete member. Evaluation of reflected signal strength and shape allow characterization and classification of flaws.



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