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5.12 IMPACT ECHO

5.12.1 Introduction

The impact echo method is a nondestructive evaluation technique used for detecting internal flaws in concrete. It has been used on a variety of members, particularly slab, beam, and wall type members. The impact echo test method produces a transient stress pulse into a member by means of a point impact. This pulse produces a surface wave as well as waves that travel into the element. These waves are reflected by internal defects and the boundaries of the element.

The testing apparatus consists of a hand held unit that generates an impact (typically a small hammer) which produces a wave and a receiving transducer which receives the reflected waves. The size of the impact device produces specific frequencies of stress waves. A computer-based system is then used to process the data and display the echo wave form data. The operator interprets the data to determine the presence and extent of defects found. Refer to Figures 5.12.1-1 and 5.12.1-2 for views of an Impact Echo Test Unit and an inspector using the unit.



Figure 5.12.1-1: Impact Echo Test Unit.



Figure 5.12.1-2: Inspector Using an Impact Echo Test Unit.

Impact Echo Testing is covered in American Society for Testing and Materials (ASTM) C1383-98a; “Standard Test Method for Measuring the P-Wave Speed and the Thickness of Concrete Plates Using the Impact-Echo Method.”

5.12.2 Applications

The impact echo technique utilizes easily transportable equipment and can be performed by a single individual. Testing is fairly rapid and only minimal surface preparation is needed to assure proper transfer of the impact energy to the structure. Tests are often made on a grid pattern, with the size of the grid determined by the suspected damage. Experience has shown that the technique can be used to locate delamination, honeycomb, cracks, voids, etc. In the hands of a skilled technician, it may also locate voids around reinforcing steel and within grouted prestressing strands and post-tensioned tendons. Impact echo is also used solely as a means to determine member thickness.

Impact echo devices can also be vehicle or wheel mounted. These devices are comprised of a wheel with numerous transducers and solenoids (impactor) around the circumference. Typically two wheels are used in this set up. The solenoid impacts the surface as the transducer comes into contact with the surface. This is done in rapid succession. This can be a very efficient method for detecting deck and slab internal defects.

5.12.3 Limitations

The impact echo method requires interpretation of the wave form output for each test by the field technician. The testing technician must be trained and experienced in order to properly interpret the output data. Prior to testing, design plans should be carefully reviewed for embedded items or other details that may affect wave behavior and test results. The presence of reinforcing must also be properly accounted for. Varying member geometries can also affect data results due to wave reflection. The maximum element thickness for this test is approximately 6.5 feet.



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