**Sonic Echo/Impulse Response**

**ASTM D5882-07 | ACI 228.2R**

**Sonic Echo/Impulse Response is used for low strain integrity testing of piles and determination of deep foundation length.**

The **Sonic Echo/Impulse Response (SE/IR)** system is designed to determine the length and integrity of foundations when the top or part of the upper side of the foundation is accessible. This system and its associated methodology can be used on both new and existing foundations and is performed by impacting the foundation and recording echoes from a defect or the foundation bottom with a nearby receiver(s). It should be noted that this method works best for columnar type foundations such as piles and drilled shafts, but has also been used successfully on mat foundations, abutment walls, and similar structures. This technique is applicable on concrete, wood, and round steel pipe foundations.

The Sonic Echo (SE) method is normally conducted in conjunction with the Impulse Response (IR) method together as the SE/IR method. Olson does, however, provide a system that exclusively uses the SE methodology without the IR analyses. This system, along with its associated software, uses only the time domain information in the data for the interpretation of reflections. The IR option provides the user with the ability to transform the data from the time domain into the frequency domain. The software then automatically calculates the transfer and coherence functions, which may be useful for data quality analyses as well as providing further information about reflections within the structure.

### Features:

- System design allows for fast and accurate field measurements
- Real-time waveform display while testing
- System is compact, durable, and easily transported allowing for multiple tests per day
- Accurate within 5% in determining foundation depth
- Automatic/manual selection of echo events in SE/IR records with WinSE/IR software and echo depth prediction based on user input velocity (English or Metric units)
- Ability to perform tests with both accelerometer and geophone transducers simultaneously in SE or IR tests for better data quality than if used individually
- Integrate and average acceleration and velocity response data to velocity in SE tests for enhanced identification of echoes
- Exponentially amplify SE data with time to enhance weak echoes with 16 bit A/D sampling
- Digital filtering of SE data with lowpass, highpass and bandpass options to enhance identification of echo events and minimize background noise
- IR mobility transfer function display (velocity/force versus frequency) of IR results to identify resonant peaks indicative of echo depths and average mobility
- IR flexibility transfer function display (displacement/force versus frequency) of IR results to identify pile head stiffness at low frequencies and indicate defects

### Applicable On:

- Auger Cast Concrete Piles
- Bridge Abutments
- Driven Concrete Piles
- Drilled Shafts (Bored Piles)
- Wall Piers
- Wood Piles

### Test For:

- Cracks
- Deep Foundation Depths
- Diameter Changes (bulb or neck)
- Soil Intrusions
- Uncured or Weak Concrete
- Voids

### Table: Model Advantages

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Method
The SE/IR method is typically performed by mounting a receiver on the top of the foundation and then striking the top with a hammer. If the top of the foundation is not accessible, then the receiver and the strike are located as close to the top as possible. A similar setup is also used when the structure in question is a wall.

Data Collection
The user-friendly SE/IR software is written and tested at Olson Instruments’ corporate office in Colorado. We do not outsource any tech support questions and, should you require software support, we welcome your questions and comments.

Available Models
The Sonic Echo/Impulse Response system is available in two different models which can be run from Olson’s Freedom Data PC or NDE 360 Platforms:

1. Sonic Echo - 1 (SE-1)
2. Sonic Echo/Impulse Response - 1 (SE/IR-1)

The SE-1 Model is the base model. This system includes an accelerometer and a hammer with interchangeable plastic to rubber tips for one channel of data acquisition and processing in time domain only.

The SE/IR-1 Model includes a geophone, an accelerometer, and an instrumented impulse hammer for three channels of data acquisition and processing in both the time domain and the frequency domain.

The SE/IR-1 + PS-1 + US-1 Model combines Sonic Echo/Impulse Response (SE/IR) with Parallel Seismic (PS) and Ultraseismic (US) for complete foundation testing at a reduced price because the systems share many common components.