

**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.*



**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 WinTFS-SE/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, bandpass and bandreject 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 indicates defects
- Ability to measure sonic compression wave velocity of concrete directly to a downhole hydrophone receiver (included in Crosshole Sonic Logging and Parallel Seismic equipment systems) if CSL access tubes are present

**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.

<b>» Applicable On:</b>
Drilled Shafts (Bored Piles)
Auger Cast Concrete Piles
Driven Concrete Piles
Bridge Abutments
Wall Piers
Wood Piles
<b>» Test For:</b>
Cracks
Voids
Soil Intrusions
Uncured or Weak Concrete
Diameter Changes (bulb or neck)
Deep Foundation Depths



*Freedom Data PC or NDE 360 Required, Sold Separately*

Model	Advantages
SE-1 Model	Process data in time domain
SE/IR-1 Model	Process data in both time domain and frequency domain

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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**

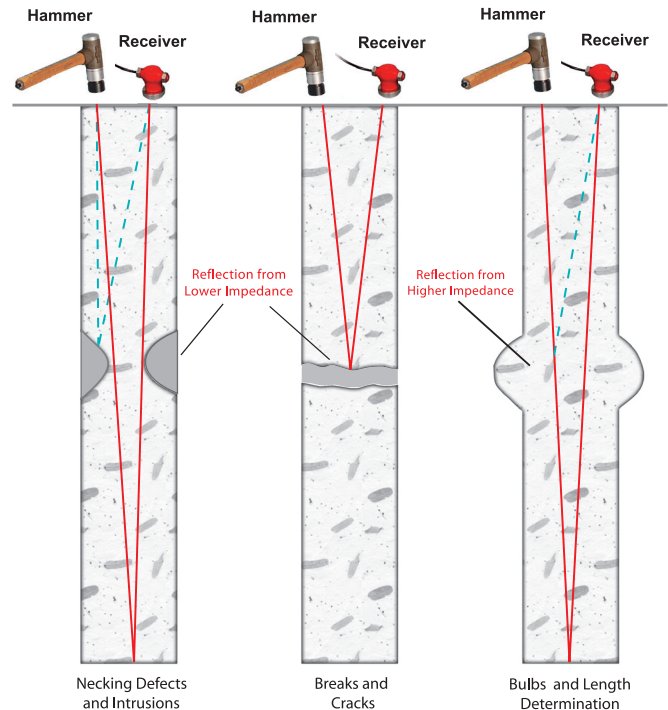
The Sonic Echo/Impulse Response system is available in two different models which can be run from Olson's Freedom Data PC or NDE 360 Platforms:

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

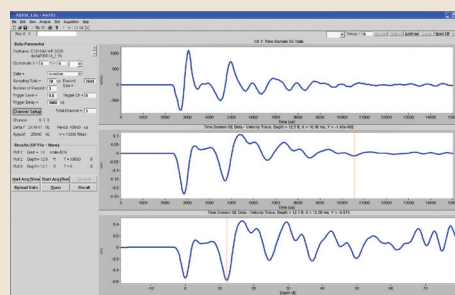
The **SE-1 Model** is the base model. This system includes an accelerometer and a hammer with interchangeable plastic to rubber tips for one channel of data acquisition and processing in time domain only.

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.



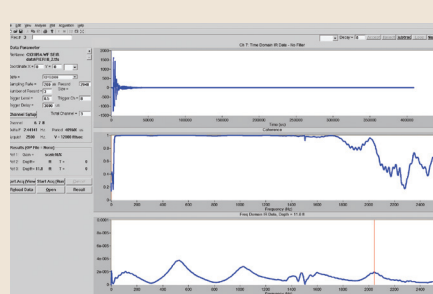
**Data Example » 1**



This is an example of good quality accelerometer data (SE) as evidenced by multiple reflections. The multiple echoes are apparent in the bottom plot from a defect. The first of the multiple echoes is marked by a vertical cursor that corresponds to the depth of a severe necking defect at ~ 12 ft (3.6 m) below the shaft top.

Results showing good quality accelerometer (SE) data

**Data Example » 2**



This is an example of good quality impulse response (IR) data as evidenced by high coherence (middle plot) over the peaks seen in the lower plot. These peaks are displayed in the frequency domain rather than the time domain as in SE data. Multiple peaks are clear and easy to identify, allowing for more accurate shaft length or the ~ 12 ft (3.6 m) defect depth calculations in this case.

Results showing good quality Impulse Response (IR) data processed from the above SE data, Example #1