Impact Echo for foundations

When conducting Impact Echo tests on foundations the major change in the collected data is that the resonant echoes that the system records will be of a substantially lower frequency.

To induce appropriately lower frequency vibration in the foundation manual impact with ball end hammer should be used.

If the impact has correctly introduced low frequency vibrations, then there should be a frequency peak in the frequency graph corresponding to the foundations depth.

Data Collection Procedure

The following procedure should assist in collecting data representative of the actual geometry of concrete footings.
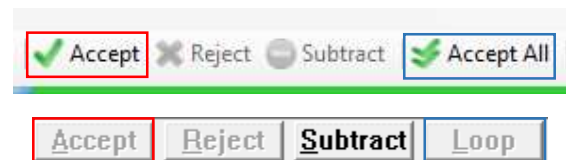
1. The system should be assembled according to the manual, particular care must be taken to use wideband inputs if available
2. The system should be set for manual impact
3. Select a test location on the foundation, it should be as central as access allows and clear of edges, steps and other similar structural features.
4. Take initial tests using a variety of hammers, ranging from 1kg in weight and less. Round faced hammers are more suitable to the task than those with a square face.
5. Based upon initial data and using the guidelines in the "Data Processing Procedure" select the hammer that provides the best data.
6. Commence data collection along foundation, avoiding edges and collecting 5 or more samples in each location. The aim is for each sample to be nearly identical to the previous sample to confirm data is repeatable and representative of the structure.
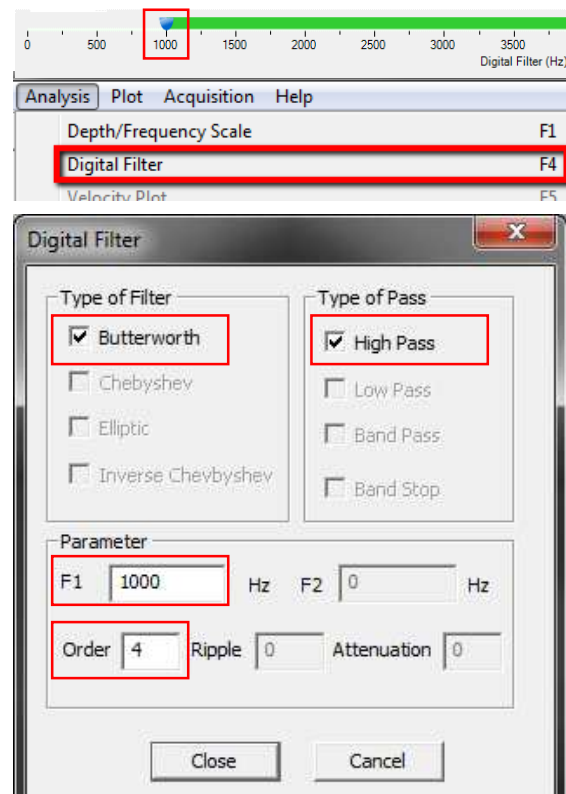
Data Processing Procedure

Load data from system

Review files, if CTG each test is a single file, if NDE 360 multiple tests for each location are stored in one file, the NDE 360 has the added advantage of allowing for the data to be averaged after bad tests have been discarded

The "Accept" button confirms individual NDE 360 file tests are suitable. This is where you should re-examine your 5 or more sample tests for consistency. If you have already reviewed the data as acceptable and all tests in an NDE 360 file passed muster you can use the "Accept All" or "Loop" button to accept every test.

A high pass filter is usually applied to Impact Echo data to remove any low frequency component from the spectrum graphs. A filter of between 800 and 1000 is suitable when foundation testing

Data Interpretation

Impact Echo data is displayed as a graph of amplitude vs frequency. Resonant frequencies inside the structure will be visible as peaks in the frequency graph.

The images below show a frequency domain graphs in Win IE and WinTFS.

The vertical blue or red line in the lower graph shows the position of the base of the foundation, and above each graph is the thickness measurement.

The scattering of data around the peak is usually due to a rough surface of the foundation base.

If a high pass filter is not applied there is often a very strong low frequency peak around or below 500Hz.

When reviewing this data each peak should be selected and corresponding depth noted. If the lowest of these depths is around the expected depth of the foundation this should be taken as a hypothetical depth and the remaining tests checked for peaks conforming to this depth.

If no low frequency peaks are visible it may be necessary to re-take data for the foundation using a heavier hammer blow.

High frequency peaks may be due to reflections from foundation walls, inclusions and other sources of sonic reflections in the structure, if they are consistent in each test it reasonable to assume that the data collected is repeatable.

Avg Frequency Spectrum, T = 1.17 meter V = 3657 meter/sec

Low Frequency peak
Indicates foundation depth

Spectrum of Current Waveform for Ch 1, F1 = 1568, T = 1.16 m.

Low Frequency peak
Indicates foundation depth