# LOADTEST
# Pile Integrity Testing (PIT)

## INTRODUCTION

Defects in concrete piles caused either during or after construction may seriously affect their performance in service. The PIT test, sometimes referred to as the SIT, TNO, Sonic Integrity Test, Acoustic integrity test, TDR (Time domain Reflectometry) or Pulse Echo Test, is a non-destructive method to evaluate a pile foundation element in order to confirm its integrity. The test detects potentially dangerous defects such as major cracks, necking, soil inclusions or voids and, in some situations, can determine unknown lengths of piles that support existing buildings.

## DESCRIPTION

The test requires the pile head to be struck by a small hand-held hammer. An accelerometer, held against the pile head, measures the acceleration caused by this impulse and the reflecting shock waves. These reflections are stored in a small hand held computer where they are integrated to yield a velocity versus time graph. This record is displayed and stored for later analysis. The test equipment can amplify the signal exponentially with time to emphasise the signal reflected along the pile shaft and from the pile toe and therefore remove the effects of any signal attenuation as it travels along the pile.

Reflections from significant discontinuities, such as the pile toe, cracks within the shaft, and major changes in pile cross-section or variations in soil stiffness can affect the signal and be determined from the velocity vs time graphs. Several tests are carried out on each pile to eliminate the possibility of erroneous results.

## ADVANTAGES

- Defects can be discovered at an early stage and remedial work undertaken.
- Testing can be carried out on any accessible pile.
- The method is quick and economical.
- A large number of piles can be tested in a single day (up to 200 piles dependant upon pile head access and adequate pile head preparation).

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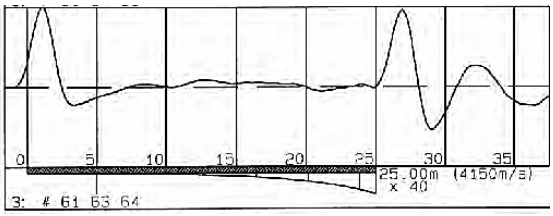
## LIMITATIONS

- The test does not give any information about the bearing capacity of the pile or its behaviour under load.
- Major defects are easily detected but minor deficiencies such as loss of cover to steel or small soil inclusions may not be discovered.
- The presence of debris at the pile toe can not be detected.
- Gradual changes in cross section may not be detected.
- If the pile is long, has a large length to diameter ratio or is constructed in soil of a high skin friction value, reflections from lower in the shaft section, including the toe reflection, may be masked or not detectable.

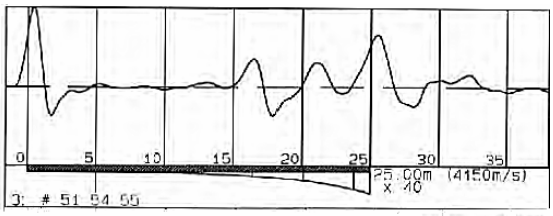
## RESULTS

As the stress wave travels down the pile shaft, reflected waves are generated from any changes in the pile shaft acoustic impedance, which in most cases may be interpreted as changes in pile shaft cross-sectional area, which may or may not be intentional or a function of the ground conditions.

These reflected waves arrive some time after the input blow at the pile head and are registered by the pile head accelerometer. The time of arrival of these reflected waves and their form allows the depth of the change in impedance (by assuming the wave velocity in the pile material) and its sense (i.e. an increase or decrease) to be determined easily.




***Pile considered to be of sound integrity with clear toe reflection***




***Pile with anomalous reflections within the pile shaft***

## ANALYSIS

Each individual trace is inspected on site by the testing engineer. Anomalous readings, which are readily identifiable, are noted on site and can then be processed in the office to estimate the nature and location of the anomaly using advanced software techniques.

The resulting analysis can then be reported back to the site engineering team for further investigation and remedial works undertaken or replacement piles installed if necessary.



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