



TERRADRIVE
PILING AND FOUNDATIONS LTD.

A Brief Guide to Pile Testing





This guide gives a brief introduction to the more common techniques of pile testing.

Pile testing is an integral part of any piled foundation construction process. It is important that the techniques employed are appropriate to the type of piling employed, the requirements of the structure and also to the prevailing site conditions.

There are various methods, both direct and indirect, of pile testing available from simple visual inspection to more intricate techniques such as nuclear radiation methods.

Pile testing is necessary because;

- In essence, it is the ground that is being tested and not the structural element. As ground conditions vary, the performance of the pile will consequently vary.
- Pile testing is necessary to validate design, to confirm ground conditions and as a quality control tool.
- In large scale projects pile testing can yield project savings when employed to improve and rationalise pile design.

Pile testing is employed for;

- Design Validation
- Quality Control Check
- Possible improvements in Foundation Design
- Research & Development

Static Load Test

Static Load Testing (SLT) is the truest test of a pile performance available as it involves the direct application of a physical load to the pile while recording the corresponding settlement at the head of the pile.

In a perfect world all piles would be tested by this method. However, as SLT's are very expensive and require approximately 5 days to carry out, it is not practical to test all piles in this manner. General guidelines suggest testing 1% of piles by SLT.

Dynamic Pile Testing

Dynamic Load Testing (DLT) involves striking the head of the pile with a weight dropped through a height, thus inducing a quick load and response from the pile. Sensors, attached to the pile head, measure the acceleration and strain produced from the impact. From these parameters, and using stress wave theory, predictions of the soil resistance are generated that would be mobilised by the pile under static load conditions - this is referred to as **Case Analysis**. This test also proves the integrity of the pile. Further analysis can be carried out using models of the pile/soil interaction to provide predictions of **Load Vs Settlement performance** of the pile - this is referred to as **CAPWAP** or **Simbat Analysis**.

Integrity Pile Testing

Integrity Testing is a simple test to use to detect any anomalies in the pile shaft which may have occurred during construction. The test itself involves the measuring of the response of a sound wave (produced by a hand held hammer) travelling through the shaft of the pile. This test is commonly used on cast in-situ piles (CFA and Bored piles). Typically 100% of cast in-place piles are tested by this method. This test is not relevant to precast concrete or steel piles.

How Many Test Piles And Which Type of Test?

The amount of testing required and type of testing depends on several factors. These include the following:

- Extent of site investigation information
- Information on similar piling techniques in the area or similar ground conditions.
- Factor of safety used in pile design.
- Experience of the Piling Contractor.
- Cost and programming implications.

A general rule of thumb for testing rates can be summarised as follows:

- Dynamic Pile tests; 10 - 15% of working piles (Case only)
- 20% CAPWAP or SIMBAT analysis of Dynamic Tests carried out
- 1 Preliminary Static Test pile per 250 piles.
- 1 working Static Test pile per 100 piles
- 100% Integrity testing for CFA Bored piles.

Dynamic Pile Testing is normally associated with driven piles - the testing hammer is already on site!

Static Pile testing normally applies to bored piles, although it can also be applied to driven piles to act as a correlation with the Dynamic results achieved on the site.

Integrity testing normally applies only to cast in-situ piles.

Specification

Having decided on the type(s) and amounts of testing required for the contract it is important that the engineer in charge of the piling produces a clear and relevant specification for the testing. The ICE Specification for Piling and Embedded Retaining Walls sets out in detail the information required to be included in the specification.

How many piles should be tested?

100% by Integrity Testing

10 - 20% by Dynamic Testing

1 - 2% CAPWAP analysis

1% by Static Load Test

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