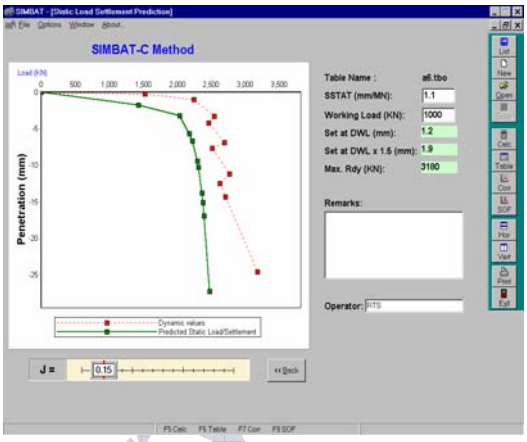
FOUNDATION TESTING DATA SHEET 3
SIMBAT – Dynamic Load Testing

TESTCONSULT
TESTING AND CONSULTING SERVICES

Testconsult has been offering a dynamic pile test service for many years using the SIMBAT technique. The technique is a dynamic pile test that allows the prediction of static load settlement behaviour of bored, cast-in-place and pre-cast driven piles. It is recognised by many organisations as being a superior alternative to other systems, as it includes a number of features that enables the operator to validate data, such as the specially designed optical theodolite.

Recent trials carried out in Belgium have proven that the system can produce good correlations with static load test results, even better than some 'quasi-static' dynamic test systems.

The prime advantages of dynamic load testing is the speed of testing and low cost. Typically, anything up to 10 piles per day can be tested and preliminary results can be available on the same day. The rate will depend on preparation and the type of drop weight used.



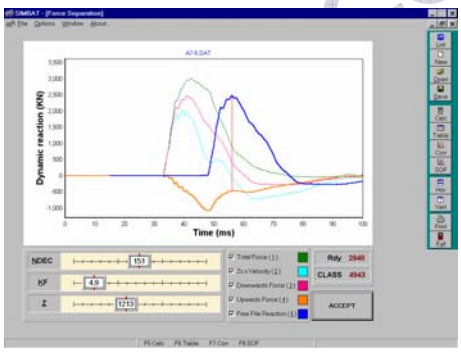
SIMBAT Load – Settlement Plot

Principle of the Test

The method is based on the propagation of waves in long elastic cylinders. When the pile top is struck with the falling weight the pile section is deformed (enlarged) and this enlargement travels down the pile to the toe where it is reflected back up. In a free, un-damped piles the particle velocity of the return wave would be identical to the original wave.

When the pile is surrounded and restrained by soil, part of the wave is reflected back up at each and every external restraint, the remainder of the wave continues downwards. So at any one time there are both upwards and downwards forces and velocities in the pile.

The SIMBAT technique is able to separate these upwards and downwards forces, F (up) and F (down) and calculate dynamic soil reaction, Rdy, as the difference between the upwards force in a free pile and the real upwards force measured. The conversion of dynamic to static reaction is carried out by expressing Rdy as:



Separation of Forces

$$Rdy = R\,STAT + (K.ep)a$$

Where: ep = permanent penetration. K = a parameter which is a function of the pile and the sequence of the blow. a = a parameter which is a function of the soil.

An integral part of the procedure is a numerical simulation whereby experimental signals are introduced into the programme and compared with theoretically generated signals. This pile/soil model enables the distribution of soil resistance down the shaft and at the pile toe to be determined.

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METHODOLOGY

The first stage of the test is to build a pile cap, 2.5 x the pile diameter in height and reinforced sufficiently to prevent bursting under the drop weight impact. Normally it is sufficient to use a thin wall steel casing. It must have a smooth surface and constructed of good quality homogeneous concrete as it is effectively acting as a dynamometer.

Strain gauges, accelerometers and a special theodolite target are mounted on the side of the cap. These are all connected to the portable SIMBAT data acquisition system.

A laser guided high speed optical theodolite is set up between 3-5m from the pile and pointed at the target. This can measure the displacement of the pile cap, before the surface wave reaches it, totally remotely from the pile.

SIMBAT Theodolite

A cushion of rope is placed on the pile to ensure an even distribution of load, prevent tensile cracking and to increase the duration of the test blow.

A series of impacts are made with the hammer drop height being progressively increased/ decreased in magnitude. This applies high and low strains to the pile and is a crucial part of the SIMBAT methodology. All data, i.e. acceleration, strain and displacement, are stored during the test and can be analysed immediately if required. This data is then processed to give the dynamic reaction of the pile, which is corrected to give the equivalent static reaction of the pile.

The drop weight required will depend on the test load and the mass of the pile. As a guide, the drop weight mass will generally be 1% of the test load or 10% of the pile mass – whichever is greater. It is not recommended to use a smaller drop weight with a bigger drop height, as this can produce high tensile forces in the pile, which can lead to cracking.

30,000KN Simbat test in Taiwan

There is no real limit to the test load that can be applied, the largest test to-date being 30,000KN, carried out using a 30T drop weight in Taiwan, and the smallest being 50KN carried out using a 200Kg drop weight.

On overseas contracts, or where transport is a problem, drop weights can be constructed locally using concrete or steel, and we can provide guidance on the most suitable type of weight to use and supply quick release systems to ensure a free-fall drop.

Minirig Simbat Testing

In the UK we also provide a service to test mini piles, using a small hand portable half tonne drop weight system. The unit can be dismantled for use in buildings and difficult locations or on trackside contracts.

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