THE SYSTEM

SIMBAT™ 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 also used for pile driving analysis and calculation of hammer efficiency. The prime advantages of dynamic load testing are speed and low cost. Typically, up to 10 piles per day can be tested and preliminary results available the same day.

Testconsult have been offering a dynamic pile test service for many years using the **SIMBAT** ™ technique. This technique, acknowledged by many to be superior to other systems, is based on rigorous data collection and data processing techniques. We have recently incorporated some major improvements, upgraded the software and made the whole package very user friendly. The software and equipment is now available for sale.

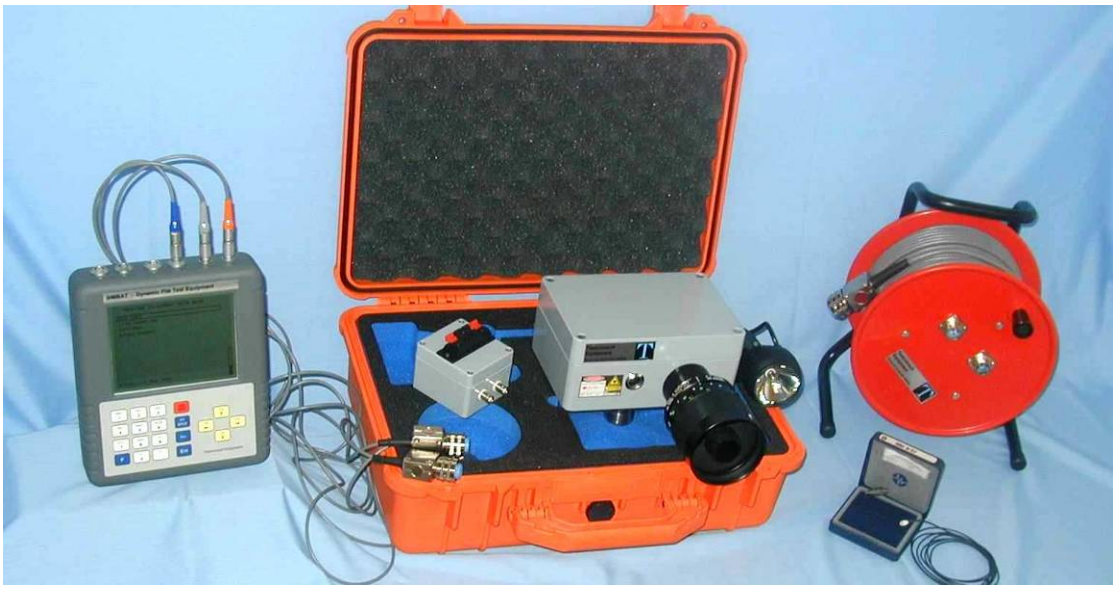
The system comprises the following main components:

- **Data collection unit, for capture of strain, acceleration and displacement**
- **Site computer**
- **Optical theodolite to measure dynamic displacement of pile**
- **Accelerometers and strain gauges**
- **Software for signal acquisition and data processing**

METHODOLOGY

The pile is first equipped with transducers, two accelerometers, two strain gauges and a small black and white target for the theodolite. The theodolite itself is set up on a tripod, between five and ten metres from the pile.

The pile is then impacted with a drop mass, typically ½ - 5 tonnes, and the resulting acceleration, strain and displacement of the pile are captured. This data is then processed to give predicted static pile performance.



Complete SIMBAT™ kit including data collection unit, accelerometers, digital theodolite, cable reels and waterproof carry case

Testconsult Limited – Tel: +44 1925 286880 Fax: +44 1925 286881

Ruby House, 40a Hardwick Grange, Warrington, Cheshire, WA1 4RF email: huw@testconsult.co.uk website:www.testconsult.co.uk

DATA COLLECTION UNIT

This is a splash proof, resin simulated ABS enclosure sealed with an internal “O” ring.
Overall dimensions 218 x 187 x 55mm . Weight 1.35 Kg. The unit has a full alpha-numeric keypad and a 320 x 240mm black and white transflective display for easy daylight viewing.

Waterproof Lemo connectors are provided, each having different pin numbers or keyways to eliminate incorrect connection. The unit has back up battery power which will last for several hours.

16 bit acquisition at 10KHz sample rate on all channels. Pre-trigger and auto gain. Automating balancing of strain gauges.

The unit is driven from a simple menu system which prompts the operator for inputs.

The data collection unit will store up to 740 files, each file consisting of accelerometer, strain gauge and theodolite data as well as headers.

Basic processing of data can be carried out on site up to and including determination of the dynamic/total force and permanent settlement for each blow.

Transfer of data to a PC is via the serial port. This can be done concurrently with testing on site or later, in the office. Transfer time is one second per file.

The acquisition unit, as well as the accelerometers and theodolite, are supplied with calibration certificates traceable to national standards. We recommend re-calibration annually.

SIMBAT™ Digital Theodolite

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THEODOLITE

During many years of site experience, Testconsult have found that a direct measure of pile deflection during impact is essential for the correct interpretation of data. It is only by making such measurements that the pile top velocity can be correctly inferred from the acceleration data. It also gives a second and totally independent check on the magnitude of the pile movement during the impact.

Testconsult developed a special digital, optical theodolite that measures the whole of the deflection cycle of the pile during impact as well as the permanent deflection caused by the blow. The device focuses on a small target attached to the pile, through a 500mm lens and operates at 10,000 data points per second. The resolution is 0.14mm at a distance of 5m from the pile.

The theodolite mounts conveniently on a standard surveyors tripod and can be positioned at up to 10m from the pile. The target is lit by a small halogen lamp attached to the side of the enclosure. A laser pointer, incorporated inside the enclosure facilitates setting up the theodolite and aiming it correctly at the target. An LED display aids the correct focussing of the lens. The unit operates from any 12volt supply, making it safe for site use.

TRANSDUCERS

Two piezo electric, 5000g PCB 350B04 accelerometers are supplied. These are mounted in nylon blocks which are attached to the pile using 6mm Hilti wedge anchors.

The traditional method of measuring strain (and thus force) is to attach mechanical strain gauges to the pile by drilling holes and inserting wedge anchors. The problem with this technique is that the drill holes themselves create stress concentrations that lead to incorrect measurements. We use 55mm long, electrical resistance, foil strain gauges which are bonded to the pile surface with a rapid setting epoxy. This arrangement is not only very convenient, it also gives reliable measurements that truly represent the strain in the pile top during impact.

SOFTWARE

The processing and reporting software is inevitably quite complex and detailed. It has, however, been designed to be clear, user friendly and powerful.

The main functions are:

- **Creation of a table of files for each pile**
- **Correction of acceleration data using the theodolite displacement**
- **Separation of forces to give the dynamic or total reaction of the pile, Rdy, for each blow**
- **Determination of the dynamic/static correction and plotting of predicted load/settlement graph**
- **Computer modelling to verify data and to separate shaft and end bearing resistance**

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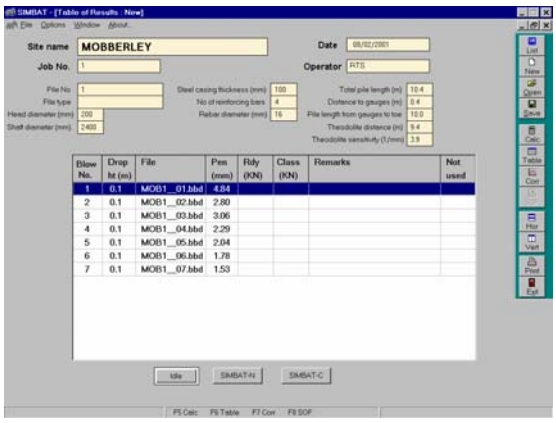
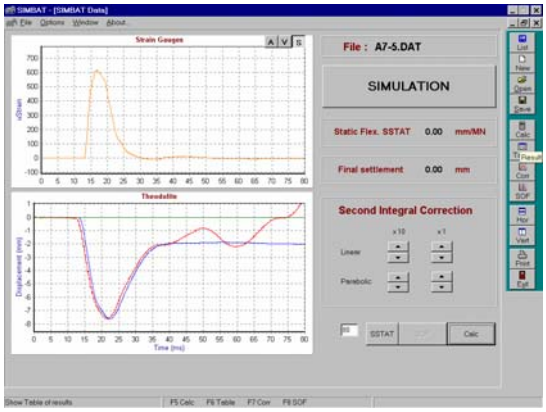


Creation of table for each pile

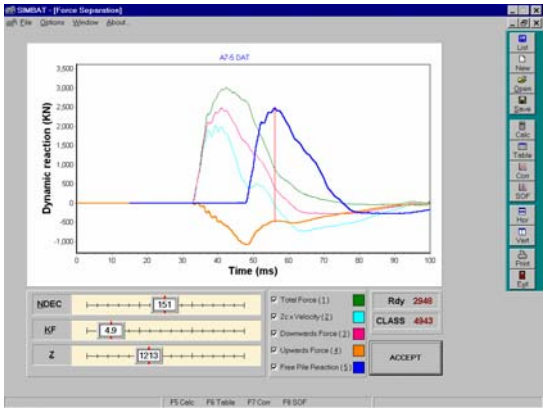
Site data is downloaded into the PC and, for each pile, a table is created. This give hammer drop height, file name, and permanent penetration. As well as all header information. The data for each blow is then called up simply by clicking on the file name.

The acceleration/velocity is then corrected using the theodolite data and the up and down forces and velocities separated in the normal way to give Rdy, the total or dynamic reaction for each blow. These values are automatically placed in the table.

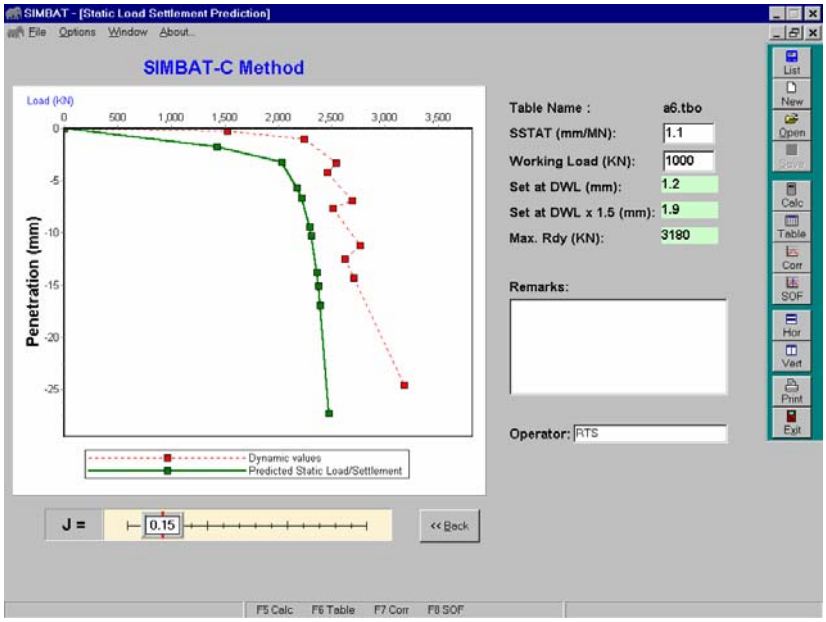
A predicted static load settlement plot is then produced .



Correction of velocity from theodolite



Separation of forces, calculation of Rdy



The last stage, is the predicted static load/ settlement plot for each pile. This is done using algorithms that do not need any assumptions concerning soil damping factors.

The separation and distribution of soil resistance along the shaft and at the base are determined by simulation.

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