TNOWAVE

Wave Equation Program

TNOWAVE represents a group of wave equation application programs and is a powerful simulation tool to predict pile behaviour. The TNOWAVE applications are suitable for simulating pile-soil interaction under dynamic conditions. TNOWAVE is based on the one dimensional stress wave theory and allows the modelling of:

- **All types of vibratory and impact hammers with anvils and cushions**
- **Piles with cross sectional variations and cracks**
- **Tubular steel piles, open ended or closed**
- **Shaft friction and toe resistance**

Principle of TNOWAVE

The TNOWAVE algorithm is based on the Method of Characteristics. A pile is divided into elements, which may have different cross sections. The forces caused by shaft friction are assumed to be concentrated at the boundaries of the elements. For each element between the set boundaries an analytical solution for the wave equation is valid. The TNOWAVE algorithm has been proven to be very stable and accurate.

TNOWAVE Applications

- TNOWAVE consists of the following application modules:
- PDPWAVE for Impact Hammer and Vibratory Hammer driveability studies
- SITWAVE to determine local pile defects from Sonic Integrity Testing signals by signal matching
- DLTWAVE to determine pile capacity from a Dynamic Load Test by signal matching
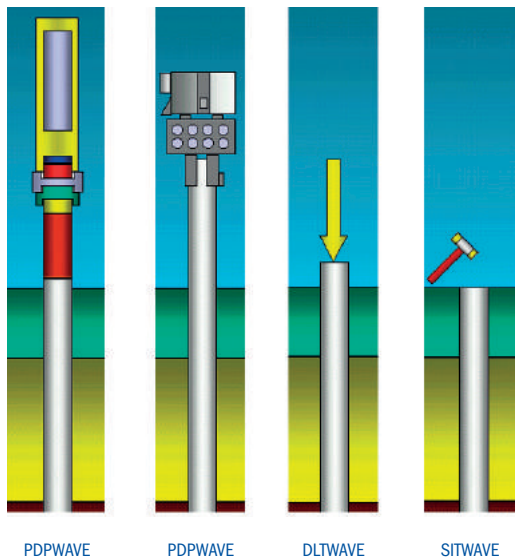
User interface TNOWAVE

All TNOWAVE modules are designed for professional geotechnical engineers as well as technical practitioners to make pile behaviour predictions and simulations. All dimensions and parameters are expressed in engineering units (SI or English). Each module is a powerful program including a digital manual and Help functions with practical examples to assist the user. New users are strongly advised to follow a training course at the Profound Academy.

The advantage of the user interface is that the design has been kept simple and logical for the user. The program has three application levels.
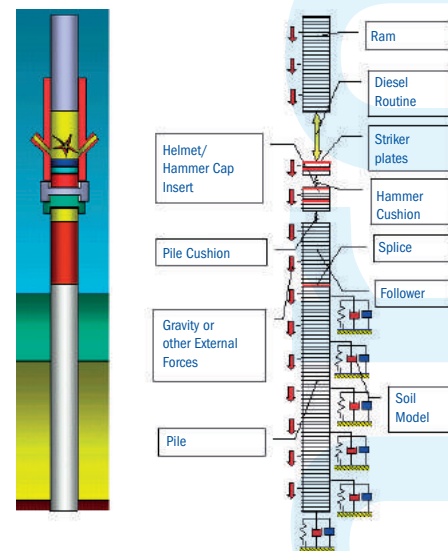
Simple
In this case the program sets default values and many actions are performed automatically.

Intermediate
The user has access to the fundamental parameters of the program and can apply his/her own experience.

Advanced
The advanced option allows for maximum flexibility and is intended for experienced users, giving them access to a multitude of input parameters and programming options.

PDPWAVE   PDPWAVE   DLTWAVE   SITWAVE

TNOWAVE Applications

Ram
Diesel Routine
Striker plates
Helmet/ Hammer Cap Insert
Hammer Cushion
Pile Cushion
Splice
Follower
Gravity or other External Forces
Soil Model
Pile

TNOWAVE allows the modelling of all types of vibratory and impact hammers with anvils and cushions

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TNOWAVE Modules

PDPWAVE for impact hammer Pile Driving Prediction
PDPWAVE simulates the pile driving process for many combinations of pile driving hammers (either impact or vibratory), cushions, pile types, and soil conditions.
With the results of PDPWAVE the piling engineer can:
· Perform driveability studies
· Optimize the selection of the hammer
· Select the maximum energy level without damaging the pile
· Increase the efficiency of the pile driving equipment
· Predict compression and tensile stresses in the pile

SITWAVE pile modelling from Sonic Integrity Testing signals
SITWAVE is used to estimate the dimensions and location of pile defects from SIT signals. In SITWAVE the user builds a model of the pile and the soil using a reference pile from the project. Subsequently the measured signals are compared with the simulated signals and the pile parameters will be automatically adjusted until a good match is obtained.

DLTWAVE signal matching for Dynamic Load Testing (DLT)
DLTWAVE simulates the dynamic load test obtained with the signals of a PDA/DLT-system. The pile and soil are modelled. In an automatic interactive way soil model parameters are adjusted. Measured and calculated signals are matched to determine the capacity and the static load displacement behaviour of the pile from the DLT test results.

Advantages of TNOWAVE applications

· Accurate prediction results from the method of characteristics algorithm, eliminating potential numerical instability which may be experienced with other discrete lumped mass based models
· Large variation of input options for hammer, pile and soil selection
· User-friendly interface for the geotechnical parameters
· Soil input with digitising option for CPT, SPT, Cu, DMT, PMT and Soil Laboratory results
· Soil data input with GEF files (Geotechnical Exchange File)
· Multiple soil fatigue models
· Extensive graphical options for processing of prediction results
· DLTWAVE to determine pile capacity from a Dynamic Load Test by signal matching

Training and support

TNOWAVE applications are licensed and provided with a protection key. TNOWAVE Maintenance & Support contracts are available. New users are strongly advised to follow a training course at the Profound Academy.

Profound, pioneer in the field of professional pile testing both in research and equipment, has over 50 years of worldwide experience and continuously strives to make the best technology available to clients.
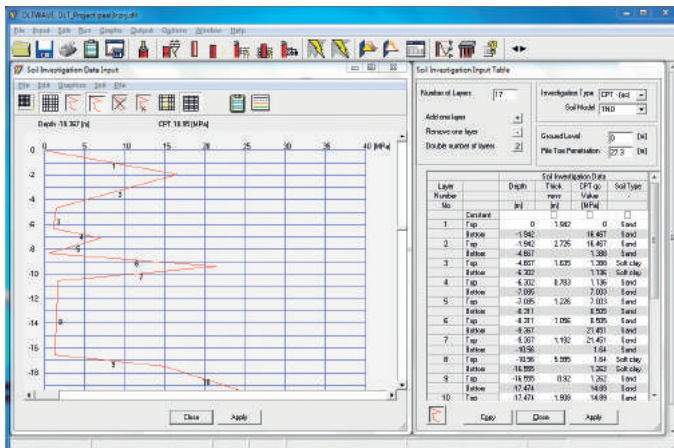
Digital input soil data (CPT)
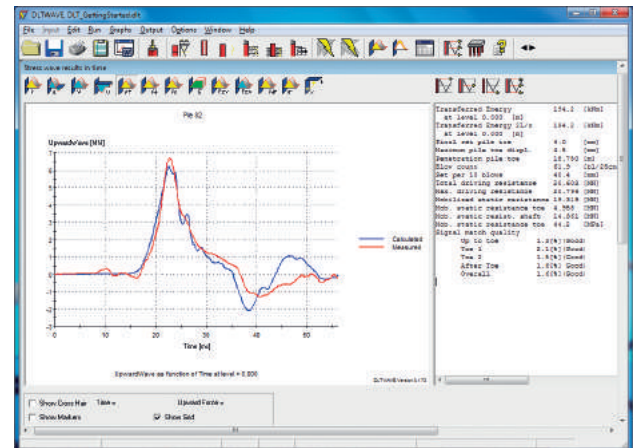
DLTWAVE Result

FOR FURTHER INFORMATION

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