THE SYSTEM

The Transient Dynamic Response method of assessing the integrity of piles has long been regarded as the best technique. The system measures both the input force to a pile as well as the resulting velocity response and this allows the pile shaft to be examined in both x and y directions ie depth and cross section.

The technique also means that data can be viewed in time domain and frequency domain, this is advantageous when interpreting the results.

The TDR2 system comprises two main elements, the data acquisition hardware and a sophisticated windows based software package, purpose designed for ease of interpretation and reporting. The software, known as TPAP (Testconsult Pile Analysis Programme) is used to transfer data from the TDR-2 to a pc, carry out basic analysis of results and produce reports. Advanced Simulation and Impedance profiling modules are also included with the software for further analysis of more complex results. These are powerful aids to correct data interpretation.

The TDR2 system is designed to be compliant with the relevant sections of the American standard ASTM D5882-00 and the French standard AFNOR NF P94-160-2 & 4.

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HARDWARE

Enclosure Blue, splash proof, Resin simulated ABS, sealed with internal "O" ring.
Overall dimensions 218mm x 187mm x 55mm, Unit weight 1.35 Kg.

Display Black and White LCD, Transflective for easy daylight viewing. Backlight can be used when required. Protective polycarbonate screen shield. Viewing area 122mm x 92mm - Dot pixels 320(W) x 240(H).

Keypad Velvet polyester reverse printed in 5 colours. All keys have a tactile response. Wipe clean waterproof surface. Size 165mm x 70mm. Full alphanumeric functions.

Acquisition Twin channel, 16 bit acquisition at 25khz sample rate. Pre-trigger on both channels.
In operation, the first impulse autoranges the gain on both channels and this can then be accepted or changed as required. The system requires a minimum of 4 impulses - and the coherence for the best three is calculated and displayed. Thereafter additional impulses automatically replace the worst hit. The best three are stored.

Connectors. Six waterproof Lemo connectors are provided at the top of the unit. These have different keyway configurations and are not interchangeable. The ends of the connecting cables terminate in a colour coded strain reliever, which fits into the connector. See below.

Connectors are provided for: Hammer, Geophone, AC charging (110/240 Volts), DC charging (Cigar lighter 12volts) and serial USB port for downloading to a PC.

Battery. The unit is designed to give at least 8 hours continual use on site prior to recharging. Emergency boost recharging can be carried out on site from a vehicle cigar lighter socket (12volts) Normal charging is done overnight from 110/240 volts AC.

Storage For each pile the system stores three, 16 bit x 1024 data arrays for both force and velocity. In addition, a full set of header information such as date, site, pile number, etc is stored. The internal memory of the TDR2 stores up to 700 such results.

Software The TDR2 is driven from a simple menus system, which prompts the operator for inputs. At the start of testing the site name is entered along with Job Number, Pile type, Pile diameter, operators initials, geophone ref and sensitivity, hammer ref and sensitivity. Thereafter the operator enters the acquisition menu and simply enters the pile number for each test.

Processing The acquisition unit has a number of processing functions built in so that basic interpretation can be carried out on site. Functions include :

- *Viewing of Mobility plot, measurement of length, stiffness and mean mobility*
- *Viewing of time domain velocity plot, length measurement.*
- *Scale changing to suit*
- *View time domain force plot and spectrum of force.*
- *Data processing on site is saved and stored with file*

Data transfer The transfer of data from the TDR2 is via the computer USB port. TPAP allows easy viewing of the files stored on the TDR2 followed by selection and transfer. Each file takes one second to transfer.

Calibration The TDR2 unit as well as the hammer and geophone come with a calibration certificate traceable to National Standards. We recommend that re-calibration is done at least annually - we offer this service or will provide copies of our own calibration procedures if required.

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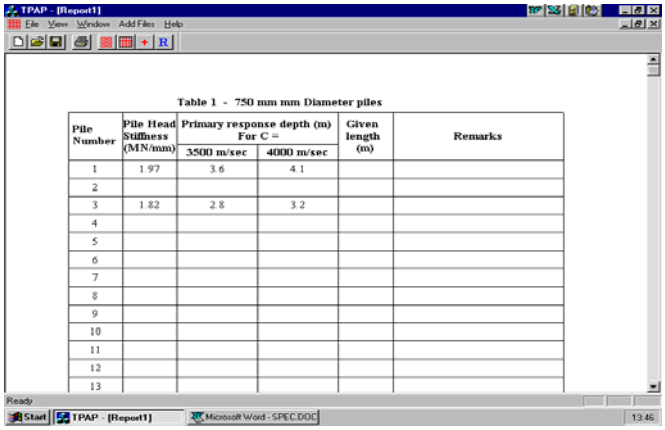
Hammer 1.4 Kg fibreglass shafted hammer complete with built in PCB load cell. The hammer requires a constant current power supply (ICP) which is provided from the TDR2. Two standard “black” hammer tips are provided, spares are readily available in a range of stiffnesses.

Geophone A vertical SENSOR geophone, type SM 6 with a natural frequency of 4.5Hz. Geophones have a nominal output of 20 volts /m/sec.

Carry case The kit is supplied in a rugged, orange, case constructed of structural resin and fitted with a neoprene “O” ring. These cases are virtually indestructible and airtight/waterproof to a depth of 9m. In addition, a tough nylon site pouch is available for carrying around site.

TPAP SOFTWARE

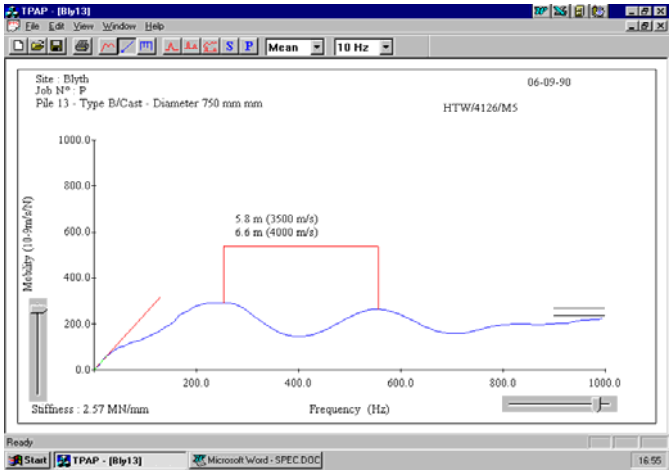
The software has been designed to allow rapid and repeatable interpretation of data, and convenient report presentation. It includes two very powerful aides to correct interpretation, a simulation module and an impedance profile. The software is very user friendly and Windows based. A demonstration disc is available on request. All normal Windows functions are available for file handling and printing.



The first step in creating a report is to transfer the required files from the TDR-2. This takes about one second per result.

These files are then automatically arranged in a blank table of results on the screen.

The results are sorted into order by pile number and a separate table is created for each different pile diameter.



The test result is viewed by clicking with the mouse on the particular pile number in the table. The result initially appears in the form of a mobility plot. The following parameters are then measured:

- The dynamic stiffness of the pile top from a line pivoting about the origin.
- The depth to a change in impedance using the mouse
- The theoretical mean mobility is automatically marked on each trace.

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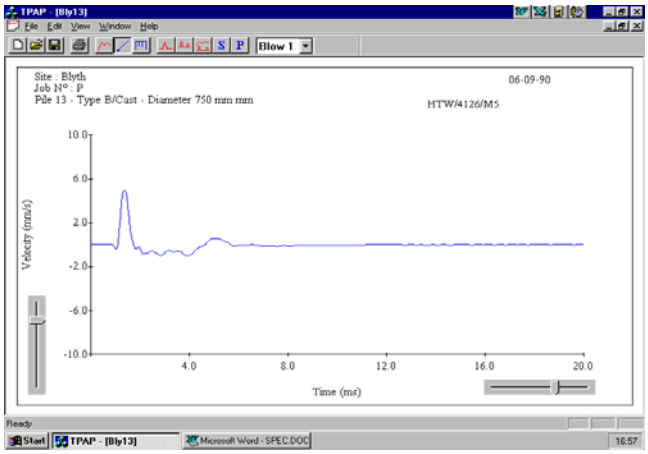
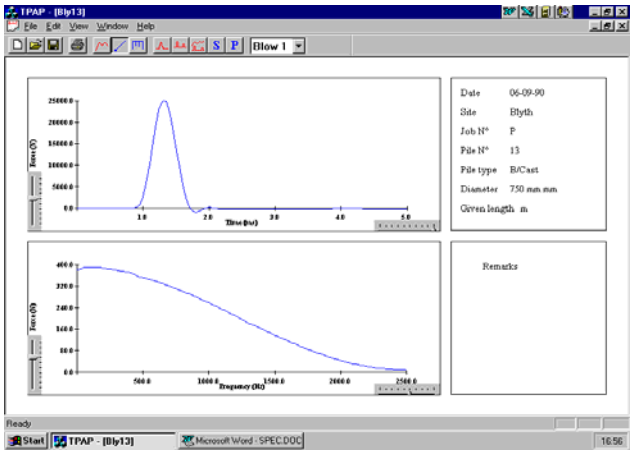
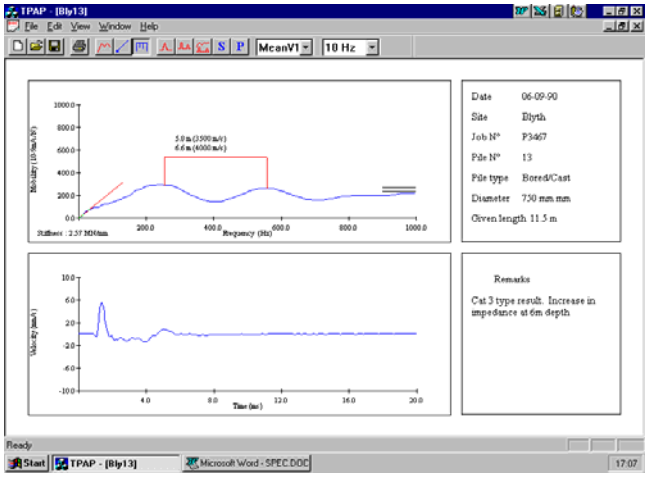
The initial mobility plot displayed is the average of the three results stored, but at any stage any one of the three results can be viewed and treated individually. The time domain velocity plot can then be viewed and an exponential amplification of the signal applied simply using the mouse, clicking and dragging. The depth to an impedance change can be marked up if required. The force can be viewed in both time and frequency domain.



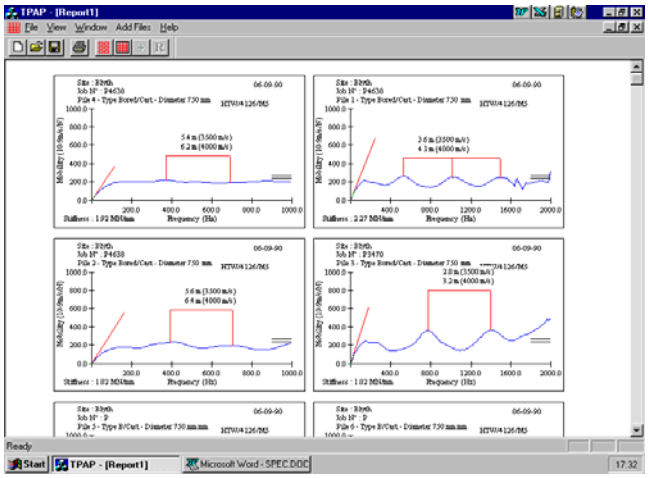




Lastly, a multiple screen is displayed which shows :

- Mobility plot
- Velocity time domain
- Header information (which can be corrected if necessary)
- Remarks section

The header information can be changed here if necessary and any remarks which are to appear in the table of results are added. The file is then closed and the screen view switches back to the table of results for the next pile to be selected.



There are the following options for printing of data for inclusion in the report.

- Mobility 8 traces per page
- Mobility 2 traces per page
- Velocity 8 traces per page
- Velocity 2 traces per page
- Mobility and velocity 2 traces per page

An example of the first is shown opposite

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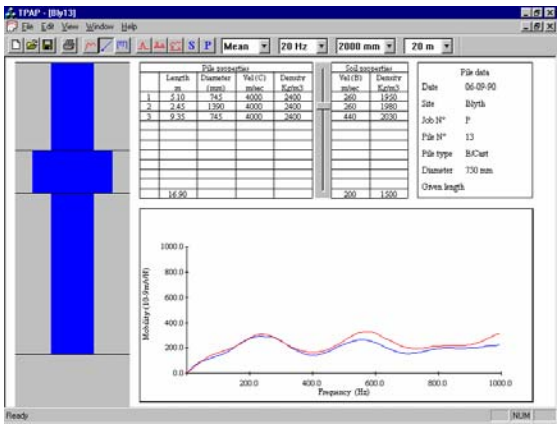
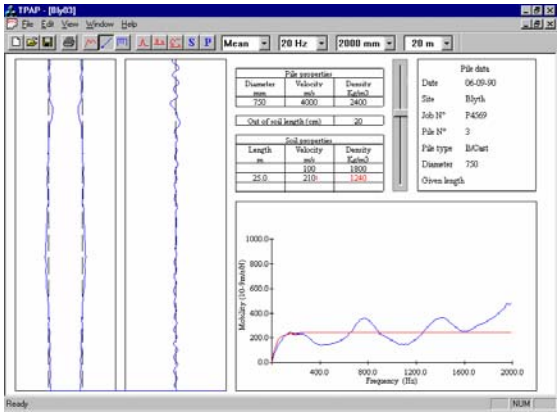
FURTHER ANALYSIS OF RESULTS



COMPUTER SIMULATIONS

TPAP offers an easy to use, rapid simulation module ***SIMUL*** ™. This is used both for predicting the expected TDR test result based on a knowledge of the pile geometry and the soil conditions and for iteratively matching with real test results.

The potential influence of geotechnical conditions on individual pile shafts can be assessed and the programme is also a very useful tool for interpreting real results obtained on site. Theoretical and site response curves are presented together with details of soil parameters and pile dimensions.



IMPEDANCE PROFILES

The pile impedance log software ***IMPRO*** ™ takes the simulation a step further, and by analysing pile shaft impedance responses from the real result with depth is able to produce a pile shaft cross section profile. The result obtained are easy to interpret and explain to the client . The impedance profile is presented together with cross section profile and details of soil parameters used. Used in conjunction with the ***SIMUL*** ™ software interpretation of pile integrity testing results using IMPRO has helped to remove the subjective element which was previously unavoidable.

Both the ***Simul*** and ***Impro*** analysis modules are included with the basic TPAP programme. They both work within the TPAP framework and interact directly with test results. Computations are immediate simulated results can be viewed alongside real results for easy comparison and curve fitting.

SYSTEM REQUIREMENTS

We recommend the following minimum requirements to run the TPAP programme on a pc system:

- Pentium 4 microprocessor with Windows XP software
- 256 MB RAM
- Video resolution 800x600, 256 colour
- USB Serial port
- CD Rom Drive
- Fixed hard disc minimum 1GB

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