FUGRO LOADTEST
THERMAL INTEGRITY PROFILING

The Thermal Integrity Profiling method allows for earliest assessment of pile integrity, profile and construction issues using cloud based technology

THERMAL INTEGRITY PROFILING

The Thermal Integrity Profiler (TIP) uses the heat generated by curing cement in a process called hydration, to assess the quality of cast in place concrete foundations such as bored piles, continuous flight auger (CFA), drilled displacement piles, grout columns and barrettes.

TIP evaluates the concrete quality of the entire cross section, including outside the reinforcing cage, along the entire length of the shaft, without length limitations. TIP measurements may be used to pinpoint areas of concern, estimate the actual shape of the pile and determine the concrete cover and/or position of the reinforcement in the shaft.

The TIP Thermal Integrity Profiling System consists of cable strings fitted with a series of thermal sensors spaced at every 300 mm which are mounted along the length of the reinforcing cage. The minimum number of vertical cables to be installed is determined by the foundation size (ASTM D7949). A Thermal Acquisition Port (TAP) is connected to the string at ground level after concreting and collects the data from each wire. The TAP automatically samples data from each embedded Thermal Sensor at user selected time intervals, typically 15 minutes, until after the peak concrete temperature is reached usually around 3 to 5 days.

The data from the thermal strings is collated from the TAP units and sent to the Cloud via the TAG (Thermal Aggregator) system allowing the data to be viewed live as the concrete cures. If anomalies are detected during the logging period, the data can be analysed immediately allowing early assessment.

TIP ADVANTAGES

Foundations can be profiled in 3D giving a more complete interpretation of the pile integrity.

Anomalies can be determined with much greater detail than by CHSL, inside and outside the reinforcement.

The positioning of the reinforcement and alignment through the shaft can be determined and concrete cover assessed.

A major safety feature is there are no large and heavy pipes as in CHSL, eliminating the risk of damage to personnel or construction equipment in the event of pipe slippage. Assembly time over the open bore is reduced considerably as there are no access pipes to fit or connect at splices.

Wires and equipment are fitted on site prior to installation or in the fabrication yard prior to cage delivery. Unlike CHSL pipes, thermal strings do not interfere with the structural working of the foundation and do not require post-test grouting.

TIP strings installed in conjunction with O-cell equipment in a 110 m long 2,000 mm diameter bored

SUCCESSFUL TIP PROFILING WORLDWIDE

TIP has been deployed around the World. As the merits of the system are recognized, more and more consultants in an ever-expanding list of countries are requesting the system as the best and safest method of integrity testing of foundation structures available.

Because the main working part of a foundation is located at the interface between the concrete and the soil, TIP really can offer so much more than traditional methods of integrity testing such as CHSL and PIT.

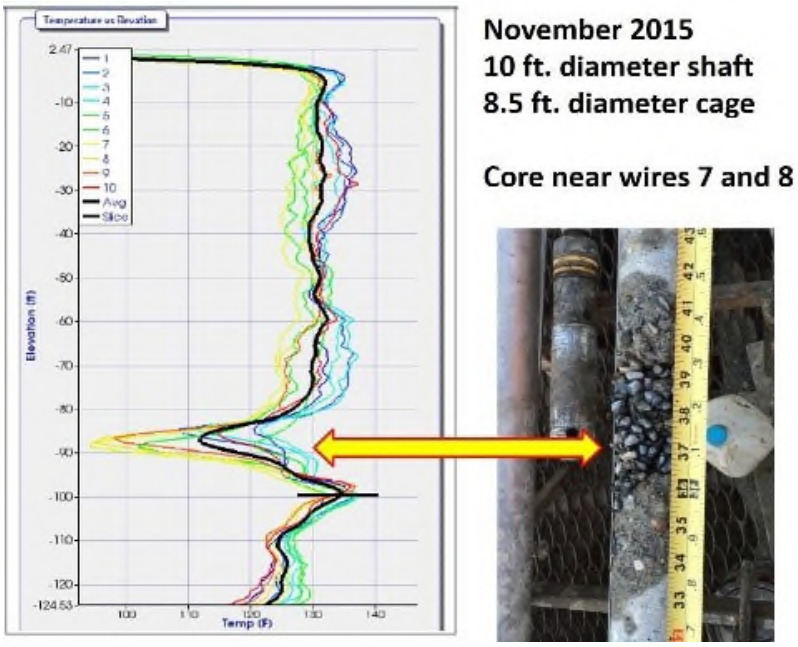
TIP has been used in the World's longest and biggest bored piles, CFA piles, D-Walls, barrettes, grout injection piles and so many more. Foundations with deep cut-offs can be profiled by placing nodes within the concrete section only without the waste of CHSL pipes being bought to the surface.

TIP can even be used in foundations with plunge columns.

The system is safer than cross-hole sonic logging, more effective as it covers the full cross-sectional area, requiring just battery powered data loggers on the end of the strings for the duration to peak hydration, providing more cost effective early results for analysis ensuring any construction issues can be addressed at the earliest opportunity

PROFILING RESULTS

By analysis of the thermal profile in time, anomalies have been detected early in the construction phase without waiting for the pile concrete to cure sufficiently for successful use of acoustic cross-hole techniques.



Anomalous low temperature detection investigated by coring resulting in detection of poor quality concrete

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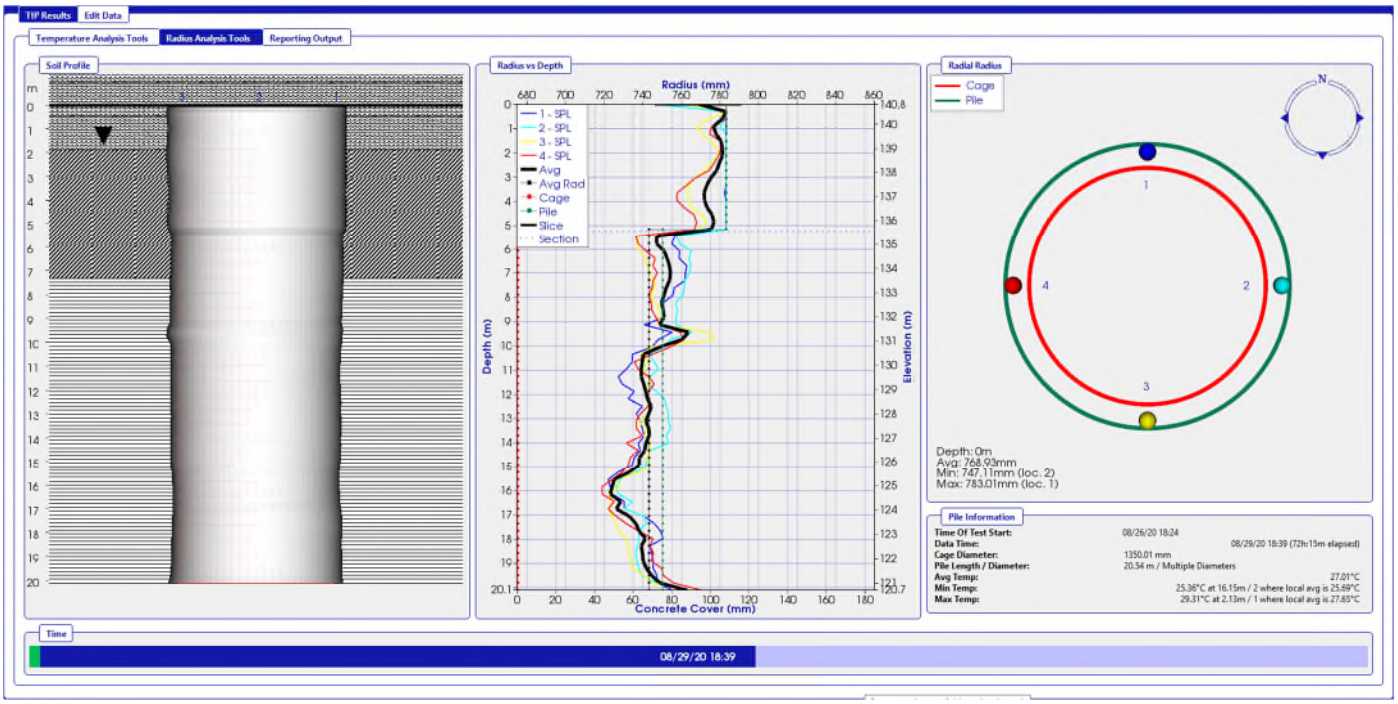
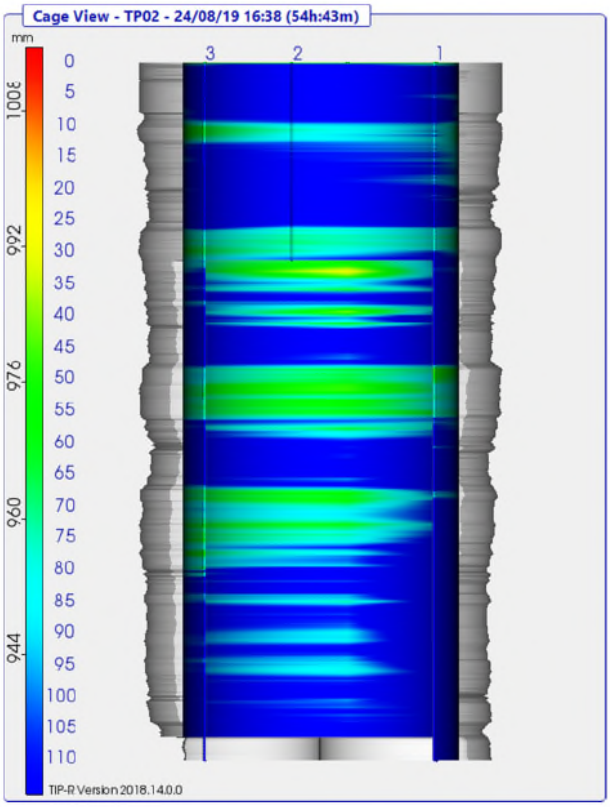
Typical reporting output can identify position and tip of casing elevations, splice positions and O-cell assembly elevation, where fitted, as well as anomalies due to construction issues. Soil interfaces that result in pile diameter changes can often be detected.



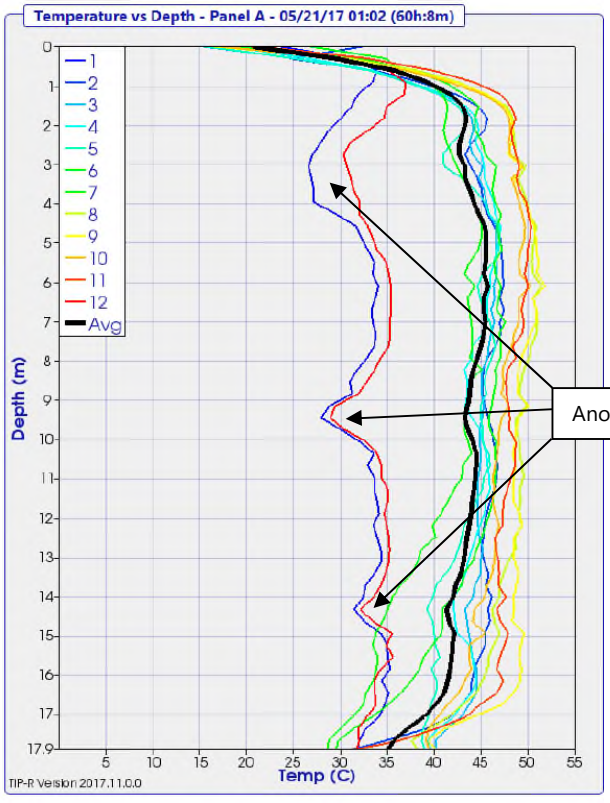
Typical output illustrating casing in the top section, soil horizons, and changes in section.

Temperature profiles can be illustrated as coloured thermal plots to identify hot or cool areas which in turn may be interpreted as changes in pile diameter or thickness of cover.

Diaphragm walls and barrette sections, as well as other sections that are not circular, can be investigated by plotting the thermal profile of each string with depth. In this example, strings 1 and 12 were placed in the corners at one end of the panel indicating that the position of those strings may be worthy of further investigation.



Thermal profile of 110 m long pile



Three zones of anomalous readings identified in a D-wall section

loadtest@fugro.com
www.fugro.com