Project Experience

Thermal Integrity Profiling

Fugro LOADTEST has been performing Thermal Integrity Profiling on both preliminary and working foundation elements for many years.

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

The TIP System consists of cables fitted with a series of thermal sensors spaced at 305 mm intervals and are mounted along the length of the reinforcing cage. The number of strings deployed being dependent of the foundation size.

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 data may be used to identify areas of concern (zones of potential variation in radius or quantity of cementitious material), estimate the geometry of the as-built pile, and determine the concrete cover and/or position of the reinforcement within the shaft.

Some examples of Thermal Integrity profiling projects are illustrated below:

Light House Tower, Aarhus, Denmark

The iconic Light House Tower located in Aarhus is Denmark's tallest residential tower with a height of 143 m.
In order to verify and improve the design of the foundations of the project, two 70 m long preliminary test piles of 1860 mm and 2000 mm diameter were to be load tested to a gross load of over 70 MN with two 690 mm O-Cells in each. These piles were fitted with TIPs and the bore was profiled with the SONICaliper ®. The piles for this project are founded in extremely complex strata with soft clays of extremely high plasticity.
From a derelict waterfront to an impressive number of modern apartments, shops and hotels, Aarhus has become 'THE' place to live, outside of Copenhagen.

Elbtower Project, Germany

On completion, the 244 m high Elbtower will be the third tallest skyscraper in Germany and forms part of a 157-hectare megaproject to redevelop the former harbour and industrial areas in the Hafen City district of Hamburg.
Several instrumentation systems were fitted on the deepest ever bored piles in Germany, of 1850 m diameter which had concreted lengths of over 110 m. The instrumentation included an O-cell® loading assembly capable of 64 MN; fibre optics and vibrating wire strain gauges distributed along the length of the piles to assess the mobilised reaction. The preliminary test piles were also fitted with the longest ever TIP strings with 395 nodes to verify the structural integrity of each of the 4 piles constructed.

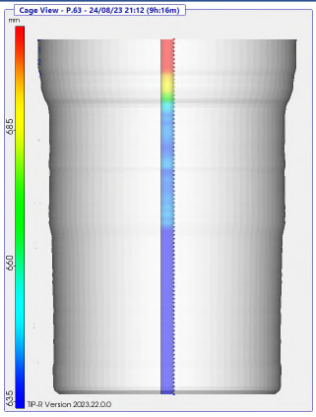
Mahall Bomonti Project, Izmir Turkey

Mahall Bomonti Project is established on a 44,966 m2 land in Konak, Izmir, which has been home to the old Bomonti Brewery for more than a century. A 58 storey tower will be accompanied by eleven structures.
A nominal 2800 x 1200 mm, 98 m deep test barrette was constructed with a hydro fraise. A single level, O-cell bi-directional loading arrangement with a total rated capacity of 100 MN was utilised for the preliminary load test.
The test was instrumented with twelve levels of strain gauges to determine the stress distribution and skin friction values throughout the length of the barrette. These sensors were also monitored during the concrete curing for changes in strain and temperature alongside 6 sets of TIP strings, a first in a barrette in Turkey.

HS2 London to Birmingham, UK

HS2 is Britain's new high-speed railway and Europe's largest current infrastructure project. Once operational, trains will provide zero-carbon travel between the UK's two largest cities, London & Birmingham.
The final project comprising 140-miles of track, four new state-of-the art stations, two depots, 32 miles of tunnel, and 130 bridges, HS2 will leave a legacy of environmentally responsible travel, economic regeneration and technological innovation for generations to come.
Working with various piling contractors across multiple sites we have been using Thermal Integrity Profiling on numerous preliminary test and working piles along the route.

CFA piles



Integrity testing of Continuous Flight Auger piles CFA has been a requirement since their introduction in Europe in the late 80's.
The innovative application of a centralised single Thermal Integrity profiling string in small diameter CFA piles, is a vast improvement on previous integrity testing techniques such as the low strain method.
For these CFA piles, a string is attached to a single reinforcing bar which is lowered down the centre of the bore immediately after cage insertion in the wet concrete to the full depth of the pile.
The thermal profile is then used to produce an effective diameter versus depth model revealing any anomalies in the total cross sectional area profile.
This method is also be applicable to small diameter cast-in-situ foundations such as screw displacement piles.

Kincardine Bridge upgrade, Scotland

The £16.85 million of Kincardine Bridge upgrade, over the Firth of Forth from Falkirk Council's region to Kincardine in Fife and is located 8 miles south east of Stirling.
The project involves construction of a temporary bridge, the demolition of Kincardine Bridge's southern piled viaduct and replacement with a new structure. The new viaduct will be made of reinforced concrete, with five spans of 15m to match the appearance of the rest of the bridge.
Two preliminary test piles complemented with TIP were used to verify and improve the initial design and TIP services were then applied for quality assurance of the working piles.
Data was harvested remotely from the cloud enabling swift processing and assessment of the results.