



Pile Driving Monitoring Services



Pile Driving Monitoring is the best way to ensure a safe and successful installation without time loss.

Services

Dynamic pile monitoring is an approach widely used in offshore construction works to ensure the structural integrity of the piles during driving and provide key elements for assessing the pile capacity at the end of driving. Dynamic pile monitoring **is done in real time during driving, without affecting construction timescales.**

FUGRO engineers are used to working on the installation barge in close cooperation with Client field engineers and hammer operators in order to optimize driving operations, conclude on pile acceptance or advise Client for remedial procedures if needed.



In working offshore installations

Field Application

Dynamic pile monitoring can be used both for onshore and offshore operations including above water and underwater driving. Main applications are for the installation of:

- offshore jacket pile foundations
- offshore conductor pipes
- offshore wind farm pile foundations
- onshore or nearshore pile foundations (bridges, wharfs, buildings...)

Personnel & Competences

The FUGRO group and its specialized staff are internationally recognized by the offshore construction community. FUGRO is employing several experts who are justifying more than 20 years experience in pile installation and have been involved in several major international pile testing projects (e.g. Euripides, Ras Tanajib).

Field crews are composed of experienced geotechnical engineers and skilled technicians who are specialised with offshore overwater, underwater pile monitoring as well as onshore and nearshore pile monitoring work.

Equipment

Accelerometers and strain transducers are attached to the pile at a small distance from the pile top. Signals produced by each hammer impact are recorded and analysed by a dedicated data acquisition system. The equipment is light, small, handy and particularly suitable for offshore barge installation conditions. Waterproof transducers and cables are available for underwater driving.



Hammering offshore pile / Presenting transducers attached to the pile



Acquiring data in real time by geotechnical engineers

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Data Acquisition, Processing and Interpretation

FUGRO has in-house resources to provide high quality services and complete assistance for pile installation. A successful pile driving monitoring operation should be organized in three successive steps.

In-office preparation: pile driving predictions are performed using wave equation analyses and state of the art methodology to derive soil resistance to driving. These analyses are used to:

- select a suitable suite of hammers and predict blowcount
- assess stresses induced in the pile wall steel
- define specific pile acceptance criteria

Field operations: sensors are installed on the pile sections without affecting contractor's operations. The main parameters acquired in real time are:

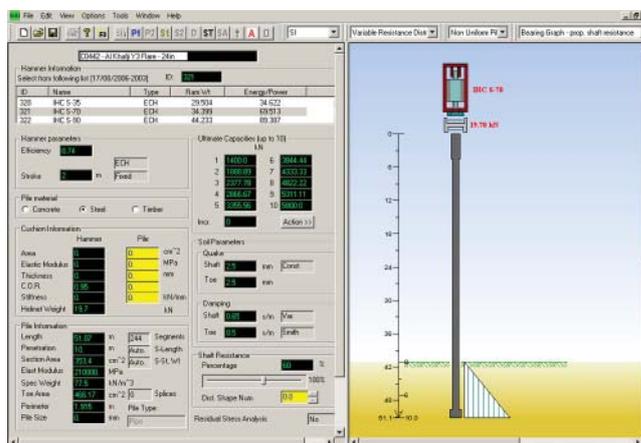
- the blowcount (number of blows per 25cm pile penetration)
- the stresses induced in the pile by each hammer impact
- the enthu energy, which is the energy effectively transmitted to the pile top
- the actual Soil Resistance to Driving (SRD)

These data are analysed by the geotechnical engineer and compared to driving predictions. A signal matching procedure is performed immediately after installation in order to assess pile capacity at end of driving. This information is used to conclude on pile acceptability. In case of premature refusal, mitigation procedures can be proposed.

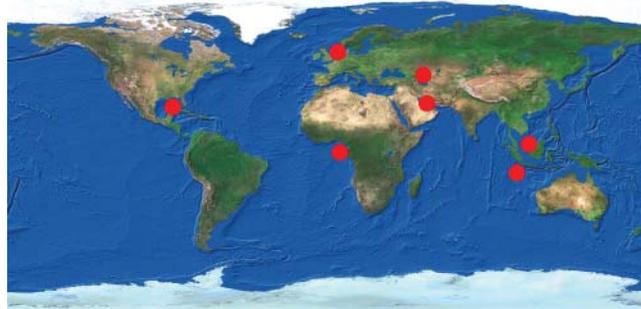
In-office back-analyses: Further analyses are made to check and refine parameters obtained on site. Back-analyses are extremely useful to improve predictions for future installations on similar soil conditions.

Experience

FUGRO has been involved in pile driving monitoring since late 1970's. Throughout the last three decades numerous projects have been successfully executed for the Oil and Gas industry and international civil contractors. Major projects include many offshore platform installations in the North Sea, Arabian Gulf, Gulf of Mexico, Southeast Asia and civil infrastructures and buildings such as the Canary Wharf, London, the Tagus Bridge, Portugal and the Jamuna Bridge, Bangladesh among others.



Driving prediction - in office preparation



Monitoring offshore field experience



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