

Further information:
Cementation Skanska
skanska.co.uk/cementation
cementation@skanska.co.uk

Instrumentation and Automation of CFA Piling

Application

Monitoring and control of CFA pile construction process.

Provides a permanent record of the installation process.

Improvement of contract management through analysis of pile records.

Suitable for use constructing contiguous and secant walls, and with low-headroom rigs.

Advantages

- Operators no longer have to constantly control the rig, minimising fatigue
- Operators have additional freedom to monitor other activities around the rig, adding to site safety and efficiency
- The concreting phase is more reliable when automated, reducing over supply of concrete
- Productivity can be increased to a level where the rig characteristics determine the limiting elements
- The automatic system provides consistency in pile installation and reduces the potential for differential settlement, resulting in a more cost effective design, with savings for the client.

Patents

UK Patent No 2303 868
UK Patent No 2328 700
International Patent No PCT/GB96/01855

Trademarks

AUTO-CFA®



Automation of CFA Piling

The process of constructing Continuous Flight Auger (CFA) piles has progressed substantially in recent years and now represents a major technique in the piling market.

Piles are constructed by drilling with a continuous flight auger to the required depth and pumping the concrete through the hollow stem of the auger during its extraction. Use of this technique, as with all piling solutions, is not without risk. Construction risks can be minimised once the process is understood and the hazards addressed.

Cementation believes that quality should never be sacrificed for expediency and has developed CFA piling into a cost effective, reliable and efficient method of installing piles in most ground conditions.

Reliable installation of the pile requires that sufficient concrete is delivered to the auger tip to prevent any ingress of spoil from the walls of the bore which may contaminate the cross section of the pile.

Reliance is placed on instrumentation to ensure a high level of control and give assurance of the quality of each installation. Computer based systems display and record the significant actions that affect the successful installation of every pile.

The challenge has been to develop these systems from a role of recording the pile execution details to controlling the process.

The more advanced instrumentation systems employed record all the relevant data for subsequent examination. It is then possible to check the installation of every pile either manually or automatically and to present the results statistically to evaluate rig-driver performance.

When such a management tool became available it was apparent that the installation of CFA piles could be more reliably performed using less concrete and in a more cost effective manner. This promoted the use of real time displays showing how the installation is progressing so that the operator can take any necessary corrective action.

Despite the presentation of real-time graphical and numeric displays as guide, drivers have been unable to maintain concrete injection volumes within 10% of the requirements. As a result, an electronic control system has been developed. AUTO-CFA® replaces the manual operation so that pile installation can be controlled automatically by the monitoring computer.

To achieve automation, the recipe for CFA pile installation has been carefully developed by assessing statistically the significant aspects of the process and instructing corrective action to be taken where needed to both increase productivity and enhance pile performance.

Research has been conducted on both the theoretical and practical aspects of excavation with a focus on determining the best boring technique. This has culminated in the development of a process which can consistently maintain the load bearing capacity of CFA piles.

Having proven the success of the enhanced installation technique which may be generally adapted to most ground conditions, the requirements have been programmed into the control systems on the piling rig computers to control the boring and the lifting of the auger.

Automated concreting allows the progress of the pile installation to match the speed of auger withdrawal. The target delivery can be adjusted at any time during the concreting phase to suit the ground conditions.

In addition, any interruptions to the concrete delivery, for example when awaiting the next load of concrete, can be detected automatically and the concreting phase paused until the supply is resumed. The key benefit is the speed with which the system can react in contrast to operator reaction times.

After full evaluation and commissioning of the first automated rig, the success has been outstanding and a program of equipping the entire Cementation fleet of CFA piling rigs is now in progress.



Benefits of Automation

Operators no longer have the strenuous task of constantly controlling the rig and are delighted with this simple innovation which minimises fatigue.

The operators now have additional freedom to monitor other activities around the rig, adding to site safety and efficiency.

The main benefit of automation of the concreting phase is that the process can be carried out reliably. This allows a reduction in the over supply of concrete. Productivity can be increased to a level where the rig characteristics determine the limiting elements. These factors are greatly appreciated by the piling contractor.

The automatic system provides consistency in pile installation and reduces the potential for differential settlement, an aspect welcomed by clients. This consistency in pile performance results in a more cost effective design, with savings for the client.