

# CFA Piling Guidance



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## 1. Introduction

This guidance deals solely with **Continuous Flight Augered (CFA)**.

The decision as to the appropriate type of piling system will normally have been made prior to contract award. The possible options include driven (steel or concrete), vibro-stone columns, continuous flight auger (CFA) and auger bored.

## 2. Selection of Pile Type

Issues which will affect the decision as to the piling type to be used will include the types of soil, the load to be carried by each pile, the presence of obstructions, proximity to adjacent structures (and especially sensitive structures), ground water conditions, the presence of contamination and the risk that such contamination may affect ground water quality, etc.

## 3. Soil Report / Boreholes

The Soil Report for the project will generally guide the decision as to the type of piling to be used on the project. If an Environmental Report is available, it too should be considered. Information should also be obtained for any buildings which previously occupied the site.

Information on the soils should extend beyond the depth of the deepest piles

Large sites may require more than one borehole.

The soil report may also show obstructions which will have to be removed or penetrated. These must be recorded and actions agreed with the structural engineer. Probing may also be required to identify the presence of obstructions to enable them to be dealt with in advance of piling. Ensure a proper regime is in place before any probing operations are commenced.

## 4. Obstructions

If any information suggests the potential for structural obstructions, consideration must be given to the need for pre-pile probing, excavations for potential obstruction removal, and potential redesign of the pile caps.

## 5. Design and installation of piling mat

Do not under-estimate the importance of the piling mat.

The following must be considered in order to design the piling mat to suit the ground conditions and the piling equipment being used, so that plant will not bog down in muddy conditions;

- The depth of the initial dig (this will vary dramatically from brownfield and city sites to greenfield sites) – too deep will incur unnecessary cost; too shallow may result in an inadequate piling mat and excessive repair and making good.
- The extent of the piling mat.
- The depth and type of material used to form the piling mat.
- The rig loadings

Ensure that you allow sufficient area of stable mat for the piling rig, any attendant navy crane, excavator, muck-away lorries and concrete deliveries and any ramps needed to allow the piling rig to move around the site. Plant must be able to manoeuvre freely around the piling area and position the piles.

The height of the top of the piling mat needs to be agreed. Neil Foundations Systems would recommend that the top of the mat is generally 640mm above pile cut off level. This enables steel to be placed flush with the piling mat, thus enabling the rig and attendant excavator an unobstructed site, reducing the risk for pile damage.

Remember, stuck or standing piling rigs waste money. If the plant cannot move around the site properly on a stable platform, the resultant costs, delays and massive upheaval could turn any potential profit into a disaster.

To reinforce all of the above, ensure that Neil Foundations Systems visits site both to view and agree the proposed working area in advance.

Piling contractors will require a 'Working Platform Certificate' (WPC) to state that the piling mat has been properly designed and installed to support the equipment to be used.

Piling mats need to be ROLLED and compacted in layers. Tracking in with excavators is NOT adequate.

When the piling contractor arrives on site, ensure the equipment is the same as that taken into account in the design of the piling mat or the Working Platform Certificate will be invalid.

Ensure that the Piling Mat is installed in accordance with all agreed design specifications.

The mat needs to be maintained and checked on a daily basis to ensure it has not deteriorated

On some occasions Neil Foundations Systems may request 20t of crushed concrete to enable a ramp to be formed to the concrete drum.

## 6. Permit To Dig

Prior to piling commencing Neil Foundations Systems will require a permit to dig to be signed to state that all underground services have been located, exposed, marked, terminated.

## 7. Setting out

Ensure responsibility for pile setting out is properly established. Errors in pile position can be extremely expensive to overcome. Delaying the piling rig because no setting out is available is also very costly.

Ensure that the piles are set out as per the drawing co-ordinates or from gridlines – in either case; the normal tolerance for piles at pile cut-off level (i.e., below the piling platform level) is +/-75mm in plan. The out-of-plumb or verticality tolerance is 1:75, and this too must be checked.

In the case of contiguous or secant walls this tolerance must be considered when setting out. When setting out consideration needs to be given to overhanging trees or adjacent structures that may have an effect on the positioning of the rig. Generally the closest the rig can pile to a vertical face is 900mm to the centre of pile. This will be greater at internal corners.

Piling rigs often have tall masts. An overhanging branch will prevent the rig from accessing a pile position.

## 8. Water

The piling operation will require a good supply of water at all times. Remember in winter this needs to be insulated.

## 9. Attendant Excavator

The piling operations will require a suitably sized excavator and competent driver. It needs to be established who is responsible for the provision of this.

The excavator must be fitted with Lifting Eye and have marked SWL.

## 10. Working Hours/Delivery Restrictions

Without concrete operations cannot commence. Any delivery restrictions need to be discussed

## 11. Start Date

Dates given by Neil Foundations Systems are week commencing dates. We cannot commit to arrive on any specific date.

## 12. Design and Installation of Piles

In most situations, the detailed design of the pile will be the responsibility of the appointed piling contractor. The design must take into account not only the ground conditions expected and the required pile capacity, but also the piling equipment and techniques being used. The design must however be approved by the Structural Engineer.

Any changes in design must be approved by the Structural Engineer.

Pile cap design will normally be done by the Structural Engineer.

Mix design must be approved by the Structural Engineer.

Ensure that the structural engineer has provided a complete and finalised numbered pile layout complete with details of required pile capacities, which he has approved the piling contractor's pile design.

Ensure all mix designs have been approved by the structural engineer in advance (this process is vital to all insitu concrete works).

It is very important to obtain a full installation method statement prior to commencement of the piling operations.

Neil Foundations Systems will phase delivery of his reinforcement requirements both pre-fabricated cages or site fabricated. Ensure that the cages are tied or welded to specification.

Ensure that the piling contractor is required to provide full piling logs (both daily piling record sheets and copies of all rig instrumentation records), concrete delivery tickets, cube results, load test results and integrity test results as the works proceed.

Once the piling rig has been positioned over co-ordinate pin, the stabilising legs lowered and the auger plumbed, ensure the auger head end cap is in position prior to drilling.

The drilling operation can then begin. Remember, the auger is only extracted from the pile bore as concrete is pumped down the hollow stem of the auger – the auger supports the bore. Spoil will need to be removed as the auger is withdrawn.

### 13. Concreting

Ensure that all the necessary equipment is on site for concrete testing (slump cone and tamping rod, cube moulds, tamping bar, thermostatically controlled tank for curing after de-moulding), and ensure it is correctly used and that cubes are properly stored. Problems with cube results usually become apparent **after the piling contractor leaves site, and usually the problem is found to be due to poor cube making practice. Do it right, and avoid the problems, worries and unnecessary costs.**

Ensure that the concrete records (including cubes) are accurate enough to trace individual concrete deliveries to individual piles.

Once the auger head has reached the prescribed depth, the system is pressurised with concrete pumped through the hollow stem. Usually a static concrete pump is used, feeding the rig through demountable pipes. The static pump is fed by a static concrete drum which is topped up by normal concrete delivery trucks. The static drum must continually agitate the concrete until it is all used. The operation must be monitored to ensure that concrete quality is maintained, that water IS NOT added to the agitator or pump and concrete is not held on site for too long.

As the auger is slowly withdrawn, with a positive concrete pressure being maintained through withdrawal, the auger end cap remains at the bottom of the bore.

### 14. Protection

Consideration needs to be given to adjacent buildings, roads / footpaths, piling is not a clean operation.

## 15. Reinforcement

Once the auger has been removed, clear the remaining spoil from the pile position and hand dig a small quantity of concrete from the top of the pile to properly and cleanly locate the pile head, prior to the placing of the reinforcement.

Ensure that the reinforcement is free from deleterious materials including mill-scale, mud, etc.

Ensure that the links are at the correct centres and fully tied to specification.

For long cages which may be placed in two sections, ensure that the bar lap length is to specification. A good rule of thumb is for the lap length to be 40 times the bar diameter.

The reinforcement cage is plunged into the already concreted pile. Longer cages and large diameter cages may have to be vibrated into place using a cage vibration system.

Check the level at the top of the cage and secure a temporary support bar in situ to prevent the cage falling below level.

Is debonding required? If so the piling contractor will require pile mat levels and cut off levels.

## 16. Load Testing

On-site pile load tests will normally be required to prove the design if piles have been designed to FOS 2.5 or lower.

Agree in advance the preliminary, working pile and integrity test pile requirements and ensure that these are fully included within the piling contractors contract prior to works commencing on site. Ensure the project programme includes the time periods (including concrete curing time) for pile testing for both load testing and integrity testing.

## 17. Pile Trimming

Cast piles will inevitably have to be trimmed down from piling platform level. The trimming method needs to be agreed in advance with Neil Foundations Systems and the structural engineer. Wherever possible use methods which avoid the need for breaking down the piles using hand held concrete breakers (HAVS problems).

Ensure that there is a full method statement for trimming piles down to cut-off level.

Excavating round piles and trimming must be undertaken with great care. Excavators and heavy breakers can easily fracture piles, especially at depth. Small diameter piles are especially vulnerable. Repair will not be the piling contractor's responsibility.

Providing a saw cut around the pile before any trimming down operations are carried out will help to prevent spalling.

Wherever possible, use a proprietary system to break down piles rather than breaker (to avoid the risk of hand arm vibration syndrome).

## 18. Integrity Testing

It is vital to ensure that any full load and integrity tests required are carried out and recorded in accordance with Neil Foundations Systems engineering procedures. Remember that for integrity testing, the concrete should have achieved at least 7-day strength, piles need to have been trimmed to cut-off level with the pile head being exposed and free from standing water before any integrity testing takes place.

Piles should be tested when they have been trimmed to cut off level and before steel reinforcement is placed.

## 19. Records

Ensure copies are obtained of piling record sheets, and rig monitoring sheets (computer printout from the piling rig), on a daily basis.

Ensure copies are obtained of load and integrity test results and cube results, as soon as they are available.

Mark up a drawing or schedule to record date pile cast, relevant cube results, integrity test date and result.

## 20. Site Access

The site access must be suitable for heavy plant and lorries.

Crossovers may need to be reinforced and an area in the site entrance stoned up to keep lorries in a clear hard standing for unloading and preventing muck on the roads.

Main contractors are responsible for street cleaning.

## 21. Other considerations

Piled retaining walls.

Do they need propping?

Allowance to be made when setting out for positional and vertical tolerance.

In soft ground piles often become oversize. Allowance needs to be made for this.

Secant walls will require a reinforced concrete guide wall at least 800mm in depth.