Aarsleff Piling | Technical Helpline

Pile Bearing Capacity

Aarsleff Piling install Centrum precast concrete piles which are manufactured using the most advanced technology available, and have a high structural capacity that results from the use of high strength sulphate resisting concrete and exceptionally rigid welded reinforcing cages. This means that piles can be installed to work at higher concrete stress levels than would be permissible for piles formed in the ground using wet concrete. The safe working loads in compression stated in the table below are indicative, based on a design factor of safety 2.0. Indicative values of safe working loads in tension and allowable lateral loads are also included. (see further notes below)

Section size (mm)	200	250	300	350
SWL compression (KN)	350	650	900	1200
SWL lateral (KN in conjunction with compression load)	5	10	20	30
SWL tension (KN)	80 (type 4)	100 (type 6)	150 (type 8)	180 (type 12)
Minimum pile spacing (mm)	800	1000	1200	1400

Soil conditions prevailing on a particular site may limit load bearing capacity to lower values, and consideration of other factors such as negative skin friction, pile head fixity, pile settlement specification and requirements for a higher factor of safety may also affect the allowable pile head load. Higher values of all the above indicative safe working loads may be achievable in certain circumstances, sometimes up to the limiting structural capacity of the pile section.

Where piles are required to resist tensile loads, this will be governed by the structural capacity of the pile section and the frictional resistance of the soil, whichever is the more critical. A design factor of safety of 2.5 is normally used in geotechnical design for tensile loads, and a load factor of 1.5 for structural design. Piles carrying combined tensile and lateral loads will generally require detailed analysis, normally involving the use of commercially available pile design software or bespoke calculations based on recognised design principles.

Design Factors of Safety for Driven Precast Concrete Piles

The factor of safety employed in pile design is intended to safeguard against failure of the pile/soil interaction that provides the resistance to the applied load, and to ensure that pile settlement characteristics are within acceptable limits in the service condition.

The value of the factor of safety applied is generally in the range 2.0 to 3.0, but the particular value chosen will depend on the following factors: -

- Piling technique.
- Quality and quantity of site investigation data.
- Load testing regime.
- Settlement specification.

For driven precast concrete piles, the industry norm is a design factor of safety 2.0, for the following reasons: -

- The pile is manufactured under quality assured factory conditions and arrives at the pile location preformed; consequently the risks associated with placing fresh concrete in the ground are absent. The pile can be inspected prior to driving and the successful achievement of the design pile toe level and/or driving resistance is usually acknowledged as a demonstration of pile shaft integrity on completion.

- Even with relatively basic site investigation data, a reasonable estimate of pile length can be made. The records of resistance to penetration on probe piles installed in working pile locations can be compared with reported soil conditions. Piles may be installed to a calculated embedment or length, to a dynamic resistance or set, or to a combination of both. In variable soil conditions the precast concrete pile can be driven on until the design resistance to penetration is achieved, as opposed to say forming a CFA pile without first seeing the spoil that has been excavated.
- It is normal practice to apply a dynamic load testing regime to a driven piling scheme, quite frequently testing the probe piles. Using this method gives a more cost-effective and more comprehensive picture of pile performance than say a single static load test. A check on pile integrity is a useful by-product of the dynamic load test.
- Most settlement specifications are based on an acceptance criterion of 10mm permissible settlement at working load. A design factor of safety of 2.0 will normally satisfy this requirement for all but very long piles (20 metres plus), where elastic compression of the pile shaft can become a large, albeit constant, proportion of pile settlement.

Design factors of safety in the range 2.5 to 3.0 are more appropriate to piles that are formed in the ground with wet concrete (e.g. driven or bored cast in place piles); or in ground conditions that cannot be verified until the pile has been constructed (e.g. CFA piles); or where pile load testing logistics and costs are prohibitive (e.g. large diameter bored cast in place piles).

The Pile Joint

Centrum precast concrete piles can be easily and quickly extended when required using a robust mechanical interlocking joint cast into the pile segment. The pile joints used by Centrum Pile Limited are recognised as being the strongest, most durable pile joint available. The joint mechanism actually pretensions the connection between the pile segments that are being joined together, thereby inhibiting the ingress of water or corrosive agents. Continuing development has recently resulted in a new generation of joint, initially introduced for the 200mm square pile to the same high standards.

The Environmental Balance

Although driven piling is sometimes perceived as being less “environmentally friendly” than other piling techniques, in fact when the true overall environmental impact is considered, in many cases precast concrete driven piles are actually the most environmentally friendly. Precast concrete piles use less natural materials per unit load capacity than cast insitu systems. Also there is less road transport required for delivery and removal of materials from site. Overall sound levels from todays modern hydraulic drop hammers are comparable with systems such as CFA.

Aarsleff Piling are able to operate in sensitive locations that might otherwise be expected to require the use of more costly CFA or bored piles. The piling hammer can be shrouded, further reducing sound emissions at source. Where adjacent structures are sensitive to vibration, the hammer fall height can be finely controlled to minimise the effects of pile driving, or pile positions can be prebored prior to driving.

Aarsleff Piling work closely with Clients and their Engineers to satisfy the Environment Agency that the risk of piling induced contamination of aquifers on brownfield sites is properly assessed and managed in accordance with their requirements.

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