Hydraulic piling Rig

JOB SAFETY ANALYSISS FOR PILING WORK

method statement for hydraulic piling works

hydraulic piling, reinforcement & concreting

This Work Method Statement outlines the method of which the bored piling works are installed for the project.

i) **HYDRAULIC PILING**

1) Hydraulic bored piling plant shall be used. The piling plants consist of a telescopic kelly bar and the lower of the kelly bar is an adaptable to other drilling tools.

2) On completion of the temporary platform, the piling rigs shall be moved in assembled and ready for work on the installation of the 800 mm and 1050 mm diameter bored piles. A test pile for vertical pile shall be carried out to verify the designed load carrying capacity of the piles, the installation of which shall be determined jointly with Employer's Representative.

3) Bored piles are cast-in-situ piles formed by excavating a hole of the specified size (diameter), to the required depth and casting the excavated hole with concrete of specified strength after the reinforcement is lowered into the hole.

4) The hydraulic pile points setting out shall be provided by a qualified Surveyor. The boring plant will be moved to the pile point intended for excavation. The kelly bar mounted with an auger is placed just above the pile point. The vertically of the kelly bar should be checked by means of a spirit level. Adjustment should be made so as to enable the kelly bar to be as vertical as possible. Then the positions of the auger are checked against the pile point.

5) Adjustment should be made so that the center of the auger is nearest to the pile point. The auger is then lowered and boring operating commenced.

6) Reasonable care should be taken so that the pile position and vertically are constructed within the specified tolerance i.e. 75mm and 1 in 150 respectively.

7) Boring commerce after the positions of the boring plant is checked. Usually, an auger of the required size is used to excavate hole is collapsible; a temporary casing of the same size should be installed to prevent collapse. Excavation of the hole continued until the required depth.

8) At the point of encountering the rock head level where soil drilling tools are unable to penetrate the strata any further, boring shall cease in order that the Employer's Representative to verify the occurrence and confirm the rock head reduced level.

9) Rock drilling tools shall be used for drilling into and through rock.

10) After reaching the required depth, a cleaning bucket will be used to clean up the bottom of the borehole. A joint measurement of the depth should be made before lowering of reinforcement and concreting.

ii) **Reinforcement**

1) Reinforcement to bored piles will be fabricated in the reinforcement yard and transported to the borehole for placing. After fabrication by the bar benders, the helical links will be tack welded to the main reinforcement Laps are also to be welded sufficiently so that they are intact during transportation. 100 mm diameter round spacers will be welded to the reinforcement to provide the cover to the reinforcement against the soil during concreting.

2) The reinforcement will be lowered to the completed bore hole, prior to concreting, by means of a service crane arid to be adjusted to the correct level.

iii) **Concreting**

Concreting conforming to the specification will be delivered to the site by Ready Mixed supplier.

If bore hole are dry, the concrete shall be discharges through a short funnel at the top of the bored hole to prevent free falling concrete hitting the sides of the bore. If bored holes contain either water or bentonite drilling mud the concrete shall be placed by the tremie method.

(i) Dry Hole Mix

This mix shall be designed to give a works cube strength of 35 Mpa at 28days with a slump of 100 ± 25mm.

(ii) Tremix Mix

(iii) This mix shall be designed to give a minimum works cube strength of 35 Mpa at 28 days with a slump of 175 ± 25mm.

(iv) The method of placing shall be such as to ensure that the concrete in its final positions shall be dense and homogeneous.

(v) The piles shall be concrete in one continuous operation immediately after the excavation has been completed and inspected where inspection is required by the Specification. If the continuity of placing the concrete is interrupted, no further concrete shall be placed without the prior approval of the Engineer.

iv) Extraction Of Temporary Casing

All temporary casings are to be extracted immediately after completion of concreting. A vibro-Hammer will be used to extract the casing.

Reasonable care should be taken to ensure that the concrete level is above the cut-off level after extracting of casing point.

Examples of Hazards associated with Piling and Diaphragm Walling Works and how these might be managed within the design phase of a project (neither exhaustive nor exclusive)

This list of examples has been produced to assist designers but given the unique nature of each individual project can not be considered exhaustive. The designer must consider the issues relevant to every new situation when engaging in the risk management process.

It is important here to be aware that by designing out one hazard and eliminating the associated risk quite often another hazard will be introduced into the process.

Hazard	Potential effects	Risk management or mitigation
Sequencing of piling work.	Conflict with other parts of the project construction creating unsafe working conditions.	Plan for safe, practical and economic working, not just for time. Avoid return visits for piling rigs if possible.
Piles located in positions with restricted working space, e.g. corners of site and adjacent to public areas outside the site.	Personal injury from falling debris, crushing. Unsafe removal of guards or auger cleaners. Risk to third parties.	Design the foundation so that the plan position of piles or alignment of the wall allows adequate working space with rig guards fitted and operational. Only in extreme situations, and after consultation with the CDM Co-ordinator, a controlled procedure according to FPS Notes for Guidance on PUWER Regulations in relation to Guarding and Cleaning of Augers on Piling Operations (March 2010) may be implemented.
Piling near to the top of slopes.	Slope failure, rig overturning.	Consider the type and size of rig(s) to be used, track bearing pressures and the requirements for adequate safe working space, exclusion zones and storage areas. The physical limits of the designed platform should be clearly defined on site. Evaluate the balance between optimum earthworks scheme and optimum pile foundation scheme.
Working in excavations.	Access ramps and wall props can impede working space.	
Inadequately designed/constructed/maintained working platforms.	Rig overturning, unsafe working conditions for operatives.	Ensure working platform is designed, constructed and maintained in accordance with published guidance or other appropriate best practice. Specify site investigation works to take account of the need for measuring near surface soil properties required for design. Construct platform according to specification, inspect regularly and maintain to original specification. Operate proper procedures for excavations (e.g. for removal of obstructions) and reinstatement.
Underground services.	Personal injury or death, loss of amenity, delay to project.	Enquiries with utility companies to establish presence of services. Arrange pile positions to “bridge”over services. Instigate permit to dig/ work systems.
Unexploded explosive ordnance (UXO).	Personal injury or death, damage to construction plant and/or surrounding	Undertake preliminary risk assessment and if possibility of UXO is identified notify client of his CDM responsibilities should it appear they have not been discharged. Follow on with detailed assessment and risk mitigation.

Hazard	Potential effects	Risk management or mitigation
	property, delay to project.	Implement UXO risk management strategy and emergency response plan.
Overhead services.	Injury to workforce, electrocution, fire, loss of amenity, delay to project.	Instigate appropriate method statements and lifting plans. Agree working clearances with utility companies. Utilise smaller/low headroom plant if required, possibly with a change of construction technique if technically acceptable.
Working adjacent to major highways or railways	Plant or materials falling onto road or rail	Instigate appropriate method statements and lifting plans. Agree working clearances with r elevant authority. Utilise smaller plant possibly with a change of construction technique if technically acceptable.
Static load tests using kentledge as the reaction for loading.	Dangers of working at height.	Wherever technically feasible use reaction piles or other means of providing the reaction.
CFA auger changes.	Personal injury.	Limit number of pile sizes on one project where possible by varying pile lengths.
Hand tying of reinforcement cages.	Repetitive strain injuries.	Use automated cage making equipment or tying tools.
Racking of/damage to reinforcement cages while lifting.	Injury to operatives from falling steel bars.	Consider design of reinforcement cages to ensure adequate robustness for temporary lifting stresses. Consider provision of lifting rings etc.
Open pile bores or wall panel excavations, with or without support fluid.	Operatives falling into open bore or excavation, injury and possible drowning.	Avoid leaving pile bores open, implement Suitable protection measures such as barriers and life-jackets.
Diaphragm wall panel instability prior to concreting.	Instability of heavy plant at surface with potential for overturning.	Ensure adequate slurry head above high Groundwater level. Avoid excessive surcharge and/or ground borne vibration near panel.
Displaced pile/panel support fluid during concreting.	Contamination of open water courses.	Adequate containment by bunding and control by pumping and tanking/settlement tanks as necessary.
Contaminated spoil.	Infection of piling operatives, contamination of the site and the surrounding area.	Use displacement piling methods unless these are technically unsuited to the site soil conditions or performance requirements of the foundation.
Ground water contamination.	Damage to water resources.	Carry out foundation risk assessment in accordance with Environment Agency guidelines

Hazard	Potential effects	Risk management or mitigation
		[1]. Consider increasing pile size or number of piles to allow piles to stop above water table
"Immediate" environmental impact.	Unacceptable levels of noise and/or vibration, hearing damage to operatives.	Determine acceptable levels of both effects that can be tolerated by the nearest receptors (both human and non-human). Compare these with predicted levels from piling techniques suited to the ground conditions and load bearing requirements, remembering to take account of anticipated programme periods and all ancillary operations. Enforce hearing protection zones. Use quiet hammers or alternative non-percussive installation methods (e.g. contiguous flight auger).
Excessive vehicle movements on/off site.	Traffic incidents, personal injury, air pollution, noise.	Piling techniques that reduce or eliminate spoil will reduce this risk.
Flighting of soils during pile installation.	Damage to/instability of adjacent buildings.	Consider the susceptibility of soils to flighting due to piling method or plant employed. Implement suitable monitoring/construction controls or alternative piling methods or plant.
Incorrect retaining wall excavation sequence.	Excavation below design depth leading to potential wall failure.	Ensure excavation sequence (including levels) is communicated to project team.
Temporary wall props.	Wall collapse if props are damaged.	Design with minimum propping. Consider possibility of changing the construction sequence
Failure of retaining wall props.	Collapse of excavation.	Ensure propping levels, sequencing and loads are communicated to project team and that responsibilities for design and implementation of propping are clearly defined.
Pre-stressed ground anchors.	Sudden release of pre-stress energy, personal injury, damage to surrounding area.	Ensure adequate information regarding the details of pre-stressed anchors is passed on to project team so it may be incorporated in the H & S file/maintenance manual.
Overall stability of embedded retaining wall.	Failure passing beneath toe of retaining wall.	Ensure responsibility for considering this failure mode has been assigned and communicated to project team.
Stability of a slope above a retaining wall.	Failure on slope entirely top of	Ensure responsibility for considering this failure mode has been assigned and communicated

Hazard	Potential effects	Risk management or mitigation
	retaining wall.	
Base fracture by hydraulic heave or piping.	Rapid flooding of excavation and potential retaining wall collapse.	Consider hydraulic aspects of wall design and incorporate the necessary measures into the design. Communicate construction controls (e.g. water level to be maintained if excavating in the wet) to project team.
Excess surcharge placed behind retaining wall.	Collapse or distress of retaining wall.	Ensure surcharge loads/limits are clearly specified and accounted for in the design. Ensure any limitations on surcharges are communicated to project team.
Ground movements behind retaining walls.	Damage/instability of adjacent structures.	Consider the effect of ground movements arising out of pile installation and wall excavation on adjacent structures. Consider if any monitoring is required. Communicate any construction controls (including responsibilities) to project team.
Pile trimming to cut-off level and exposing of reinforcement.	Vibration white finger injuries.	Correct use of mechanical pile croppers or other means of pile trimming that do not involve the excessive use of hand-held tools. Consult Federation of Piling Specialists guidance [(4)] on breaking down of piles. Consider the possibility and practicality of debonding reinforcement above cut off level.
Scabbling pile surface.	Personal injury from flying debris, vibration white finger injuries.	Use pile concrete retardant to enable “lighter methods” of achieving scabbled finish to pile surface.
Exposed ends of reinforcement after pile trimming.	Personal injury.	Use protection caps on the bars after pile trimming and before placing foundation concrete.
Inadequate access to piles for integrity testing.	Personal injury trips and slips.	Ensure safe access to pile head – avoid steep sides of excavations for pile caps –provide safe means of access and egress.
Congested reinforcement in pile caps around head of pile during integrity tests.	Personal injury to integrity testing operatives	Ensure there is uncluttered access to pile heads at time of test. Plan for integrity testing to taken place between pile trimming and placing of pile cap steel.
Voids and collapsed deep mine workings, opencast quarry edges.	Loss of concrete with cast insitu piles, loss of base support to all pile types, possibly damaged or	Obtain Coal Authority Report [(2)] to determine existence of abandoned deep/opencast workings or shafts/high walls and consider also local anecdotal evidence. Grouting may be required or it may be possible to relocate structures to avoid some features.

Hazard	Potential effects	Risk management or mitigation
	broken piles.	
Shallow mine workings.	Collapse of ground, loss of support to piling plant, delay to project.	If desk study indicates likely presence Coal Authority Report [2] must be a part of the site investigation works. Use properly designed piling platform appropriate to the intended rig. Grouting may be required
Solution features in weak rocks such as chalk and marl.	Loss of platform support, loss of concrete, delay to project.	Resistivity imaging, electromagnetic conductivity, microgravity, can all be used in conjunction with (gamma) cone penetration testing to identify these features.
Inadequate or non-existent ground investigation report.	Inaccurate assumptions about soil parameters & profile leading to inadequate pile performance.	Educate the Client regarding the value of a good GI and specify a scope of intrusive investigation works that is appropriate to the nature of the project and the anticipated ground conditions, starting with a good desk study.
Confirmation of bedrock levels.	Bedrock or boulders?	Establish from desk study the expected depth to bedrock and treat shallow refusal of cable percussion boring with suspicion. Continue for an appropriate depth below “rockhead” with rotary drilling to prove the rock.
Over reliance on pile end bearing in variable/layered rocks.	Excessive pile settlement possible pile failure.	Consideration of partial factor of safety greater than unity on shaft resistance only or reduced end bearing component.
Concrete durability.	Inadequate concrete specification.	Ensure that ground and groundwater samples are collected and tested to establish the chemical properties required to apply BRE SD1 [3] protocol for classification.