

Piling rig

Note: It is recommended that you read the Supporting Information page before you read this factsheet.

Preparation for work *(Preparation)*

- Piling has long roots as a construction method and is a specialist sector which is traditionally mechanised and heavily dependent on machinery and equipment. Although piling activities using crawler-crane based units still occur, the majority of piling work is now undertaken, in essence, with dedicated piling rigs adapted from a 360 degree excavator chassis and upper structure.
- Although in the main operated by dedicated and specialist operators, accidents and incidents do occur. This factsheet aims to remind piling operators of factors that can cause incidents, based on issues that have occurred, and make them aware of particular contributory factors. This factsheet covers all types of mechanised piling, except tripod-type works.
- Proper pre-use checks are a requirement for safe operation and failure to properly check the rig or components before work could mean that, as with all plant and machinery, incident or injuries occur because faults can affect both performance and safety.
- For example, an auxiliary hoist rope needs to be checked for serviceability and ensured that the rope diameter is consistent throughout its length and that the rope is not kinked, has no broken wires and is sufficiently lubricated at the required places. Unequal diameter of a rope indicates damage and could mean a failure at that point.
- Where the operator notices a fault or is unsure whether the rig is safe to use, they must report any fault or defect immediately and place the machine out of service in the meantime.
- If a piling rig with a defect, such as a leaking track motor, is used, it could become rapidly worse during use. Although an operator may decide that the fault is minor and the rig can be used, they may not be sufficiently qualified or experienced to make that judgement.
- Undertaking checks on the rig may require being at height, for which control measures need to be undertaken to prevent falls. As a first course of action, the need to work at height should be prevented. If this is not possible then safe means of access to the various parts of the rig need to be implemented.
- As piling involves ground penetration, checks need to be made before work takes place, including a thorough check for underground services. A series of procedures should be followed, with the first course of action being consultation with utility and service providers – electricity, water/waste water, gas, telecommunications etc. Only then should cable avoidance tools be used to confirm the exact locations of services.
- Some cable avoidance tools have limitations in detecting certain types of services, such as plastic piping, and the avoidance tool operator needs to know about these limitations.
- Minimum distances or conditions apply when piling near to underground services and these should be checked with the utility or service provider before work starts.
- Before work can take place at a new site or new location on a site, a permit to pile needs to be provided which is only issued once the absence of underground services in the piling area is confirmed.

Stability and working platforms *(Stability)*

- The majority of piling rigs, by the nature of their design, have a higher centre of gravity than other plant and are more at risk of becoming unstable. Piling rigs have overturned both when travelling and whilst working, for which both effective planning for travel routes and of working platforms is required, and that care must be taken by the rig operator.

- Travelling on inclines with rigs equipped with high or tall masts or leaders makes the rig inherently unstable due to a higher centre of gravity. The manufacturer's criteria must be checked before travel but, in general, when travelling up an incline, the weight or centre of gravity should be biased towards the uphill side which entails travelling up forwards with the mast tilted forward. On a steep incline, travelling with the mast to the rear, or keeping the mast tilted back can bias the centre of gravity towards the rear of the rig, which can cause a rearwards tip.
- An effective support platform is required to ensure the rig remains stable during work and this must be of sufficient size for the type of rig and operation. A working platform certificate must be issued before work starts to confirm that the platform has been checked by a competent person and is suitable for the rig type.
- The design of a platform should ensure that it is at least 2 metres longer than the working area of the rig and that the edges of the platform should be clearly identifiable to the rig operator so that they would not inadvertently exceed the safe zone.
- The platform should contain water run-off channels. Regular checks should be made during operations to ensure that the channels are clear and can effectively drain water from the platform. Water ingress through the platform could affect ground support and this could possibly place the rig in an unstable situation.
- If piling is taking place in an area with a high water table, the rig operator needs to be aware that groundwater could be drawn or forced up into the platform both by the rig's weight and the piling activity, which can affect the integrity of the platform.
- Ineffective platforms or changes to an existing platform during the piling operation have caused rig overturns. For example, if a trench has been cut across the platform during the operation and even it has been backfilled, voids or uncompacted areas may be present and could cause the rig to become unstable. The platform, following any alteration, must be checked for integrity by a competent person before piling recommences.
- Piling operations with a rig require supporting personnel who, being around the rig, are at risk of being struck by debris from the piling operation.
- For example, where an auger is being drawn up and there is a large amount of material which has not been sufficiently cleaned, debris could fall on the nearby support operatives. The term 'overflighting' is used to describe the excessive amount of spoil that is drawn when an auger is raised.

Working safely and with others *(Working safely)*

- Conditions on site need to be taken into account before, during and after work. The rig must be kept well clear of any overhead power lines. Guidance issued by the energy networks utilities indicates what minimum distances must be kept and the higher the voltage in the power line, the greater the distance that must be kept. This is to reduce the danger of arcing if the rig is close to but not actually touching the power line.
- It is good practice and important that the engine is switched off when the operator needs to leave the cab at any time and that they lower all equipment to ground level, even to check something externally.
- It has been known for operators of similar plant, when leaving cab, to keep the safety bar in the down or active position lever, and have inadvertently moved a lever and caused unintentional machine movement.
- After entering the cab but before starting the engine, the operator must check that their clothing is not caught on the operating levers, as assistants or those within the working area could be injured if the machine moves unintentionally when the engine is started.
- Once the rig is assembled and erected ready for work, an exclusion zone needs to be placed around the piling area in case components fall from the rig or materials are ejected from the piling area.
- The operator needs to be aware at all times of supporting personnel and, for example, not lower a pile or auger until the team members are clear of the drop area or danger zone. During operations, the operator needs to ensure when slewing the upper structure that the lower part of the mast is clear of the tracks.
- The pumping of concrete is a common activity with bored piling operations and the delivery schedules of the concrete should form part of the piling planning process.

- If a delivery of concrete is delayed, the piling team, including the rig operator, needs to take into account that any residual concrete within a pipeline can begin to set, causing a potential blockage that may, if left too late, require a change of the pipework.
- Part of the consideration when planning the location of the platform is the required distances to the edge of a nearby slope or trench.
- A minimum distance needs to be kept with, in general, the distance from the edge being twice the depth of the slope or trench. A competent person should determine the required distance.
- The reversing of vehicles and plant is a major contributor to plant-related injuries and deaths. In terms of vehicle movements, the first course of action is to prevent plant or vehicles from reversing.
- Only where this is not reasonably practical, such as when it is not possible to slew the upper structure to face the opposite direction, then reversing should be kept to a minimum and in a segregated area.
- Although rigs are now being fitted with CCTV systems, the operator needs to be aware that the perception of distance can be limited because objects or structures look further way in the screen than they actually are, meaning that operators should not rely on one method of observation.
- Other hazards that a rig operator needs to be aware of relate to extracting temporary casings or piles. Ground adhesion can make a pile or casing difficult to extract, which could cause overloading of components or instability of the rig.

Piling operations *(Working tasks)*

- Some types of rigs are equipped with a second line or auxiliary winch. The main function of the line or winch is only to lift materials that are directly connected with the work.
- Lifting of general loads means that in effect, the rig becomes a crane for which lifting requirements need to be implemented.
- Hoist ropes are subjected to the stresses and strains of both piling and the lifting of piling materials and, as mentioned previously, need regular checks and inspections. Hoist ropes that have seriously deteriorated have eventually broken.
- As previously mentioned, travelling and working on an ineffective platform can cause instability. The operator needs to be aware of the forces that are exerted upon the rig and the pressure applied by the rig.
- When a rig is being travelled across the site, the total weight of the rig can be considerable and produce high ground-bearing pressures which are exerted through the tracks. The components that constitute the total weight of a CFA rig in addition to the base machine include the counterweight, mast, the rotary table, and any auger fitted.
- In addition to the total weight, ground-bearing pressure could increase significantly because of, for example, the pull-down force of a rotating auger. The bearing pressure through the tracks may not be spread evenly and in the instance of auger pull-down force, is applied primarily through the front of the tracks.
- Weather conditions can affect the nature of piling. For example, during periods of cold weather, pre-cast piles may be specified instead of pouring concrete into a pile, as the water within the concrete may freeze before setting, which can affect the integrity of that pile.

Sample questions

The following questions are based on the text within this factsheet and indicate how the questions and answers are structured. Based on the factsheet, there is only one correct answer. The correct answer to each question is indicated at the end of this factsheet.

Q1. What can make the extraction of temporary casings or piles hazardous to rig operations?



The increased length of the pile or case



The ground adhesion on the pile or case



The working platform not able to support the weight of the rig



Lack of visibility to the operator

Q2. What checks should be made to the platform during periods of heavy rain?



That the exclusion zone is maintained



That all accessories and materials are clear of water puddles



That the platform meets the design specification



That water run off channels are clear of debris

Study checklist

This checklist aims to act as a study aid to ensure that the reader has identified and understood the relevant parts of this factsheet.

Do you know?

1. Why all faults, even those considered minor, must be reported and checked by an expert.
2. What the procedures are for the checking of underground services.
3. What the limitations are of certain cable avoidance tools in locating underground pipes and cables.
4. When a permit to pile would be issued.
5. Why piling rigs can be considered less stable than other types of plant.
6. Why the planning of travel routes needs to be carried out before movement of the rig occurs.
7. How slopes and inclines should be dealt with when travelling a rig.
8. What the requirements are for the supporting platform and why it needs to be certificated.
9. Why working platforms should contain water run-off channels.
10. How a rig can become unstable whilst on the platform.
11. What risks there are to support workers helping with the piling operation.
12. Why the rig must be kept clear of nearby overhead power lines.
13. Why the rig operator must keep a constant check on the support workers during the operation.
14. The effect of a late delivery of concrete on the rig.
15. How reversing incidents with the rig or supporting plant can be minimized.
16. Why the extracting of piles can cause stability issues with the rig.
17. What and how ground forces are exerted by the rig when travelling and working.
18. What needs to be taken into account if using the auxiliary winch.

Answers to sample questions: Q1: B and Q2: D