
Code of practice for

Safety precautions in the construction of large diameter boreholes for piling and other purposes

(Formerly CP 2011)

Code de bonne pratique pour les mesures de sécurité pour la réalisation de
forages de grand diamètre pour pieux et autres usages

Richtlinie für Sicherheitsvorkehrungen für den Bau von Großbohrlöchern
für Pfahlkonstruktionen und andere Zwecke

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This code of practice represents a standard of good practice but compliance with it does not confer immunity from statutory and legal requirements and bye-laws.

Foreword

This code of practice was originally published under the number CP 2011, in 1969; in accordance with BSI policy whereby codes of practice are now published in the general series of British Standards, this revision is published as BS 5573.

In the past decade the use of large diameter boreholes, particularly for cast-in-situ piling work, has increased very materially. Men descend these boreholes, either for purposes of inspection or for additional hand work such as cleaning out or extending the under-reamed bases of the piles. Much of this work has been done without accident; nevertheless, it is clear that there are risks involved, the results of which could be serious unless reasonable precautions are observed.

Considerable reliance is necessarily placed on the experience of supervisors and on the commonsense of the men engaged in this work since it is clearly extremely difficult in a code of practice of this type to provide for every potentially dangerous circumstance which may ever arise.

The Construction (General Provisions) Regulations, 1961, include many regulations which apply to large diameter boreholes as well as to ordinary trench excavations. Attention is drawn in particular to Regulation 13 which requires that all excavations be fenced or covered to prevent persons falling in, to Regulation 14 in relation to the stacking of materials near to the edge of any excavation, to Regulation 21 in regard to the ventilation of excavations and to Regulation 22 in regard to the use of internal combustion engines.

Attention is also drawn to the following regulations and acts

- (a) The Construction (Working Places) Regulations, 1966,

(b) The Construction (Health and Welfare) Regulations, 1966.

(c) The Construction (Lifting Operations) Regulations, 1961.

(d) The Electricity (Factories Act) Special Regulations, 1908 and 1944.

(e) The Factories Act, 1961.

(f) The Health and Safety at Work etc. Act, 1974.

It is incumbent on users of this code to ensure that, at the time of usage, they are referring to the latest editions of the statutory regulations mentioned above and elsewhere in this code.

Those engaged on this work need to keep these regulations, or subsequent amendments, in mind at all times. If the regulations are complied with, the possibility of an accident will be reduced but certain other precautions are also necessary in the case of large diameter boreholes. It is one of the purposes of this code to draw attention to them.

Feedback information from engineers, contractors and site personnel has indicated that the main provisions of the first edition of this code, based largely on South African documentation, have been reasonably effective both as regards comprehension and practical application by those responsible for such operations on site.

Additionally, by drawing attention to many of the potential hazards, the likelihood of accidents occurring has been correspondingly reduced. This second edition, therefore, contains no radical revisions, but many clauses have been clarified, amended or expanded to take account of experience gained in five years of use, further legislative requirements, new or revised related standards and codes, and advances in borehole technology leading to larger and, in particular, deeper shafts.

British Standard Code of practice for

Safety precautions in the construction of large diameter boreholes for piling and other purposes

1. Scope

This code deals with the safety precautions which should be taken in the construction of any boreholes, of or exceeding 0.75 m diameter, into which a man may descend for inspection or working purposes. Reference is made, where appropriate, to other publications dealing with work of a similar nature. In addition to the precautions which should be taken the code deals with specific safety requirements for the equipment which is to be used and the gas hazards which might be encountered in deep boreholes.

2. References

The titles of the standards publications referred to in this code are shown on the inside back cover and in clause 6.

3. Definitions

For the purposes of this British Standard the following definitions apply.

contractor. The firm or person constructing the boreholes.
contractor's supervisor. The authorized agent of the contractor who is giving his whole time to superintending the works on site.

4. Exchange of information

4.1 Site investigation. It is of greatest importance that proper site investigation should be made before construction works are commenced. The results, together with any records of any underground installations and services, should be made available to the contractor who in any event should take all reasonable steps to obtain them. The contractor should always act with competent engineering advice and assess the general hazards which may arise during construction due to the nature of the ground, the existence of high water pressures in strata immediately beneath the bottom of the hole, underground installations and services, the nature of any industry on closely adjoining property and evidence of vibration from traffic or other sources.

On sites where adequate information on ground conditions is not available, such investigations as are necessary to determine the nature of the ground in relation to possible hazards during construction should be made before the commencement of construction work on site.

The location of small diameter holes made during site investigations should always be accurately recorded at the time of carrying out site investigations, and the holes back-filled and sealed at the top of impervious strata. Attention is drawn to hazards which may exist where a large diameter hole is excavated immediately adjacent to an unsealed small borehole, which may cause partial collapse of the wall and influx of water into the shaft or under-ream.

4.2 Related codes. Further information on certain subjects referred to in this code is contained in CP 2001, CP 2003 and CP 2004.

5. Precautions during construction

5.1 General precautions

5.1.1. Supervision. All those responsible for the construction of large diameter boreholes should ensure that supervisors are not given authority until they have had reasonable experience under competent direction. Further, these men should be intelligent and endowed with sufficient commonsense to recognize potential dangers as they arise. They should know that unusual smells or extraordinary ground conditions may be signals of danger which require further investigation. Such conditions may be found on sites which have been affected by previous occupation. They should also beware of all overhead transmission lines, which may be fouled by the machine derricks, of buried electrical cables and of sewer and other drains and pipes below the surface.

It is extremely important that holes are adequately ventilated (see 7.1) whenever men are working below the surface and that a responsible supervisor be in charge at all times. As a corollary to this, men new to the work should be accompanied on their first descent by an experienced person, unless the size of the hole prevents this. In such a case an experienced person should always make a preliminary descent to ensure that no danger exists.

The contractor's agent or other responsible supervisor should be available at the site at all times during construction.

5.1.2 Precautions against persons falling into unattended holes. All holes which are left unattended should be adequately and securely covered or have an effective barrier placed as close as is reasonably practicable to the edge.

5.1.3 Precautions against fall-in of objects from the surface. Before a man enters a hole the ground surface next to the hole should be cleared for a distance of at least 1 m and all loose soil, materials and equipment removed.

A person working near or descending the hole should on no account carry any loose tools on his person, nor should tools and equipment be thrown into the hole (see also 6.8.1).

All component parts of surface equipment should be secured, i.e. there should not be any detachable handles or any sections of winches, etc. which may come loose and fall into the hole.

5.1.4. Duration. A person should not remain in a hole for more than 1 h at a time.

5.2 Surface equipment and attendance. Persons entering holes should always be lowered and raised in suitable skips, cages, or harnesses (see 6.3) using properly constructed cranes, winches, shearlegs or other appliances suitable for the purpose (see 6.2 and 7.3.3). While persons are below ground this equipment should be continuously attended by competent operators, in addition to whom there should always be one or more persons within easy calling distance to render assistance if it becomes necessary to lift a man quickly out of a hole. It is essential that the power source of the appliance be kept running during the whole period any person is below ground. It is recommended that the cranes to be used for such man-riding should be selected from suitable machines having integral devices to prevent danger from over-hoisting or over-lowering.

A banksman should be in attendance at ground level at all times unless the operator of the lifting appliance is always in a position to observe and hear persons working at the bottom of the hole. While persons are working in a hole, the attendant at the surface should ensure that they are aware of the movement of any skips or cages within the boring. A code of signals should be arranged between the person working in the hole and the attendant at the surface. This is of importance when men cannot be observed from the surface. Of equal importance is ensuring that all persons in the borehole and in charge or control on the surface fully understand the means of signalling and the code employed*. An alarm system, preferably audible and capable of being operated from the bottom of the hole, should always be provided.

Before any person descends into a hole it should be lined to such depth below ground as is necessary to maintain the stability of the hole and also of the ground adjacent to the hole. The lining tube should extend to a depth of not less than 1 m below the surface of the ground and be adequately supported to prevent it slipping from the set position.

Every hole, unless covered, should be provided with guard rails and upstand which comply with the Construction (Working Places) Regulations, 1966. The upstand may be formed by the lining or similar tube projecting above ground level to the required height. The guard rails and upstand may be removed for the time and to the extent necessary to allow access of persons or the movement of materials or plant in connection with the works, but they should be replaced as soon as practicable and a lining tube or upstand should on no account be removed when a person is in the hole.

It is also important that the plant and gear for the extraction of lining tubes should be used in such a manner as to avoid overloading.

5.3 Minimum size of hole for access. Men should not descend into holes of less than 0.75 m diameter.

5.4 Lining through water-bearing and unstable overburden. Where persons are to descend holes, it is essential that lining tubes be used in unstable strata.

Water entering the hole from overburden or underlying strata should be sealed off by driving the lining tubes sufficiently into impervious material. It is particularly important that such lining tubes penetrate sufficiently into the top surface of clay or other impervious material to provide a secure seal against ingress of ground water into the unlined hole below. Where this is not possible or

practicable, other precautions, such as pumping, should be taken if men are required to enter a hole.

5.5 Collapse of hole. It is essential that the contractor pays particular attention to the general stability of the ground and safety of the persons in the vicinity of the hole during boring operations.

Men should not descend a hole where there is a danger of collapse of the wall. Danger of such collapse can be assessed only by persons with responsible judgement and experience and the responsibility for inspection and safety should rest on the contractor and his supervisor.

When assessing dangers of this type, attention should be given to the length of time that the hole has been opened (see 5.6) and to the presence of water in the hole or seepage into the hole, particularly at the bottom edge of tight linings. Winch or other equipment supports, and equipment causing ground vibrations, should be kept far enough away from the edge of the hole to avoid displacement of soil into the hole.

Cracks in the wall of the hole, resulting from a tendency to burst inwards owing to the presence of extensive fissures or joints, are a feature which can serve as a warning. However they are often difficult to detect, if they appear at all, and the warnings of potential collapse are more likely to be the presence of unstable soil lenses or layers, a high degree of fissuring and heavy seepage of ground water from the exposed face of soil in the wall of the boring. Loose boulders and stones in the wall of the hole should be removed. It is in the interests of safety that the holes are not left for long periods awaiting inspection.

Men should never be permitted to descent into boreholes immediately adjacent to other holes containing drilling mud, water, or concrete which has not set.

5.6 Descent of unlined holes. In cases where holes are bored in material considered by the contractor to be stable over a sufficient length of time, no lining other than the lining tube at the top of the hole (see 5.2) need be used provided the following conditions are observed.

(a) The contractor's supervisor should ensure that a physical examination is made of each hole on the site with particular reference to the wall and the roof of the under-ream, to satisfy himself that descent of the unlined hole is safe. He should ensure that inspections are made on first descending and at frequent intervals thereafter.

(b) A descent should not be made into an unlined hole more than 12 h after commencement of excavation nor more than 3 h after completion, including mechanical under-reaming, unless authorized by the contractor. These periods may have to be shortened.

(c) Hand excavation work should be limited to the clearance of loose spoil, softened zones in the base and limited excavation within the time limits given in (b).

In all cases where any one of the above conditions does not hold, a safety lining which may be loose and not in contact with the wall, but adequately supported, should be inserted in the hole or, alternatively, the tight lining continued at least to the top of the under-ream.

In very large diameter boreholes particular attention should be given to reduced natural stability resulting from loss of 'arching effect' and such boreholes may have to be considered as trenches.

* A recommendation on a suitable code of signals is given in 'Safety in Wells and Boreholes' published by the Institution of Civil Engineers.