
Izvedba posebnih geotehničnih del - Uvrtani piloti

Execution of special geotechnical work - Bored piles

Ausführung von Arbeiten im Spezialtiefbau - Bohrpfähle

Exécution des travaux géotechniques spéciaux - Pieux forés

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	Gradnja temeljev. Dela pod	Foundation construction.
	zemljo	Underground works

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EUROPEAN STANDARD
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EUROPÄISCHE NORM

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prEN 1536

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ICS

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Execution of special geotechnical work - Bored piles

Exécution des travaux géotechniques spéciaux - Pieux
forés

Ausführung von Arbeiten im Spezialtiefbau -
Bohrpfähle

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European foreword

This document (prEN 1536:2026) has been prepared by Technical Committee CEN/TC 288 “Execution of special geotechnical works”, the secretariat of which is held by AFNOR.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 1536:2010 + A1:2015.

This document includes the following significant technical changes with respect to EN 1536:2010 + A1:2015:

- revised substantially in its structure and content;
- harmonized in particular to align with prEN 1538:2026.

This document has been prepared under a standardization request addressed to CEN by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

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Introduction

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

The general scope of TC 288 is the standardization of the execution procedures for geotechnical works, including considerations to design, provisions on materials, supervision, testing and monitoring, records of the works executed, and on special requirements including sustainability.

WG25 has been charged to revise EN 1536:2015, with the subject area of bored piles, functioning as foundations, retaining walls, or cut-off walls, but not “micro piles” of diameter less than 0,3 m. Barrettes, which had been covered by EN 1536:2015, are now within the scope of prEN 1538:2026.

The design, planning and execution of bored piles call for experience and knowledge in this specialized field. The execution phase requires skilled and qualified personnel, and the present standard cannot replace the expertise of specialist contractor.

The document has been prepared to complement EN 1997, *Eurocode 7: Geotechnical design*. Clause 7 “Considerations related to design” of this document expands on design only where necessary (e.g. the detailing of reinforcement) but shall provide full coverage of the execution and supervision requirements.

With regards to EN 13670, Execution of concrete structures, EN 1536 contains specific requirements for bored piles as a concrete structure, such as the detailing of the reinforcement, the concrete placement and the supervision of concreting process which are complementing the provisions of EN 13670.

Guidelines providing supplementary information, published by the European Federation of Foundation Contractors and the Deep Foundation Institute, can be found in the bibliography. These are considered to reflect state-of-the-art experience and contribute to a more elaborate understanding of the subject matter.

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1 Scope

1.1 This document establishes general principles for the execution of bored piles as per the execution specifications.

NOTE 1 It is expected that the execution specifications define the execution standard to be applied based on EN 1997 where relevant.

NOTE 2 Piles which deviate from the following clauses in this section can be considered as bored piles provided the execution principles correspond to this document (see Clause 8).

1.2 This document applies to bored piles (see Figure 1) with:

- uniform cross-section (straight shaft);
- telescopically changing shaft dimensions;
- excavated base enlargements; or
- excavated shaft enlargements.

1.3 This document generally applies to bored piles with:

- a shaft diameter $0,3 \text{ m} \leq D \leq 3,0 \text{ m}$;
- a depth to width ratio ≥ 5 , with a depth $\geq 5 \text{ m}$;

NOTE This document can apply to bored piles with a shaft diameter of less than 0,3 m or more than 3,0 m where the general principles allow the execution in accordance with this document.

1.4 This document applies to permanent or temporary works for:

- piled foundations,
- retaining walls.

NOTE This document can apply to rigid inclusions for ground improvement, and to cut-off walls.

1.5 This document applies to piles with the following rake (see Figure 2):

- $n \geq 4$ ($\theta \leq 14^\circ$);
- $n \geq 3$ ($\theta \leq 18^\circ$) for permanently cased piles
- $n \geq 10$ ($\theta \leq 6^\circ$) for piles where the reinforcement cage is installed after concrete placement.

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1.6 This document applies to bored piles with the following dimensions of the shaft or base enlargements (see Figure 1):

- a) base enlargements:
 - 1) in non-cohesive ground: $D_B/D \leq 2$;
 - 2) in cohesive ground: $D_B/D \leq 3$;
- b) shaft enlargements in any ground: $D_E/D \leq 2$;
- c) slope of the enlargement in non-cohesive ground $m \geq 3$;
 - 1) in non-cohesive ground: $m \geq 3$;
 - 2) in cohesive ground: $m \geq 1.5$.

1.7 This document applies to:

- single bored piles;
- bored pile groups (see Figure 3);
- walls formed by piles (see Figure 4).

1.8 This document applies to bored piles where excavation methods are either continuous or discontinuous using support methods for stabilizing the excavation walls where required.

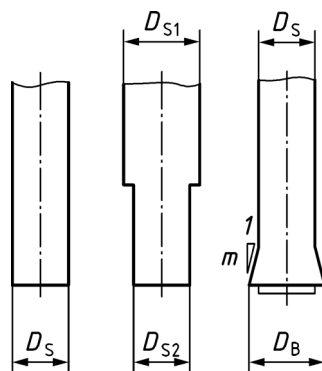
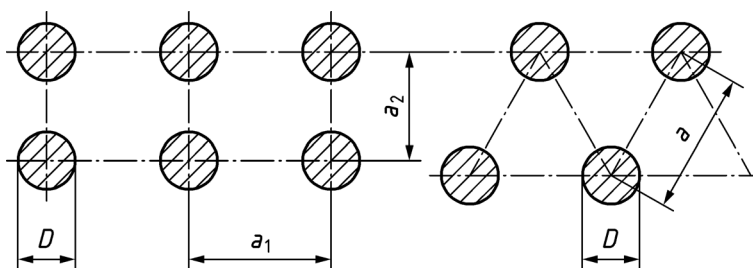
NOTE Where a continuous flight auger is used for excavation with partial displacement of soil, the pile is considered a partial-replacement pile and its execution is covered by this document.

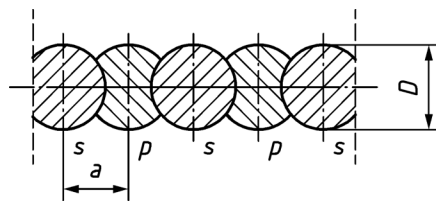
1.9 This document applies only to execution methods that allow the designed cross-sections to be produced.

1.10 This document applies to bored piles (see Figure 5) constructed with:

- self-hardening slurries;
- unreinforced (plain) concrete incl. plastic concrete;
- reinforced concrete;
- concrete reinforced by structural elements (reinforcing elements);
- precast concrete (including prestressed concrete) elements or steel tubes where the annular gap between the element or tube and the ground is filled by concrete.

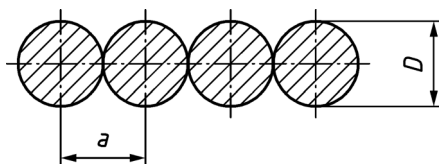
NOTE Concrete can be substituted by grout, where applicable.

**Key** D_s Shaft diameter D_{si} Shaft diameter for a given section (telescopic pile) D_B Base diameter**Figure 1 — Examples for straight shaft piles and piles with shaft and base enlargement****Key** D Rake θ Angle of pile axis to the vertical**Figure 2 — Definition of the rake****Key** D Shaft diameter a_i Centre to centre spacing of the piles**Figure 3 — Examples of pile groups**



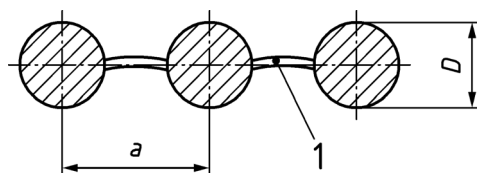
$$a < D$$

a) Secant pile wall



$$a \triangleq D$$

b) Contiguous pile wall



$$a > D$$

c) Spaced pile wall

Key

a Centre to centre spacing of the piles

D Shaft diameter

1 Lagging

p primary piles

s secondary piles

Figure 4 — Examples of pile walls

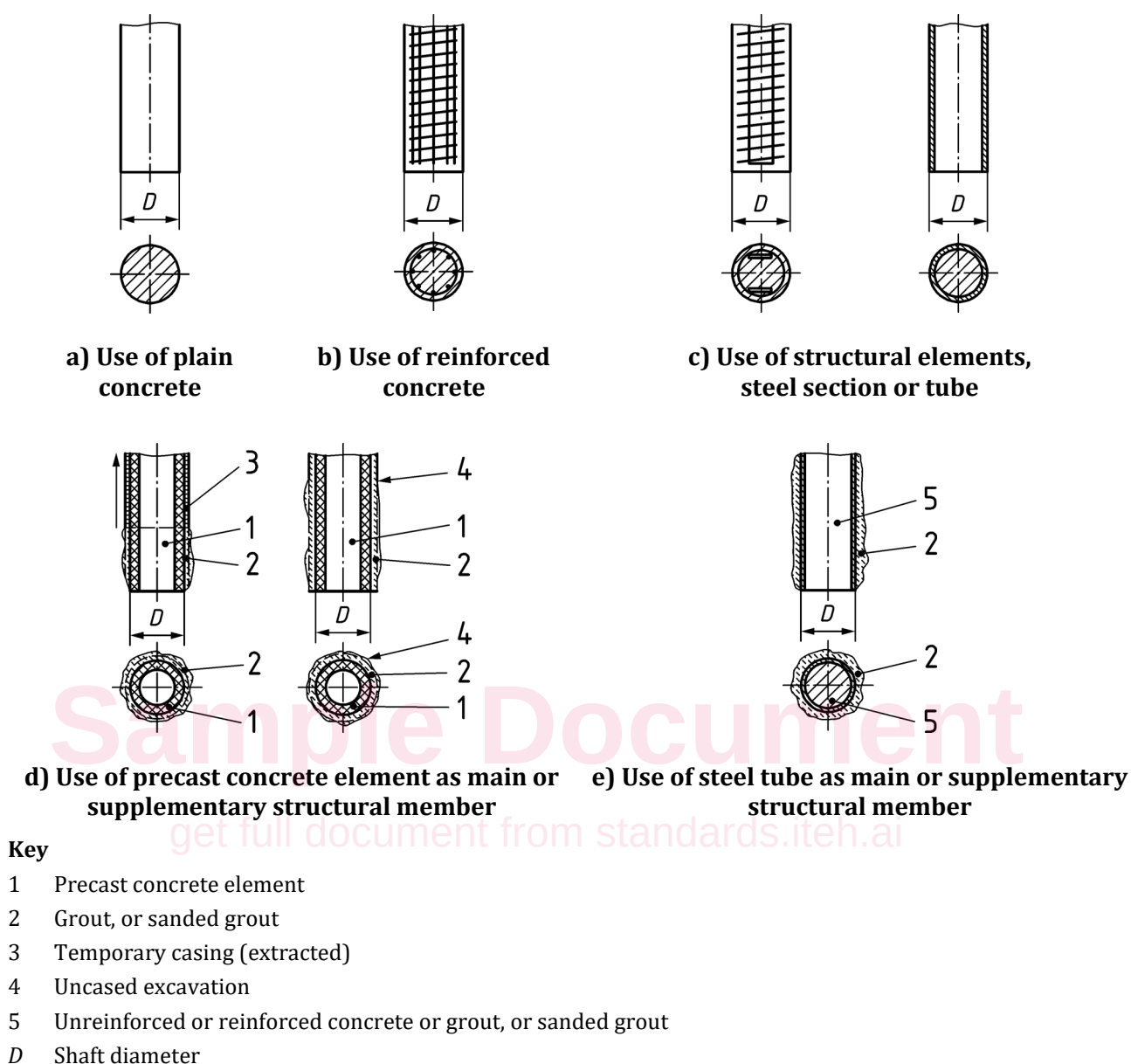


Figure 5 — Examples of bored piles

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 206 (all parts), *Concrete — Specification, performance, production and conformity*

EN 1538, *Execution of special geotechnical works — Diaphragm walls*

EN 1992 (all parts), *Eurocode 2: Design of concrete structures*

EN 1993 (all parts), *Eurocode 3: Design of steel structures*

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EN 1994 (all parts), *Eurocode 4: Design of composite steel and concrete structures*

EN 1997 (all parts), *Eurocode 7: Geotechnical design*

EN 10025-2, *Hot rolled products of structural steels - Part 2: Technical delivery conditions for non-alloy structural steels*

EN 10080, *Steel for the reinforcement of concrete - Weldable reinforcing steel - General*

EN 10210 (all parts), *Hot finished structural hollow sections of non-alloy and fine grain steels*

EN 10219 (all parts), *Cold formed welded structural hollow sections of non-alloy and fine grain steels*

EN 12715, *Execution of special geotechnical work - Grouting*

EN 13670, *Execution of concrete structures*

EN 16228 (all parts), *Drilling and foundation equipment. Safety*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp/>
- IEC Electropedia: available at <https://www.electropedia.org/>

Note 1 to entry: Terms not listed below can be defined in referenced standards, same terms can deviate as per the specific field of application.

3.1

execution specifications

set of documents covering all relevant requirements, technical specifications and construction drawings necessary for the execution of the works

3.2

bored pile

pile formed, with or without a casing, by continuous or discontinuous excavation methods, and filled with a self-hardening material

3.3

continuous flight auger pile

CFA pile

pile formed by excavation means of a continuous flight auger through the hollow stem of which concrete is pumped as the auger is extracted

3.4

partial replacement pile

as CFA where the ground is not completely replaced but partially displaced

3.5

raking pile

pile installed at an inclination related to the vertical (see Figure 2)

3.6

pile diameter

diameter of the pile at a given depth:

- for piles constructed with casings: equal to the nominal external diameter of the casing;
- for piles constructed without a casing: equal to the nominal diameter of the boring tool

3.7

enlarged base

base of a bored pile formed to have an area greater than that of its shaft (see Figure 3)

3.8

base grouting

pressure injection of grout below the base of an installed bored pile base in order to enhance performance under load

3.9

shaft grouting

injection of grout carried out after concrete of the bored pile has set for the enhancement of skin friction accomplished by the use of grouting pipes which are installed down the shaft, normally placed with the bored pile reinforcement

3.10

concreting level

upper level to which concrete is cast in a borehole

3.11

cut-off level

designed level of the pile head

3.12

empty borehole

length of excavation from the working platform level to the cut-off level

3.13

temporary casing

steel tube used to maintain stability of a pile excavation (e.g. in unstable ground) which is withdrawn during or after concrete placement

3.14

permanent casing

steel tube used to maintain stability of a pile excavation which is not withdrawn

3.15

starter casing

temporary casing of a certain length used to secure the borehole beneath the working platform level

3.16

lining

tubular element, generally made of thin steel, surrounding the pile shaft