SLOVENSKI STANDARD
SIST EN 16907-1:2019

01-april-2019

Zemeljska dela - 1. del: Načela in splošna pravila

Earthworks - Part 1: Principles and general rules

Erdarbeiten - Teil 1: Grundsätze und allgemeine Regeln

Terrassement - Partie 1 : Principes et règles générales

Ta slovenski standard je istoveten z: **EN 16907-1:2018**

ICS:

93.020	Zemeljska dela. Izkopavanja. Gradnja temeljev. Dela pod zemljo	Earthworks. Excavations. Foundation construction. Underground works

SIST EN 16907-1:2019 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16907-1

December 2018

ICS 93.020

English Version

Earthworks - Part 1: Principles and general rules

Terrassement - Partie 1 : Principes et règles générales

Erdarbeiten - Teil 1: Grundsätze und allgemeine Regeln

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COMITÉ EUROPÉEN DE NORMALISATION
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Ref. No. EN 16907-1:2018 E

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European foreword

This document (EN 16907-1:2018) has been prepared by Technical Committee CEN/TC 396 "Earthworks", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2019, and conflicting national standards shall be withdrawn at the latest by June 2019.

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.

This document is one of the European Standards within the framework series of EN 16907 on *Earthworks.* The set of standards prepared by CEN/TC 396 is divided into several parts, which correspond to different steps of the planning, execution and control of earthworks and should be considered collectively as a group of standards for executing earthworks. The full set of Parts is as follows:

— EN 16907-1 *Earthworks - Part 1: Principles and general rules* (this document);

— EN 16907-2 *Earthworks - Part 2: Classification of materials;*

— EN 16907-3 *Earthworks - Part 3: Construction procedures;*

— EN 16907-4 *Earthworks - Part 4: Soil treatment with lime and/or hydraulic binders;*

— EN 16907-5 *Earthworks - Part 5: Quality control;*

— EN 16907-6 *Earthworks - Part 6: Land reclamation earthworks using dredged hydraulic fill;*

— EN 16907-7 *Earthworks - Part 7: Hydraulic placement of extractive waste.*

Within this standard, references to specific parts of the standard are written by reference the full reference (e.g. "EN 16907-2").

These "Earthworks standards" do not apply to the environmental planning and geotechnical design that determines the required form and properties of the earth-structure that is to be constructed. They apply to the design of the earthworks materials, execution, monitoring and checking of earthworks construction processes to ensure that the completed earth-structure satisfies the geotechnical design.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard (Part 1) gives definitions, principles and general rules for the planning, design and specification of earthworks. It introduces the other parts of the standard, which will be used together with Part 1.

Earthworks are a civil engineering process aimed at creating earth-structures by changing the geometry of the earth surface for construction or other activities. Application fields of earthworks are associated with:

— transport infrastructures (road and motorways, railways, waterways, airports);

— platforms for industrial, commercial and residential buildings;

— water engineering, flood defence and coastal protection works;

— harbours and airport areas, including the construction of embankments in water;

— river dykes and marine embankments for land reclamation;

— earth and rock fill dams;

— onshore embankments made of hydraulically placed fill;

— noise barriers, visual barriers and other non-load bearing earthworks;

— landscaping embankments;

— backfilling of open mines and quarries;

— tailings dams;

They are characterized by the need to use available natural or recycled materials and to handle them in a way appropriate to yield prescribed properties.

This standard is applicable to all types of earth-structures, except the cases listed below:

— some specific types of works such as the execution of trenches and small earthworks may be organized using simplified or specific rules;

— some structures, such as dykes and dams, need earthworks which have specific design and construction requirements: these may extend beyond the rules of this standard.

This standard does not cover ground improvement beneath an earth-structure by techniques such as piling, jet grouting, deep soil mixing, vertical drains or stone columns.

Due to the variable subsoil and climate conditions within Europe and to the different national contract conditions, national sets of rules have been established in several European countries which could not be harmonized within a short period by a European Standard. This European Standard gives therefore basic rules to reach the aims described above. Informative Annexes B to H of this document give examples of national practices following these rules.

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 1997-1, *Eurocode 7: Geotechnical design - Part 1: General rules*

EN 1997-2, *Eurocode 7 - Geotechnical design - Part 2: Ground investigation and testing*

EN 16907-2, *Earthworks - Part 2: Classification of materials*

EN 16907-3, *Earthworks - Part 3: Construction procedures*

EN 16907-4, *Earthworks - Part 4: Soil treatment with lime and/or hydraulic binders*

EN 16907-5, *Earthworks - Part 5: Quality control*

EN 16907-6, *Earthworks - Part 6: Land reclamation earthworks using dredged hydraulic fill*

3 Terms and definitions

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

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

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

Note The geometry of earth-structures and parts of them (layers, surfaces, etc.) are not always described in the same way in different languages and countries. Drawings explaining the meaning of these geometric terms are given in informative Annex A.

3.1 Definitions

3.1.1
air void content
ratio of the volume of air to the total volume of the soil

3.1.2
binder
product or combination of products which, when mixed with a material, provides either a short-term or a long term enhancement of the properties of the material

3.1.3
bulking
volume change of a soil mass due to handling (normally a positive volume change upon excavation)

3.1.4
capping layer
specific transition layer, part of the upper zone of the fill, placed below the superstructure. The capping layer is part of the earth structure

3.1.5
classification
definition of classes and assigning of materials to classes with similar properties for earthworks

3.1.6
compaction
densification of fill material by mechanical process, to obtain prescribed properties of the fill

3.1.7
compactive effort
overall measure of the physical exertion applied to compact a layer of fill, which reflects : compactor mass/m^2, number of passes, speed of the roller, frequency of vibration and layer thickness

3.1.8
cut or cutting
linear earth-structure formed by the process of excavation

3.1.9
degree of compaction (of fill)
ratio between *in situ* dry density of compacted fill material and maximum dry density obtained from a standard laboratory compaction test

3.1.10
degree of saturation
ratio of the pore water volume to the volume of voids

3.1.11
description
identification and naming of a given material and its physical and soil mechanical properties that are relevant for earthwork purposes

3.1.12
design of earth-structure
defining the civil engineering structure under EN 1997 series to meet the functional requirements for future use

3.1.13
design of earthworks
defining the construction process to produce a specified earth-structure

3.1.14
dredging
excavation activity or operation usually carried out at least partly underwater, in shallow seas or fresh water areas with the purpose of gathering up bottom sediments and placing them at a different location

3.1.15
dry density
mass of the solid particles divided by the total volume of a sample

3.1.16
earth-structure
civil engineering structure, made of soils, rocks, by-products or recycled materials, resulting from earthworks (cut, fill, infill)

3.1.17
earthworks
civil engineering process that modifies the geometry of ground surface, by creating stable and durable earth-structures

3.1.18
earthworks constructor
person or organization in charge of executing earthworks

3.1.19
earthworks designer
person or organization in charge of designing earthworks

3.1.20
embankment
common name for an earth-structure formed by the process of filling to form a free standing earth structure (including linear features and nonlinear platforms)

3.1.21
end product specification
specification requiring earthworks to be constructed to achieve specified engineering criteria related to the compacted fill

3.1.22
excavation
general term used both for the process of excavating the ground or for the resulting change in the ground surface either for a temporary excavation or permanent earth structure

3.1.23
extractive waste
mineral wastes derived from mineral extraction operations

3.1.24
fill
collective term used in this standard to describe all earth-structures formed by the placement of fill material in a controlled manner for an engineering purpose (including embankment, infill, platform, etc.)

3.1.25
fill material
material used for the construction of a fill

3.1.26
fill zone
subdivision of a fill (or part of an earth-structure), such as the base, the core, the shoulders and the upper zone

3.1.27
filling
process of placing fill material to form a temporary or permanent earth structure

3.1.28
formation level
prepared surface on which the fill or the superstructure is built

3.1.29
hydraulic fill
material placed in a liquid form, as a mixture of soil particles and water, in a deliberate manner so that the soil particles accumulate as a deposit, and densify as further fill is placed above to create a body of fill

3.1.30
infill
earth structure formed by filling a void or hollow in a controlled manner to form a body of engineered fill that is not free standing (including an excavation infill, filling behind an embankment for the purposes of land reclamation, mine infill, etc.)

3.1.31
materials
soils, rocks, industrial by-products and recycled mineral materials used during earthworks for construction of earth-structures. In this standard, materials do not include binders, geosynthetics and other materials, which are designated by their own name

3.1.32
mattressing
behaviour of soil that is too wet during compaction, resulting in the formation of waves, creating instability of the compaction plant and preventing further compaction

3.1.33
maximum dry density
maximum value of the dry density obtained in the reference compaction test (Proctor or Modified Proctor, Vibrating Hammer Compaction or any other compaction test). This value is related to a water content that is also known as the optimum water content

3.1.34
method specification
specification requiring to produce and place earth-structures using specified materials, specific types of equipment and methods

3.1.35
natural soil or rock
soil or rock that is either in its original geological setting or has been excavated, but has not been fundamentally modified by human activity other than earthworks processes such as excavation, screening and crushing, drying (or those processes described in this standard).

3.1.36
non-structural fill
fill that is not going to support any infrastructure

3.1.37
optimum water content
water content at which a specified compactive effort can compact a soil mass to its maximum dry density

3.1.38
over compaction
excessive compaction, by load intensity or duration, resulting in excess porewater pressure leading to unacceptable fill properties (e.g. mattressing)

3.1.39
performance specification
specification requiring the works to be defined relative to long-term project requirements, which are commonly set at a relatively high level

3.1.40
properties
physical, mechanical and chemical attributes of a material

3.1.41
quality assurance
planned and systematic actions necessary to provide confidence that the earth-structure will perform satisfactorily in service i.e. that it has been constructed to the specified requirements

3.1.42
quality control
system used to monitor, assess and adjust construction/execution processes to ensure that the final product will meet the specified level of quality

3.1.43
secondary fill material
material that has been fundamentally changed by human activity for one purpose and then is reused as an earthworks fill material (this may include: recycled material, by-product, secondary aggregate, etc.)

3.1.44
specification (technical specification)
document or set of clauses that states the technical requirements for construction and control of the earthworks (to be read in conjunction with the project drawings)

3.1.45
suitable material
fill material where the soil properties prior to compaction satisfy the requirements of the earthworks technical specification and the material is in a state that can be placed within the earthworks ready for compaction

3.1.46
superstructure
civil engineering structure placed on top of a fill (examples of superstructures are: road pavement, rail track, buildings, gantries, etc.)

3.1.47
trafficability
ability of a material surface to support the passage of earthworks equipment

3.1.48
treated fill material
fill material that has been modified by the addition of a binder

3.1.49
unsuitable material
fill material that is not suitable for use in its current state because the soil properties prior to compaction do not satisfy the requirements of the earthworks technical specification. These materials may become suitable after treatment to adjust the soil properties