

MULLATÖÖD. OSA 4: PINNASE TÖÖTLEMINE LUBJA
JA/VÕI HÜDRAULILISTE SIDEAINETEGA

Earthworks - Part 4: Soil treatment with lime and/or
hydraulic binders

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

<p>See Eesti standard EVS-EN 16907-4:2018 sisaldab Euroopa standardi EN 16907-4:2018 ingliskeelset teksti.</p> <p>Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas</p> <p>Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 05.12.2018.</p> <p>Standard on kättesaadav Eesti Standardimis-ja Akrediteerimiskeskusest.</p>	<p>This Estonian standard EVS-EN 16907-4:2018 consists of the English text of the European standard EN 16907-4:2018.</p> <p>This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation and Accreditation.</p> <p>Date of Availability of the European standard is 05.12.2018.</p> <p>The standard is available from the Estonian Centre for Standardisation and Accreditation.</p>
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English Version

Earthworks - Part 4: Soil treatment with lime and/or hydraulic binders

Terrassements - Partie 4: Traitement des sols à la chaux et/ou aux liants hydrauliques

Erdarbeiten - Teil 4: Bodenbehandlung mit Kalk und/oder hydraulischen Bindemitteln

This European Standard was approved by CEN on 14 May 2018.

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Contents	Page
European foreword.....	6
Introduction	7
1 Scope.....	9
2 Normative references.....	9
3 Terms and definitions	11
4 Symbols and abbreviations	14
5 Constituents	15
5.1 Materials.....	15
5.1.1 General.....	15
5.1.2 Natural soils and processed aggregates.....	15
5.1.3 Low strength, intermediate strength and high strength rocks, and chalk.....	15
5.1.4 Recycled materials.....	15
5.1.5 Artificial materials.....	15
5.2 Binders.....	15
5.2.1 Cement	15
5.2.2 Fly ash.....	16
5.2.3 Slag	16
5.2.4 Hydraulic road binder	16
5.2.5 Lime.....	16
5.2.6 Blends.....	16
5.3 Water	16
5.4 Other constituents	16
6 Mixtures.....	16
6.1 General.....	16
6.2 Proportioning.....	16
7 Laboratory testing methodology	17
7.1 General.....	17
7.2 Identification tests.....	17
7.2.1 Identification of the materials to be treated	17
7.2.2 Identification of the binders	17
7.3 Feasibility of treatment	17
7.4 Workability period.....	18
7.5 Characteristics for execution.....	18
7.5.1 Improvement.....	18
7.5.2 Stabilization	18
7.6 Mechanical performance.....	19
7.6.1 Curing conditions.....	19
7.6.2 Resistance to water	19
7.6.3 Strength for direct construction trafficking.....	19
7.6.4 Resistance to frost.....	19
7.6.5 Performance classification testing	19
7.6.6 Other performance tests.....	20
7.7 Preparation of the specimens.....	20
7.7.1 Particle size of the material.....	20

7.7.2	Production of the mixtures	20
7.7.3	Dimensions of the specimens.....	20
7.7.4	Compaction procedures	20
7.7.5	Curing.....	21
7.8	Content of the laboratory studies	21
7.8.1	General	21
7.8.2	Identification of the constituents.....	21
7.8.3	Improvement.....	21
7.8.4	Stabilization.....	21
7.9	Laboratory testing report.....	22
8	Performance classification of the mixtures	23
8.1	General	23
8.2	Improvement.....	23
8.2.1	General	23
8.2.2	Immediate bearing index.....	24
8.2.3	Moisture condition value	24
8.2.4	Degree of compaction.....	24
8.2.5	Swelling	25
8.3	Stabilization.....	25
8.3.1	Requirements for the fresh mixture	25
8.3.2	Laboratory mechanical performance classification	28
8.3.3	Resistance to water	32
8.3.4	Strength for direct construction trafficking.....	34
8.3.5	Resistance to frost	34
8.3.6	Other performance.....	34
9	Execution and control	34
9.1	Introduction.....	34
9.1.1	General	34
9.1.2	Prerequisites.....	34
9.2	Preliminary engineering check	35
9.2.1	General	35
9.2.2	Site investigation	35
9.2.3	Sulfide, sulfate, organic matter and other deleterious materials	35
9.2.4	Influential parameters.....	36
9.2.5	Prior laboratory testing	36
9.3	Binders	36
9.4	Soil treatment plant types	36
9.5	Soil improvement	37
9.5.1	General	37
9.5.2	Materials suitable for improvement.....	37
9.5.3	Improvement during excavation	37
9.5.4	Improvement in fill area	37
9.5.5	Binder spreading	37
9.5.6	<i>In situ</i> mixing.....	38
9.5.7	Compaction	38
9.5.8	Protection of the works	38
9.5.9	Climatic considerations.....	38
9.6	Soil stabilization.....	38
9.6.1	General	38
9.6.2	Material suitable for stabilization	39
9.6.3	Soil preparation	39
9.6.4	Stabilization processes for capping and embankment	40

9.6.5	Other applications	42
9.6.6	Layer Interface and organization of the work	42
9.7	Testing and Compliance.....	43
9.7.1	Specification.....	43
9.7.2	Compliance tests and records.....	43
9.7.3	Completion reports	45
9.8	Climatic and practical considerations	46
Annex A (informative) Production of test specimens for treated materials		47
A.1	Introduction	47
A.2	Sampling.....	47
A.3	Water content.....	47
A.4	Maximum size of the particles.....	47
A.5	Treatment.....	48
A.6	Mellowing and compaction of the treated material in the specimen mould	49
A.7	Curing and storage.....	49
A.8	Removing sample from the mould.....	50
A.9	Reporting	51
Annex B (informative) Loading speed for the strength and modulus tests		52
Annex C (informative) Non destructive seismic test method for mechanical performance		54
C.1	Introduction.....	54
C.2	Scope	54
C.3	Test apparatus.....	54
C.4	Definitions and theoretical approach.....	55
C.5	Principle of test method	56
C.6	Significance and use	56
C.7	Measurement.....	57
C.8	References	59
Annex D (informative) Example of evaluation of performance variability of treated soil as a result of variation during implementation Binder percentage adjustment and method for compensating it		60
Annex E (informative) Examples of age of classification and curing regimes for mechanical performance of treated materials for earthworks		62
Annex F (informative) Other performance characteristics for treated materials.....		63
Annex G (informative) Field and laboratory identifications of common sulfide and sulfate minerals.....		64
G.1	Field Identification	64
G.2	Laboratory Identification.....	64
G.3	References	65
Annex H (informative) Soil Treatment Plant Types		66

H.1	General	66
H.2	Binder storage units	66
H.3	Binder spreading units.....	66
H.4	Soil preparation plant.....	67
H.5	<i>In situ</i> mixing plant	67
H.6	Fixed or semi mobile mixing plants.....	69
H.7	Water bowsers.....	71
H.8	Compaction plant.....	71
	Annex I (informative) Treatment sequence and processes	72
	Annex J (informative) Other applications for stabilized materials	78
J.1	General	78
J.2	Filling in narrow places.....	78
J.3	Construction of lower layers in high embankments built with water sensitive soils or evolutive rocks which may be subject to occasional flooding.....	79
J.4	Steepened slopes of embankment.....	79
J.5	Slope repairs.....	80
J.6	Reinforced slopes	80
J.7	Foundations.....	80
J.8	Load transfer platforms	80
J.9	Water retaining structures	81
J.10	Contaminated soils.....	81
	Annex K (informative) Site Stabilization checklist.....	82
	Annex L (informative) Safety considerations	85
L.1	General	85
L.2	Specific protective equipment	85
	Annex M (informative) Climatic and practical considerations	86
M.1	General	86
M.2	Weather.....	86
M.3	Binder dust emission.....	87
M.4	Run off and leachate	88
	Annex N (informative) Method and charts to determine the quantity of lime needed to reach a targeted IPI value.....	89

European foreword

This document (EN 16907-4:2018) 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*, as follows:

- *Part 1: Principles and general rules;*
- *Part 2: Classification of materials;*
- *Part 3: Construction procedures;*
- *Part 4: Soil treatment with lime and/or hydraulic binders (this document);*
- *Part 5: Quality control;*
- *Part 6: Land reclamation earthworks using dredged hydraulic fill;*
- *Part 7: Hydraulic placement of extractive waste.*

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.

Introduction

In the context of the present standard, the treatment of a material designates the operation which consists of mixing, to an agreed specification, the material with a binder, for example lime, or hydraulic binder, or both of them, and optionally with additional water. The objective is to enhance the properties of materials with poor characteristics for use in earth structures. It can also be to enhance properties of materials to enable their use in specific applications (like capping layers, abutment fills, foundations, etc.).

Although the technique has been used for a long time, its application at a large scale, for the construction of earth structures, started in the 1960s. Since then, the technique has seen a substantial increase thanks to its many benefits, among which are:

- enhancement of the mechanical properties of material;
- elimination of lorry movements for disposal of site material;
- reduced lorry movements for importation of construction material;
- reduced noise and nuisance to local residents;
- less wear and tear on the local road network;
- no tipping charges or landfill tax;
- maintained landfill capacity;
- no waste of valuable non-renewable aggregate resources;
- generally reduced construction time and cost.

Once treated properly, the material can be used in embankment, capping layer or any part of the structure, provided it meets the specification of the project.

The treatment products considered in this standard are limited to the following standardized products: cement, fly ash, granulated blast furnace slag, hydraulic road binder and lime.

For the purpose of this standard, these treatment products will be designated as binders.

For the purpose of this standard, cement, granulated blast furnace slag and hydraulic road binder will be designated as hydraulic binders.

Fly ash includes siliceous fly ash and calcareous fly ash. Siliceous fly ash is a material which requires a source of calcium oxide, e.g. lime or cement, to produce a hydraulic reaction. Calcareous fly ash contains calcium oxide and is comparable to a hydraulic binder. For the purpose of this standard, both types of fly ash will be designated as hydraulic binders.

Lime is air lime and has no hydraulic property. For the purpose of this standard, it will be designated as a binder.

Typical uses of the binders are as follows:

- lime is generally used to dry up wet materials, and/or to enhance the performance of cohesive materials;
- hydraulic binders are mainly used to quickly and significantly increase the mechanical performance of non-cohesive materials;

- in presence of cohesive material and depending on the application, lime and hydraulic binder may be used together, in two steps on site, or through a pre-blended form like a hydraulic road binder.

The materials considered in this standard are: soils, weak rocks, intermediate rocks, chalk, recycled materials, artificial materials. They can also be mixes of these different types.

The success of a treatment operation relies upon the respect of specifications as well as of good practices that closely depend on local geological and climatic conditions. Thus, in addition to the requirements of this standard, reference may be made to the guidelines of good practices valid in the place of use. Some of them are included as notes in the standard or in the annexes at the end of this document.

1 Scope

This European Standard applies to the treatment with binders of natural soils, weak rocks, intermediate rocks, chalk, recycled materials and artificial materials for the execution of earthworks during the construction and maintenance of roads, railways, airfields, platforms, dykes, ponds and any other types of earth structure.

It relates only to the treatment in layers, produced for earthworks in situ or from a mixing plant, as opposed to the treatment by columns for example.

The standard specifies the requirements for the constituents of the mixtures, the preliminary laboratory testing methodology, the laboratory performance classification, the execution and control.

NOTE 1 The informative annexes also give example of good practices for execution and control.

The laboratory performance classification specified in this European Standard covers the two types of treatment: improvement and stabilization.

For improvement, the classification relates to the short term performance.

For stabilization, the classification relates to the medium to long term performance.

NOTE 2 EN 16907-4 prepared by CEN/TC 396 "Earthworks" is for improvement and stabilization in earthworks applications. EN 14227-15 prepared by CEN/TC 227 "Road materials" is for stabilization only in pavement applications.

NOTE 3 For stabilization, the performance classification specified in EN 16907-4 uses generally the same laboratory performance classification specified in EN 14227-15, except for the performance classification diagram according to " R_t and E " specific to pavements in EN 14227-15, which has been replaced in EN 16907-4 by a performance classification diagram according to " R_t and E " specific to earthworks (Figure 1).

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 197-1, *Cement - Part 1: Composition, specifications and conformity criteria for common cements*

EN 450-1, *Fly ash for concrete - Part 1: Definition, specifications and conformity criteria*

EN 459-1, *Building lime - Part 1: Definitions, specifications and conformity criteria*

EN 13282-1, *Hydraulic road binders - Part 1: Rapid hardening hydraulic road binders - Composition, specifications and conformity criteria*

EN 13282-2, *Hydraulic road binders - Part 2: Normal hardening hydraulic road binders - Composition, specifications and conformity criteria*

EN 13286-2, *Unbound and hydraulically bound mixtures - Part 2: Test methods for laboratory reference density and water content - Proctor compaction*

EN 13286-3, *Unbound and hydraulically bound mixtures - Part 3: Test methods for laboratory reference density and water content - Vibrocompression with controlled parameters*

EN 13286-4, *Unbound and hydraulically bound mixtures - Part 4: Test methods for laboratory reference density and water content - Vibrating hammer*

EN 13286-5, *Unbound and hydraulically bound mixtures - Part 5: Test methods for laboratory reference density and water content - Vibrating table*

EN 13286-40, *Unbound and hydraulically bound mixtures - Part 40: Test method for the determination of the direct tensile strength of hydraulically bound mixtures*

EN 13286-41, *Unbound and hydraulically bound mixtures - Part 41: Test method for the determination of the compressive strength of hydraulically bound mixtures*

EN 13286-42, *Unbound and hydraulically bound mixtures - Part 42: Test method for the determination of the indirect tensile strength of hydraulically bound mixtures*

EN 13286-43, *Unbound and hydraulically bound mixtures - Part 43: Test method for the determination of the modulus of elasticity of hydraulically bound mixtures*

EN 13286-45, *Unbound and hydraulically bound mixtures - Part 45: Test method for the determination of the workability period of hydraulically bound mixtures*

EN 13286-46, *Unbound and hydraulically bound mixtures - Part 46: Test method for the determination of the moisture condition value*

EN 13286-47, *Unbound and hydraulically bound mixtures - Part 47: Test method for the determination of California bearing ratio, immediate bearing index and linear swelling*

EN 13286-48, *Unbound and hydraulically bound mixtures - Part 48: Test method for the determination of degree of pulverisation*

EN 13286-49, *Unbound and hydraulically bound mixtures - Part 49: Accelerated swelling test for soil treated by lime and/or hydraulic binder*

EN 13286-50, *Unbound and hydraulically bound mixtures - Part 50: Method for the manufacture of test specimens of hydraulically bound mixtures using Proctor equipment or vibrating table compaction*

EN 13286-51, *Unbound and hydraulically bound mixtures - Part 51: Method for the manufacture of test specimens of hydraulically bound mixtures using vibrating hammer compaction*

EN 13286-52, *Unbound and hydraulically bound mixtures - Part 52: Method for the manufacture of test specimens of hydraulically bound mixtures using vibrocompression*

EN 13286-53, *Unbound and hydraulically bound mixtures - Part 53: Methods for the manufacture of test specimens of hydraulically bound mixtures using axial compression*

EN 14227-2, *Hydraulically bound mixtures - Specifications - Part 2: Slag bound granular mixtures*

EN 14227-4, *Hydraulically bound mixtures - Specifications - Part 4: Fly ash for hydraulically bound mixtures*

EN 14227-15, *Hydraulically bound mixtures - Specifications - Part 15: Hydraulically stabilized soils*

EN 15167-1, *Ground granulated blast furnace slag for use in concrete, mortar and grout - Part 1: Definitions, specifications and conformity criteria*

EN ISO 17892-7, *Geotechnical investigation and testing - Laboratory testing of soil - Part 7: Unconfined compression test (ISO/FDIS 17892-7)*