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Hidravliļ no vezane zmesi - Specifikacije - 12. del: Izboljģanje zemljin z granulirano plavģno ģlindro

Hydraulically bound mixtures - Specifications - Part 12: Soil treated by slag

Hydraulisch gebundene Gemische - Anforderungen - Teil 12: Bodenverbesserung mit granulierter Hochofenschlacke

Mélanges traités aux liants hydrauliques - Spécifications - Partie 12: Sol traité au laitier

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Hydraulisch gebundene Gemische - Anforderungen - Teil 12: Bodenverbesserung mit granulierter Hochofenschlacke

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Contents

Page

Foreword 3

1 Scope 4

2 Normative references 4

3 Terms and definitions 5

4 Symbols and abbreviated terms 5

5 Constituents 6
5.1 Ground or partially ground granulated blast furnace slag 6
5.2 Soil 6
5.3 Water 6
5.4 Other constituents 6

6 Mixture 7
6.1 General 7
6.2 Proportioning and dry density 7

7 Requirements for the fresh mixture 7
7.1 Water content 7
7.2 Degree of pulverization 7
7.3 Immediate bearing index 8
7.4 Moisture condition value 8

8 Laboratory mechanical performance classification 8
8.1 General 8
8.2 Classification by California bearing ratio 9
8.3 Classification by compressive strength 9
8.4 Classification by R_t, E 10
8.4.1 General 10
8.4.2 Method by direct tensile testing 10
8.4.3 Method by indirect tensile testing 10
8.4.4 Method by indirect tensile and compression testing 11

9 Resistance to water and other requirements for the mixture 11
9.1 Resistance to water 11
9.1.1 General 11
9.1.2 Strength after immersion in water 11
9.1.3 Linear swelling after soaking in water 12
9.1.4 Volumetric swelling after immersion in water 12
9.2 Strength at trafficking 12
9.3 Resistance to frost 12

10 Production control 12

11 Designation and description 13

12 Marking and labelling 13

Annex A (informative) Examples of 'age of classification' and curing regimes for R_c, R_t and E testing of treated soils including resistance to water testing by full immersion in water 15

Annex B (informative) Production control for hydraulically treated mixtures 16

Bibliography 22

Foreword

This European Standard (EN 14227-12:2006) has been prepared by Technical Committee CEN/TC 227 “Road materials”, the secretariat of which is held by DIN.

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 November 2006, and conflicting national standards shall be withdrawn at the latest by November 2006.

This European Standard is one of a series of standards for hydraulically bound mixtures:

EN 14227-1, *Hydraulically bound mixtures — Specifications — Part 1: Cement bound granular mixtures.*

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

EN 14227-3, *Hydraulically bound mixtures — Specifications — Part 3: Fly ash bound mixtures.*

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

EN 14227-5, *Hydraulically bound mixtures — Specifications — Part 5: Hydraulic road binder bound mixtures.*

EN 14227-10, *Hydraulically bound mixtures — Specifications — Part 10: Soil treated by cement*.

EN 14227-11, *Hydraulically bound mixtures — Specifications — Part 11: Soil treated by lime.*

EN 14227-12, *Hydraulically bound mixtures — Specifications — Part 12: Soil treated by slag.*

EN 14227-13, *Hydraulically bound mixtures — Specifications — Part 13: Soil treated by hydraulic road binder*.

EN 14227-14, *Hydraulically bound mixtures — Specifications — Part 14: Soil treated by fly ash*.

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

1 Scope

This European Standard specifies soils treated by slag for roads, airfields and other trafficked areas and specifies the requirements for their constituents, composition and laboratory performance classification.

In this European Standard slag refers to granulated blast furnace slag, generally ground or partially ground, complying with EN 14227-2.

2 Normative references

The following referenced documents are indispensable for the application of this European Standard. 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 933-1, *Test for geometrical properties of aggregates — Part 1: Determination of particle size distribution — Sieving method*

EN 13286-2, *Unbound and hydraulically bound mixtures — Part 2: Test methods for the determination of the 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 13286-46, *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 the California bearing ratio, immediate bearing index and linear swelling*

EN 13286-48, *Unbound and hydraulically bound mixture — Part 48: Test method for the determination of the 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 by vibrating hammer compaction*

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

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

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

EN 14227-11, *Hydraulically bound mixtures — Specifications — Part 11: Soil treated by lime*

3 Terms and definitions

For the purpose of this European Standard, the following terms and definitions apply.

3.1
soil
natural, artificial or recycled material or any combination of these

3.2
slag
granulated or pelletized blast furnace slag, generally ground or partially ground

3.3
soil treated with slag
mixture of soil, slag, other constituents and water, that sets and hardens by hydraulic reaction

3.4
slenderness ratio
height to diameter ratio of the specimen

4 Symbols and abbreviated terms

For the purpose of this European Standard, the following symbols and abbreviations apply.

W is the water content;

P is the pulverization;

IPI is the immediate bearing index;

MCV is the moisture condition value;

CBR is the California bearing ratio, expressed in percent (%);

R is the compressive or tensile strength, expressed in megapascals (MPa);

R_c is the compressive strength, expressed in megapascals (MPa);

R_t is the direct tensile strength, expressed in megapascals (MPa);

R_{it} is the indirect tensile strength, expressed in megapascals (MPa);

R_i is the compressive or tensile strength after immersion in water, expressed in megapascals (MPa);

E is the modulus of elasticity, expressed in megapascals (MPa);

E_c is the modulus of elasticity E determined in compression, expressed in megapascals (MPa);

E_t is the modulus of elasticity E determined in direct tension, expressed in megapascals (MPa);

E_{it} is the modulus of elasticity E determined in indirect tension, expressed in megapascals (MPa);

I is the 'strength after immersion' ratio;

LS is the linear swelling of a CBR specimen, expressed in millimetres (mm);

G_v is the volumetric swelling of a specimen, expressed in percent (%).

5 Constituents

5.1 Ground or partially ground granulated blast furnace slag

Ground or partially ground granulated blast furnace slag shall comply with EN 14227-2.

NOTE Depending on the soil type, it may be possible to use granulated blast furnace slag complying with EN 14227-2 that has not been ground, although the user should be aware that mixtures containing such slag rely for their performance on crushing of the slag between soil particles under rolling which may not be achieved with some soil types.

5.2 Soil

Not less than 95 % of the soil shall pass the 63 mm sieve when tested using wet sieving in conformity with EN 933-1.

The soil shall conform to classification and homogeneity requirements at the place of use.

NOTE 1 Organic matter can delay the setting and hardening process. Laboratory mixture design work will determine whether soil/material containing organic matter can be accommodated. The amount of organic matter that can be accommodated depends on the type of organic matter.

NOTE 2 Soil containing or suspected of containing sulphates can result in expansion of the mixture. Laboratory mixture design work including 'resistance to water testing' in accordance with this European Standard will determine if sulfates or other material with the potential to cause swelling can be accommodated.

5.3 Water

Water shall not contain components that adversely affect the setting, hardening and performance of the mixture.

5.4 Other constituents

Other constituents shall include lime in conformity with EN 14227-11, cement in conformity with EN 197-1, aggregate, gypsum, ground or crushed air-cooled steel slag or other materials that are either necessary for setting and hardening of the mixture or to improve workability, trafficability or performance.

NOTE Other constituents include those that are necessary for the setting and hardening of the slag e.g. a source of lime and or sulfate, and those constituents that are added to improve workability, traffickability and or performance of the mixture e.g. aggregate.

6 Mixture

6.1 General

The mixture shall comprise constituents specified in Clause 5.

6.2 Proportioning and dry density

The proportioning of the constituents including water content, expressed as percentages by dry mass of the total dry mass of the mixture, and the dry density of the mixture, shall be declared. The declared proportions shall be based on the laboratory mixture design and/or practical experiences with mixtures produced with the same constituents and under the same conditions.

7 Requirements for the fresh mixture

7.1 Water content

The water content shall be selected to permit compaction on site by rolling and to optimize the mechanical performance of the mixture. The water content shall be determined by the Proctor or other test in conformity with EN 13286-2 to EN 13286-5, and limits set to give a workable range of water content on site compatible with the compaction and the desired performance of the mixture.

When required, the water content of the mixture shall conform to one of the categories in Table 1.

Table 1 — Minimum water content

Minimum water content of the mixture	Category
0,9 optimum water content of the mixture determined in accordance with the selected method of compaction from EN 13286-2 to EN 13286-5	$W_{0,9}$
0,95 optimum water content of the mixture determined in accordance with the selected method of compaction from EN 13286-2 to EN 13286-5	$W_{0,95}$
The optimum water content of the mixture determined in accordance with the selected method of compaction from EN 13286-2 to EN 13286-5	$W_{1,0}$
Declared value	W_{DV}

7.2 Degree of pulverization

When required, the degree of pulverization of the mixture shall conform to one of the categories in Table 2.

Table 2 — Degree of pulverization

Degree of pulverization determined in accordance with EN 13286-48	Category
≥ 30 %	P_{30}
≥ 40 %	P_{40}
≥ 50 %	P_{50}
≥ 60 %	P_{60}
Declared value	P_{DV}

7.3 Immediate bearing index

When required, the immediate bearing index of the mixture at the declared water content, determined in accordance with EN 13286-47, shall conform to one of the categories in Table 3 observing the following testing procedure. After mixing, the mixture shall be stored in bags in a sealed condition for 60 min. The specimen(s) shall then be manufactured and the determination of the index carried out immediately or no later than 90 min after mixing.

Table 3 — Immediate bearing index

Immediate bearing index	Category
> 10	IPI_{10}
> 15	IPI_{15}
> 20	IPI_{20}
> 25	IPI_{25}
> 30	IPI_{30}
> 40	IPI_{40}
> 50	IPI_{50}
Declared value	IPI_{DV}

7.4 Moisture condition value

When required, the moisture condition value of the mixture, determined in accordance with EN 13286-46, shall conform to one of the categories in Table 4.

Table 4 — Moisture condition value

Moisture condition value	Category
6 minimum, 10 maximum	$MCV_{6/10}$
7 minimum, 11 maximum	$MCV_{7/11}$
8 minimum, 12 maximum	$MCV_{8/12}$
9 minimum, 13 maximum	$MCV_{9/13}$
Declared values	MCV_{DV}

8 Laboratory mechanical performance classification

8.1 General

The laboratory mechanical performance of the mixture shall be characterized and classified by one of the following three methods:

— by California bearing ratio CBR;

— by compressive strength R_c;

— by the combination R_t, E of tensile strength R_t and modulus of elasticity E.

NOTE No correlation is intended nor should be assumed between the 3 methods of characterization.

8.2 Classification by California bearing ratio

The CBR of the mixture, determined in accordance with EN 13286-47 and the following, shall conform to the selected class from Table 5.

a) After manufacture, the specimens shall be subjected to a conditioning period of either 1 h, 3 days, or other selected period, during which the specimens shall be prevented from drying out and shall be maintained at a temperature of (20 ± 2) °C or other specified temperature.

b) After conditioning, the specimens shall undergo a soaking period of either 4 days or other longer period before testing, during which they shall be maintained at a temperature of (20 ± 2) °C or other specified temperature.

c) The length of conditioning and soaking periods shall be noted in the test report.

Table 5 — California bearing ratio classes and requirements for the mixture

CBR requirement after 4 days soaking (or other specified longer period)	Class
≥ 15 and the immediate bearing index	CBR_{15}
≥ 20 and the immediate bearing index	CBR_{20}
≥ 30 and the immediate bearing index	CBR_{30}
≥ 40 and the immediate bearing index	CBR_{40}
≥ 50 and the immediate bearing index	CBR_{50}
Declared value	CBR_{DV}

8.3 Classification by compressive strength

Mixtures shall be classified by compressive strength determined in accordance with EN 13286-41 carried out on specimens manufactured in accordance with EN 13286-50 to EN 13286-53.

The class of compressive strength shall be selected from Table 6 in combination with the selected method of specimen manufacture.

NOTE 1 The permitted methods of specimen manufacture produce different specimen shapes and density, and thus for the same mixture, different strengths. Hence it is important, on the basis of experience and utilization, not to separate strength from the method of specimen manufacture.

The age of classification and curing conditions shall be specified in accordance with practice at the place of use.

NOTE 2 For information, Annex A gives examples of age of classification and curing regimes.

For characterization or mixture design testing in the laboratory, compressive strength shall be the average result from at least three specimens. If one value varies by more than 20 % of the average, it shall be discarded and compressive strength taken as the average of the other values.