



**SLOVENSKI STANDARD**  
**SIST EN 14227-10:2006**  
**01-julij-2006**

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Hydraulically bound mixtures - Specifications - Part 10: Soil treated by cement

Hydraulisch gebundene Gemische - Anforderungen - Teil 10: Bodenverbesserung mit Zement

Mélanges traités aux liants hydrauliques - Spécifications - Partie 10: Sol traité au ciment

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English Version

## Hydraulically bound mixtures - Specifications - Part 10: Soil treated by cement

Mélanges traités aux liants hydrauliques - Spécifications -  
Partie 10: Sol traité au ciment

Hydraulisch gebundene Gemische - Anforderungen - Teil  
10: Bodenverbesserung mit Zement

This European Standard was approved by CEN on 3 February 2006.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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## Foreword

This European Standard (EN 14227-10:2006) 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of an identical text or by endorsement, at the latest by November 2006, and conflicting national standards shall be withdrawn at the latest by November 2006.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 soil treated by cement for the pavement layers of roads, airfields and other trafficked areas and specifies the requirements for its constituents, composition and laboratory performance classification. It provides for the use of aggregates with grading curves, which are not constrained by the limits defined in EN 14227-1 for cement bound granular mixtures.

This European Standard does not specify requirements for strength prior to trafficking or frost resistance, which might be covered by requirements at the place of use.

Production control recommendations are included in the informative Annex B.

## 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 197-4, *Cement — Part 4: Composition, specifications and conformity criteria for low early strength blastfurnace cements*

EN 933-1, *Test for geometrical properties of aggregates — Part 1: Determination of particle size distribution — Sieving method*

EN 1008, *Mixing water for concrete — Specifications for sampling, testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete*

EN 13286-1, *Unbound and hydraulically bound mixtures — Part 1: Test methods for laboratory reference density and water content — Introduction, general requirements and sampling*

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 methods 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 mixtures — 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*

### 3 Terms and definitions

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

#### 3.1

##### soil

natural, artificial or recycled material or any combination of these components

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#### 3.2

##### soil treated by cement

mixture resulting from the addition of cement and, where appropriate, secondary constituents to a soil

NOTE 1 Soils treated by cement are described in two groups for the purposes of this European Standard, defined as cement stabilized soil and cement bound soil. Soil improvement with cement, solely to allow construction to proceed without the necessity to improve the pavement structural capacity is defined as an earthworks process and outside of the scope of this European Standard.

NOTE 2 Soils treated by cement include for the use of fine-grained soils, which are pre-treated with lime to allow them to be re-treated with cement.

#### 3.3

##### cement stabilized soil

mixture of soil or aggregate with cement as the binder and, where appropriate, secondary constituents, which is designed to attain stability measured by California bearing ratio capacity testing

**3.4 cement bound soil**  
mixture of soil or aggregate with cement as the binder and, where appropriate, secondary constituents, which is designed to attain a structural integrity directly measured by unconfined compressive strength or tensile strength and elastic modulus testing

**3.5  $R_i/R$  ratio**  
ratio, at the same age and under the same temperature conditions, of the soaked strength of the mixture to the un-soaked strength of the mixture, either compressive or tensile, determined in accordance with EN 13286-40, EN 13286-41 or EN 13286-42

**3.6 slenderness ratio**  
ratio of height to diameter of the specimen

## 4 Symbols and abbreviations

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

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).

## 5 Constituents

### 5.1 General

The primary constituents shall be soil and binder. Other constituents shall be considered as secondary constituents.

NOTE Secondary constituents may include those necessary to deactivate or assist in the pulverization of the cohesive soil, to dilute or absorb sulfate, to improve grading, traffickability, mechanical performance etc.



## 5.2 Binder

Binder shall consist of one of the following:

- a) cement conforming to EN 197-1;
- b) cement conforming to EN 197-4.

NOTE Cement conforming to EN 197-1, grades CEM II to CEM V or EN 197-4 might have setting rates, which vary significantly from those for the CEM 1 grades of EN 197-1. This will need to be considered when selecting the fresh and mechanical performance criteria and testing regimes.

## 5.3 Soil

Not less than 95 % of the soil shall pass the 63 mm sieve when tested using the wet sieving method conforming to EN 933-1.

Where applicable, the soil shall conform to the requirements for classification and homogeneity valid in the place of use.

NOTE 1 Organic matter can delay or prevent the setting and hardening process. Laboratory mixture design work might determine whether soil containing organic matter can be accommodated. The amount of organic matter that can be accommodated depends on the type and particle size of the organic matter.

NOTE 2 Mixtures containing sulphates or other material that could result in expansion of the mixture should be tested for the resistance to water requirements of Clause 9.

## 5.4 Water

Any added mixing water shall conform to EN 1008:2006

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## 5.5 Secondary constituents

Subject to satisfactory laboratory trials, secondary constituents may be added to improve the grading, the stability, the compatibility, the impermeability or the setting and hardening of the mixture.

## 6 Mixture

### 6.1 General

The mixture shall be made from the constituents specified in Clause 5.

### 6.2 Proportioning of the constituents, grading and dry density

The proportioning of the constituents, expressed as a percentage by dry mass of the total dry mass of the mixture, the grading and the dry density of the mixture, shall be declared. The declared proportions shall be based on the laboratory mixture design and/or experience with mixtures produced with the same constituents and under the same conditions as those to be applicable to the proposed mixture.

## 7 Requirements of 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 optimum water content shall be determined by a selected test method in accordance with EN 13286-1 to EN 13286-5. In addition the range of water content shall be adhered to that is compatible with the compaction performance and the desired mechanical performance of the mixture.

The water content of the mixture shall conform to one of the categories in Table 1.

**Table 1 — Minimum water content**

Minimum water content	Category
No requirement	$W_{NR}$
Not less than 0,90 optimum water content of the mixture determined in accordance with the selected method of compaction from EN 13286-2 to EN 13286-5	$W_{0,90}$
Not less than 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	$W_{0,95}$
Not less than the optimum water content of the mixture determined in accordance with the selected method of compaction from EN 13286-2 to 13286-5	$W_{1,0}$
Declared value	$W_{DV}$

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### 7.2 Degree of pulverization

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The degree of pulverization of the mixture shall be determined in accordance with EN 13286-48 and shall conform to one of the categories selected from Table 2.

**Table 2 — Degree of pulverization**

Degree of pulverization	Category
No requirement	$P_{NR}$
$\geq 30\%$	$P_{30}$
$\geq 40\%$	$P_{40}$
$\geq 60\%$	$P_{60}$
$\geq 80\%$	$P_{80}$
Declared value	$P_{DV}$

### 7.3 Immediate bearing index

The immediate bearing index at the declared water content of the mixture shall be determined in accordance with EN 13286-47 and shall conform to one of the categories selected from Table 3. After mixing, the mixture shall be stored in bags in a sealed condition for 30 min to 60 min. The specimen(s) shall then be manufactured and the determination of the index carried out not later than 90 min after mixing.

Table 3 — Immediate bearing index

Immediate bearing index	Category
No requirement	$IPI_{NR}$
> 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

The moisture condition value of the mixture shall be determined in accordance with EN 13286-46 and shall conform to one of the categories selected from Table 4.

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Table 4 — Moisture condition value

Moisture condition value	Category
No requirement	$MCV_{NR}$
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 methods:

- for cement stabilized soils, by California bearing ratio (CBR);
- for cement bound soils by compressive strength  $R_c$ ; or 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 methods of characterization.