



SLOVENSKI STANDARD
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Unbound and hydraulically bound mixtures - Part 49: Accelerated swelling test for soil treated by lime and/or hydraulic binder

Ungebundene und hydraulisch gebundene Gemische - Teil 49: Beschleunigte Quellprüfung von mit Kalk und/oder hydraulischem Bindemittel behandeltem Boden

Mélanges traités et mélanges non traités aux liants hydrauliques - Partie 49: Essai de gonflement accéléré pour les sol traité a la chaux et/ou avec un liant hydraulique

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93.080.20 Materiali za gradnjo cest Road construction materials

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EUROPEAN STANDARD

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NORME EUROPÉENNE

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March 2004

ICS 93.080.20

English version

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

Mélanges non traités et mélanges à base de liant
hydraulique - Partie 49: Essai de gonflement accéléré pour
les sols traités à la chaux et/ou liant hydraulique

Ungebundene und hydraulisch gebundene Gemische - Teil
49: Beschleunigte Quellprüfung von mit Kalk und/oder
hydraulischem Bindemittel behandeltem Boden

This European Standard was approved by CEN on 9 January 2004.

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.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (EN 13286-49:2004) 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 test or by endorsement, at the latest by September 2004, and conflicting national standards shall be withdrawn at the latest by December 2004.

This European standard is one of a series of standards as listed below.

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

prEN 13286-2, *Unbound and hydraulically bound mixtures — Part 2: Test methods for laboratory reference density and moisture 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 13286-7, *Unbound and hydraulically bound mixtures — Test methods — Part 7: Cyclic load triaxial test for unbound mixtures.*

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 13286-44, *Unbound and hydraulically bound mixtures — Part 44: Test method for the determination of the alpha coefficient of vitrified blast furnace slag.*

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.*

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prEN 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 binders.*

prEN 13286-50, *Unbound and hydraulically bound mixtures — Part 50: Methods for making test specimens using proctor equipment or vibrating table compaction.*

prEN 13286-51, *Unbound and hydraulically bound mixtures — Part 51: Methods for making test specimens by vibrating hammer compaction.*

prEN 13286-52, *Unbound and hydraulically bound mixtures — Methods for making test specimens — Part 52: Making specimens by vibrocompression.*

prEN 13286-53, *Unbound and hydraulically bound mixtures — Methods for making test specimens — Part 53: Making cylindrical specimens by axial compression.*

Annex A is informative.

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, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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1 Scope

This European Standard describes an accelerated swelling test for soil treated by lime and/or hydraulic binder.

The test method is applicable to mixtures that have sufficient fines or cohesion to permit, immediately after manufacture, the extrusion of the specimen from the mould without damage.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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

prEN 13286-53, *Unbound and hydraulically bound mixtures - Methods for making test specimens - Part 53: Making cylindrical specimens by axial compression.*

3 Terms and definitions

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

3.1

lime

quicklime or hydrated lime

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3.2

hydraulic binder

material or a combination of materials (cement, hydraulic road binder, granulated/ground granulated blast furnace slag, calcareous/siliceous fly ash, lime) that sets and hardens by chemical reaction with water and remains stable, even under water

4 Principle

The hydraulic setting of a specimen of treated mixture is accelerated using special storage conditions and expansion at the end of a set period of time (maximum of 14 days) is measured.

Expansion is measured to assess the dimensional stability of the mixture.

The expansion is determined by the change of apparent volume of the test specimens ($d = h = 50$ mm) over time, first stored in a saturated atmosphere, and then immersed in water at 40 °C under the conditions given in clause 6.

5 Apparatus

5.1 Mixer to provide homogeneous mixtures of materials with the treatment products considered.

5.2 Apparatus in accordance with prEN 13286-53.

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- 5.3** Constant temperature bath adequate to maintain a sufficient volume of water at (40 ± 2) °C for total immersion of the test specimens subject to the test.
- 5.4** Balance, configured to weigh specimens in air and water, whose accuracy is compatible with the requirements of 6.3.
- 5.5** Test specimen confinement belts, made from a synthetic, flexible and water permeable fabric with the dimensions of (170 ± 10) mm and 49 mm minimum.
- 5.6** Elastic bracelets.
- 5.7** Callipers readable to an accuracy of 0,02 mm.
- 5.8** Stopwatch.
- 5.9** Porous stones, sponge or absorbent paper.
- 5.10** Scoops.
- 5.11** Trowels.
- 5.12** Scissors.

6 Procedure

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6.1 Production of the test specimens

Select the appropriate water content, binder type and binder content.

NOTE If appropriate, the swelling of several mixtures characterized by different water contents and binder contents can be studied in the same test sequence.

Remove granular particles greater than 6,3 mm before mixing.

Produce the mixture in accordance with practice at the place of use, reproducing the time periods between the introduction of the binder(s) and compaction. Assess the quality of mixing visually (uniformity of colour and the granular characteristics of the mixture).

The quantity of mixture to be prepared shall be sufficient to permit the realisation of the test itself, and that of the one point "Normal Proctor" for the water content and binder dosage selected. For a given mixture, these quantities shall not be less than 4,5 kg when the Proctor mould is used and not less than 7 kg when the California bearing ratio mould is used.

Determine the value of the one-point 'Normal Proctor' wet density of the mixture in accordance with prEN 13286-2.

Using $(96 \pm 0,5)$ % of this value, produce at least 3 test specimens ($d = h = 50$ mm) using axial compression in accordance with prEN 13286-53.

Take each specimen out of the mould immediately after being made and store in accordance with 6.2.

6.2 Storage of the test specimens

6.2.1 Treatment with lime alone

Store the specimens for (72 ± 4) h at (20 ± 2) °C at more than 90 % humidity, then immerse them entirely for (168 ± 4) h in water at (40 ± 2) °C.

6.2.2 Treatment with a hydraulic binder or hydraulic binder in association with lime

Store the specimens at (20 ± 2) °C at more than 90 % humidity for a period between 1,5 and 2 times the workability period of the mixture; then immerse them entirely for (168 ± 4) h in water at (40 ± 2) °C.

NOTE The workability period to be considered is preferably that given in the technical sheet of the producer of the binder. In the absence of this information, this period may be evaluated from previous experience, or determined in accordance with prEN 13286-45.

6.3 Measurement of the expansion of the test specimens

The volumetric expansion is the average of the values measured on 3 test specimens ascertained in the following way:

Immediately after demoulding, determine the initial volume V_0 of each of the specimens by measuring with callipers, as illustrated in Figure 1, diameters d_1 , d_2 , d_3 and 2 heights h_1 and h_2 , to an accuracy of $\pm 0,1$ mm.

Calculate the volume V_0 (rounded to the nearest 0,1 ml according to the expression:

$$V_0 = (\pi/4) \times [(d_1 + d_2 + d_3)/3]^2 \times (h_1 + h_2)/2 \quad (1)$$

where

V_0 is the initial volume (immediately after removal from the mould) of the test specimen, expressed in cubic millimetres (mm³);

d_1, d_2, d_3 are the diameters of the test specimens, expressed in millimetres (mm);

h_1, h_2 are the heights of the test specimens, expressed in millimetres (mm).

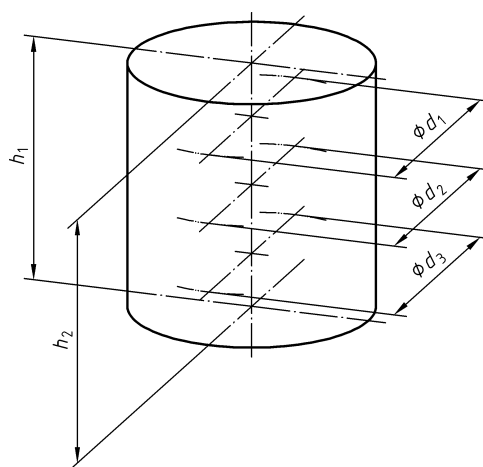


Figure 1 — Method for determining the initial volume V_0