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

Ungebundene und hydraulisch gebundene Gemische - Teil 47: Prüfverfahren zur Bestimmung des CBR-Wertes (California bearing ratio), des direkten Tragindex (IBI) und des linearen Schwellwertes

Mélanges traités et mélanges non traités aux liants hydrauliques - Partie 47: Méthode d'essai pour la détermination de l'indice portant Californien (CBR), de l'indice de portance immédiate (IPI) et du gonflement

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

Mélanges non traités et mélanges à la base de liant hydraulique - Partie 47: Méthodes d'essai pour la détermination de l'indice portant Californien (CBR), de l'indice portance immédiate (IPI) et du gonflement

Ungebundene und hydraulisch gebundene Gemische - Teil 47: Prüfverfahren zur Bestimmung des CBR-Wertes (California bearing ratio), des direkten Tragindex (IBI) und des linearen Schwellwertes

This European Standard was approved by CEN on 3 November 2003.

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 document (EN 13286-47:2004) 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of an identical text or by endorsement, at the latest by July 2004, and conflicting national standards shall be withdrawn at the latest by December 2004.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 method for the determination of 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 13286-7, *Unbound and hydraulically bound mixtures — 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.*

prEN 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 the California bearing ratio, immediate bearing index and linear swelling.*

**EN 13286-47:2004 (E)**

prEN 13286-48, *Unbound and hydraulically bound mixtures — Part 48: Test method for the determination of the degree of pulverization.*

prEN 13286-49, *Unbound and hydraulically bound mixtures — Part 49: Accelerated swelling test of 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 vibro-compression.*

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

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 specifies the test methods for the laboratory determination of the California bearing ratio and immediate bearing index.

The tests are appropriate to that part of the mixture up to a maximum particle size of 22,4 mm.

When immersion in water is specified as part of the curing of the specimen, this European Standard also includes the determination of vertical swelling of the specimen before the determination of the California bearing ratio.

## 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).

EN 1097-5, *Tests for mechanical and physical properties of aggregates — Part 5: Determination of the water content by drying in a ventilated oven.*

prEN 13286-2, *Unbound and hydraulically bound mixtures — Part 2: Test methods for the determination of the laboratory reference density and water content — Proctor compaction.*

## 3 Terms and definitions

[SIST EN 13286-47:2004](https://standards.iteh.ai/catalog/standards/sist/66187b0f-241f-4072-8a79-dec482cd0278/sist-en-13286-47-2004)

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

### 3.1

#### **California bearing ratio**

ratio used to characterize the bearing capacity of a mixture, determined immediately after compaction, or after a period of curing

### 3.2

#### **immediate bearing index**

immediate California bearing ratio test without surcharge

### 3.3

#### **proctor compactive effort**

compactive effort used in the Proctor test described in prEN 13286-2

### 3.4

#### **modified Proctor compactive effort**

compactive effort used in the modified Proctor test described in prEN 13286-2

### 3.5

#### **curing**

period of time and storage condition between manufacture and testing of the specimen for the California bearing ratio

**EN 13286-47:2004 (E)****4 Principle**

The relationship between force and penetration is determined when a cylindrical piston of a standard cross-sectional area is made to penetrate a specimen of a mixture, contained within a mould, at a given rate.

The California bearing ratio or immediate bearing index is calculated by expressing the force on the piston for a given penetration as a percentage of a reference force.

**5 Apparatus****5.1 Apparatus for specimen manufacture**

5.1.1 Proctor mould B with appropriate spacer disc, if required conforming to prEN 13286-2.

5.1.2 Rammer A or B, conforming to prEN 13286-2.

5.1.3 Balance accurate to  $\pm 0,1$  % of mass weighed and capable of weighing up to 30 kg.

5.1.4 Apparatus conforming to EN 1097-5 for water content determination.

5.1.5 Miscellaneous apparatus including coarse filter papers, a steel straightedge, scrapers etc.

**5.2 Additional apparatus for soaking procedure and measurement of swelling**

5.2.1 Base plate uniformly perforated for minimum 1 % of its surface

5.2.2 Perforated top plate in aluminium alloy with adjustable stem to provide the seating for the stem of a dial gauge.

5.2.3 Unperforated top plate in aluminium alloy with a thickness  $(10 \pm 1)$  mm with adjustable stem to provide the seating for the stem of a dial gauge.

5.2.4 Device for measuring the vertical expansion of the specimen for the California bearing ratio accurate to 0,05 mm.

5.2.5 Soaking tank, large enough to allow the Proctor mould B to be submerged, preferably supported on an open mesh platform.

5.2.6 Annular surcharge rings, each having a mass known to  $\pm 100$  g, an internal diameter of  $(53 \pm 1)$  mm and an external diameter equal to the diameter of the mould minus 5 mm.

NOTE Alternatively half-annular segments may be used.

**5.3 Additional apparatus for determination of the California bearing ratio and immediate bearing index**

5.3.1 Cylindrical penetration piston with a diameter of  $(50 \pm 0,5)$  mm, the lower end of which shall be of hardened steel.

5.3.2 Loading machine with a capacity of at least 50 kN capable of applying the test force through the piston at a penetration rate of  $(1,27 \pm 0,20)$  mm/min. The machine shall be equipped with a load-indicating device that can be read to 5 N or less.



## 6 Test sample for the California bearing ratio and immediate bearing index tests

After sieving on a 22,4 mm sieve, approximately 7,5 kg of mixture shall be used for one test and water content determination. The quantity shall be weighed accurately so that the actual quantity used for the test sample can be determined after compaction by difference for checking purposes.

NOTE Preliminary trials may be necessary to ascertain the required quantity more closely.

## 7 Specimen manufacture for the California bearing ratio and immediate bearing index tests

**7.1** Clamp the mould, with extension collar attached, to the base plate. Insert the spacer disc over the base plate and place an anti-sticking medium such as coarse filter paper on top of the spacer disc. The California bearing ratio assembly shall be placed on a solid substrate e.g. concrete or plinth, prior to specimen manufacture. Compact the mixture into the mould using either Proctor or modified Proctor compactive effort in accordance with prEN 13286-2.

NOTE It is normal but not universal practice to use a mould that requires the use of a spacer disc.

**7.2** After compaction, remove the extension collar and carefully trim the mixture flush with the top of the mould with the scraper, checking with the steel straightedge. Patch with smaller size material any holes that may have developed in the surface during trimming.

**7.3** Remove the baseplate and spacer disc (where used); weigh, and record the mass of the mould and mixture to the nearest 5 g.

NOTE In the case of mixtures lacking cohesion, it would be better to weigh the mould and mixture with the baseplate and spacer disc attached to avoid loss of mixture.

**7.4** For immediate California bearing ratio and immediate bearing index tests, proceed to clause 9, if not, the specimen shall be cured using one of the procedures described in clause 8.

**7.5** The material surplus to that required for the test specimen shall be used to determine, in accordance with EN 1097-5, the water content of the test portion.

## 8 Curing for California bearing ratio test

### 8.1 General

A curing period, which may be required between specimen manufacture and testing, shall consist of the storage of the specimens for a specified period of time in one of the following states:

- a) a condition that prevents evaporation resulting in a loss of mass of more than 2 %;
- b) a condition that permits full soaking of the specimens (immersion);
- c) 'prevention of evaporation' [as in a)] followed by full soaking.

In each case, the type of curing, the average temperature and duration of storage shall be recorded and stated.

### 8.2 Curing by prevention of evaporation

Curing by prevention of water loss by evaporation shall be carried out by one of the following methods: