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

Ungebundene und hydraulisch gebundene Gemische - Teil 45: Prüfverfahren zur Bestimmung der Verarbeitbarkeitsdauer hydraulisch gebundener Gemische

Mélanges traités et mélanges non traités aux liants hydrauliques - Partie 45: Méthodes d'essai pour la détermination du délai de maniabilité

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

Mélanges traités et mélanges non traités aux liants  
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45: Prüfverfahren zur Bestimmung der  
Verarbeitbarkeitsdauer hydraulisch gebundener Gemische

This European Standard was approved by CEN on 1 September 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 Management Centre 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 Management Centre has the same status as the official versions.

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

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

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## Foreword

This document (EN 13286-45:2003) 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of an identical text or by endorsement, at the latest by May 2004, and conflicting national standards shall be withdrawn at the latest by December 2004.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.*

prEN 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 methods 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.*

prEN 13286-47, *Unbound and hydraulically bound mixtures — Part 47: Test methods for the bearing capacity, California Bearing Ratio (CBR), immediate Bearing Index (IB) and linear swelling.*

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

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prEN 13286-49, *Unbound and hydraulically bound mixtures — Methods for making test specimens – Part 49: Accelerated swelling test for soil treated by lime and/or hydraulic binder.*

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 normative.

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

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## 1 Scope

This European Standard describes test methods to determine the workability period of a hydraulically bound mixture using granular materials.

Two methods are described: delayed compaction and sonic propagation. The latter method is not suitable for hydraulically bound mixture with  $D$  less than or equal to 6,3 mm.

## 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 method for the determination of the laboratory reference density and moisture content - Proctor compaction*

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

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## 3 Terms and definitions

For the purposes of this European Standard, the following term and definition applies.

### 3.1

#### workability period

duration of time counted from the end of the mixing, during which, the binder setting remains nil or very low

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## 4 Symbols and abbreviations

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

$\theta$  ambient air temperature of the test room (measured at less 0,5 m from the test specimen), expressed in degree Celsius (°C);

$t$  time, counted from the end of the mixing, in hours (h) and minutes (min);

$\rho(0)$  immediate dry bulk density of hydraulically bound mixture, expressed in kilograms per cubic metre ( $\text{kg/m}^3$ ), compacted at  $t = 0$ ;

$\rho(t)$  dry bulk density of hydraulically bound mixture, expressed in kilograms per cubic metre ( $\text{kg/m}^3$ ), compacted at time  $t$ ;

$W_{pc}$  workability period, determined by compaction method, expressed in hours (h) and minutes (min);

$d$  dimension of the diameter of the transmitter and the receiver, in millimetres (mm);

$t_s$  time of the start of the recording of the duration of the sound propagation, in hours (h) and minutes (min);

$D_s(t)$  duration of the sound propagation through the axis of the test specimen, expressed in microseconds at  $t$ ;

$W_{ps}$  workability period, determined by sonic method, expressed in hours (h) and minutes (min);

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$t_0$  in the sound propagation method, the time at the end of the mixing of the mixture in hours (h) and minutes (min);

$K$  specific coefficient for each dynamic testing bench, determined as indicated in annex A.

**5 Delayed compaction method****5.1 Principle**

The hydraulically bound mixture is compacted by the modified Proctor test in accordance with prEN 13286-2 with increasing values of  $t$  on different samples of the mixture.

The workability period  $W_{pc}$  of the hydraulically bound mixture is the value of  $t$  which corresponds to a reduction of 2 % of  $\rho(0)$ .

**5.2 Apparatus**

The apparatus shall conform to prEN 13286-2.

**5.3 Preparation of the mixtures**

Perform the test on the fraction of the mixture which passes through a 31,5 mm sieve. The quantity to be mixed shall be at least 1,10 times the quantity used in a Proctor mould B after compaction. After mixing, place the mixture in an airtight sealed bag until its compaction at time  $t$ .

Make at least ten identical samples. Store the samples prior to compaction at a constant temperature  $\theta$  (within  $\pm 1,5$  °C).

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**5.4 Procedure**

Compact each sample with increasing time  $t$  according to the estimated value of  $W_{pc}$  as shown in Table 1.

**Table 1 — Suggested values of  $t$  in h**

Estimated $W_{pc}$	sample 1	sample 2	sample 3	sample 4	sample 5
short (<5 h)	0	1	3	5	7
middle (5 h to 12 h)	0	2	4	7	16
long (>12 h)	0	4	7	16	24

Perform two tests per compaction time  $t$ . If the results obtained for each determination of dry bulk density do not differ by more than 1 %, the mean of the two values shall be taken as the result. When the difference is greater than 1 %, a new compaction test shall be carried out for the same value of  $t$ . The mean of the nearest two values shall be taken as the test result.

**5.5 Calculations and expression of results**

For each compaction, the dry bulk density shall be calculated in accordance with prEN 13286-2. The test result  $\rho(t)$  shall be the mean of two determinations.

The curve  $\rho(t)$  shall be plotted as shown in Figure 1.

The workability period of the hydraulically bound mixture,  $W_{pc}$ , shall be the time  $t$  which corresponds to the dry bulk density  $\rho(t)$  equal to 98 % of  $\rho(0)$ .



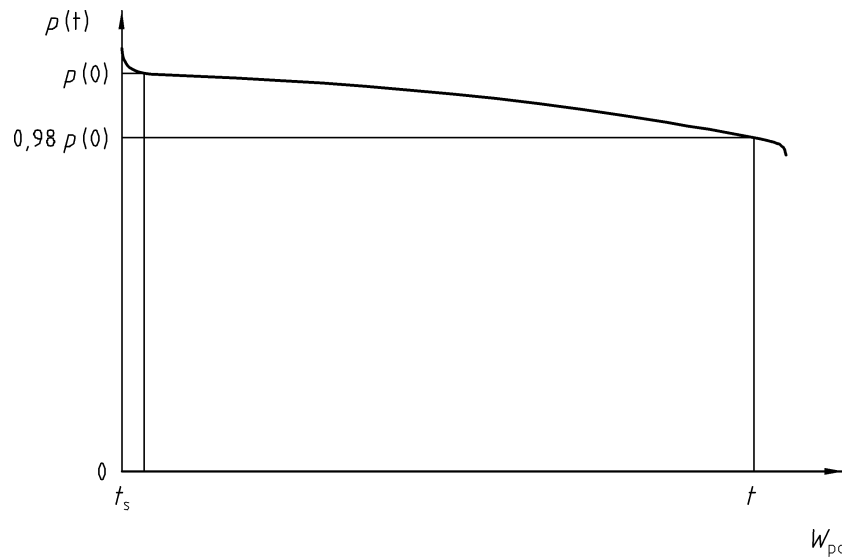


Figure 1 — Determination of  $W_{pc}$  by compacting method

## 6 Sonic propagation method

### 6.1 Principle

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The duration of propagation of the sound  $D_s(t)$  through the longitudinal axis of a test specimen of a freshly compacted hydraulically bound mixture is continuously measured.

The workability period  $W_{ps}$  of the hydraulically bound mixture is the time  $t$  when  $D_s(t)$  is equal to  $K \times D_s(0)$ .

### 6.2 Apparatus

**6.2.1 Dynamic testing bench** (see Figure 2), designed for conducting the test on 160 mm diameter by 320 mm high test specimens which have been made by vibrocompression in accordance with standard prEN 13286-52 and comprising (see Figure 2).