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Nevezane in hidravlično vezane zmesi - 54. del: Preskusna metoda za določanje občutljivosti za mraz - Odpornost proti zmrzovanju in odtaljevanju hidravlično vezanih zmesi

Unbound and hydraulically bound mixtures - Part 54: Test method for the determination of frost susceptibility - Resistance to freezing and thawing of hydraulically bound mixtures

Ungebundene und hydraulisch gebundene Gemische - Teil 54: Prüfverfahren zur Bestimmung der Frostempfindlichkeit - Frost-Tau-Wechselbeständigkeit von hydraulisch gebundenen Gemischen

Mélanges traités et mélanges non traités aux liants hydrauliques - Partie 54: Méthode d'essai pour la détermination de la sensibilité au gel et la résistance au gel-dégel des mélanges traités aux liants hydrauliques

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Unbound and hydraulically bound mixtures - Part 54: Test method for the determination of frost susceptibility - Resistance to freezing and thawing of hydraulically bound mixtures

Ungebundene und hydraulisch gebundene Gemische - Teil 54: Prüfverfahren zur Bestimmung der Frostempfindlichkeit - Frost-Tau-Wechselbeständigkeit von hydraulisch gebundenen Gemischen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 227.

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Foreword

This document (prEN 13286-54:2011) has been prepared by Technical Committee CEN/TC 227 “Unbound and hydraulically bound mixtures”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

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 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*

prEN 13286-6, *Unbound and hydraulically bound mixtures — Test methods — Part 6: Test methods for laboratory reference density and moisture content — Test methods for sampling and sample reduction*

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*

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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*

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1 Scope

This European Standard specifies a test method for the determination of the resistance of a hydraulically bound mixture to the cyclic action of freezing and thawing.

When required, a method for determining the change in length of a hydraulically bound subject to freeze thaw is specified in Annex A (normative).

When required, a method for determining the freeze thaw resistance of a hydraulically bound mixture in the presence of salt is specified in Annex B (normative).

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 932-5, *Tests for general properties of aggregates — Part 5: Common equipment and calibration*

EN 1367-1, *Tests for thermal and weathering properties of aggregates — Part 1: Determination of resistance to freezing and thawing*

EN 1367-4, *Tests for thermal and weathering properties of aggregates — Part 4: Determination of drying shrinkage*

EN 1367-6, *Test for thermal and weathering properties of aggregates — Part 6: Determination of resistance to freezing and thawing in the presence of salt (NaCl)*

EN 12390-7, *Testing hardened concrete — Density of hardened concrete*

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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 using vibrating hammer compaction*

EN 13286-52, *Unbound and hydraulically bound mixtures — Part 52: Method for the manufacture of test specimens of hydraulically bound mixtures using 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 document, the following terms and definitions apply.

3.1

test specimen

sample used in a single determination when a test method requires more than one determination of a property

3.2

laboratory sample

reduced sample derived from a bulk sample for laboratory testing

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3.3

hydraulically bound mixture

mixture that sets and hardens by hydraulic reaction

4 Principle

Two sets of three test specimens are prepared from a hydraulically bound mixture. The moulds containing the mixture are then placed in initial (first stage) curing conditions specified by the nature of the hydraulic constituents and in accordance with national regulation or decision at the place of use. On completion of the first stage curing, the 2 sets of test specimens are removed from their moulds and placed in a water bath for 2 days further curing (second stage).

On completion of second stage curing, one set of three test specimens (Set A) is removed from second stage curing, surface dried and tightly wrapped in plastic (cling) film. The second 'control' set of three test specimens (Set B) remains in the second stage curing conditions.

Set A specimens are then placed in a prepared freeze thaw cabinet and subjected to 10 freeze-thaw cycles, each cycle lasting 24 hours. After completion of the tenth freeze thaw cycle, the Set A specimens are unwrapped and returned to the second stage curing conditions for one day to ensure complete thawing.

The strength of both sets of three test specimens is then measured. The mean value of strength for each set is compared.

NOTE 1 An additional set of three test specimens (Set C) can be used to give additional information about the strength of the mixture after first stage curing. The use of Set C allows the gain in strength of the 'control' set (Set B) between the end of 2nd stage curing and the time of strength testing of Set B to be evaluated.

NOTE 2 When required, the steel hemispherical buttons used to measure the length of the test specimen (Annex A) are also fitted into the inserts at the end of second stage curing.

NOTE 3 A humidity cabinet can be used as an alternative location for second stage curing.

5 Apparatus

5.1 All apparatus, unless otherwise stated, shall conform to the general requirements of EN 932-5.

5.2 Cylindrical moulds, for test specimen preparation, as specified in the relevant test specimen preparation Standard (see Clause 6). Six moulds are required.

NOTE The use of moulds that are capable of being split along the longitudinal axis may be used to allow removal of the test specimen with the minimum of damage.

5.3 Watertight plastic bags (or plastic film), for initial curing.

5.4 Initial curing area(s), capable of temperature controlled curing at the specified temperature.

A humidity cabinet, capable of control at the specified temperature and 90 % to 100 % relative humidity, is a permitted option.

5.5 Water bath, controlled at (20 ± 2) °C, for second stage curing.

A humidity cabinet controlled at (20 ± 2) °C and 90 % to 100 % RH is a permitted alternative for second stage curing (as 5.4 above).

5.6 Low temperature cabinet, complying with the requirements of EN 1367-1.

5.7 Electronic thermocouple thermometer, or similar device, accurate to 0.1°C used to monitor the temperature in the centre of the cooled area in the low temperature cabinet.

The thermocouple probe shall be located in the centre of a metal can complying with EN 1367-1, containing $(2\ 000 \pm 5)$ g of 8/16 mm size aggregate and filled with water to a level at least 10 mm above the aggregate.

5.8 Suitable cloths, to surface dry the saturated test specimens.

5.9 Plastic (cling) film, for tightly wrapping one set of saturated test specimens before they are placed in the low temperature cabinet.

NOTE 1 See Annex A for additional requirements for the base of moulds fitted with inserts for measuring height.

NOTE 2 Suitable apparatus will also be required for test specimen preparation and strength testing, as specified in the relevant Standards.

NOTE 3 Low temperature cabinets that control the temperature of the thawing stage using air circulation are preferred for this test method.

NOTE 4 Three more moulds are required if a third set of test specimens (Set C) is tested at the end of second stage curing.

6 Test specimens

6.1 Preparation

On day 1, make six cylindrical test specimens from a laboratory sample of the hydraulically bound mixture to be tested. Prepare the test specimens in cylindrical moulds using one of the methods from Table 1.

NOTE 1 When required, an additional set of three test specimens (Set C) may be used to give additional information about the strength of the mixture at the end of second stage curing.

NOTE 2 It is important that all test specimens are the same nominal size and are prepared using the same compaction method.

Table 1 — Moulds

EN 13286	Method	Diameter mm	Height mm	Mixture size mm
-50	Proctor and vibrating table	100	120	Up to 0/22,4
		150	120	Up to 0/31,5
-51	Vibrating hammer	100	100	Up to 0/22,4
		150	150	Up to 0/31,5
-52	Vibro-compression	100	100	Up to 0/22,4
			200	
		160	160	Up to 0/31,5
320				
-53	Axial compression	100	100	Up to 0/22,4
			200	

prEN 13286-54:2011 (E)**6.2 Initial curing of test specimens**

Within (4 ± 1) hours of mixing, commence the 1st stage curing of the test specimens in their moulds by sealing each one in a watertight plastic bag or plastic (cling) film. Taking account of the strength gain of the binder, keep the test specimens in a controlled environment and for a time as determined at the place of use.

NOTE 1 Placing the test specimens in their moulds in a humidity cabinet is a permitted alternative to using watertight plastic bags.

NOTE 2 It is important that all the test specimens commence the freeze thaw cycling at a strength which is a significant proportion, say 80 %/90 %, of their ultimate strength. Elevated temperature or longer age curing will be required for slow setting and hardening mixtures compared to fast setting and hardening mixtures.

6.3 Removal from moulds at the end of 1st stage curing

Remove the test specimens from the initial curing environment. Remove each test specimen from its mould.

Group the specimens into two sets of three, known as Set A and Set B. Mark each test specimen with a suitable identification code.

NOTE If appropriate, the additional set of three test specimens is known as Set C.

7 Test procedure**7.1 Second stage curing**

NOTE 1 Duration of 2 days only for Set A and, if made, Set C.

Place all the sets of test specimens in the water bath maintained at (20 ± 2) °C.

Adjust the level of the water so that the tops of the specimens are covered to a depth of at least 10 mm for the full period of soaking.

NOTE 2 The time taken to carry out the procedures in 6.3 and 7.1 should not be more than 60 min.

7.2 Set A — Exposure to freezing after 2 days of 2nd stage curing

Place the electronic thermocouple probe in the can of aggregate and water in the centre of the cooling area. Use the thermocouple output to condition the low temperature cabinet so that the temperature in the can of aggregate is (20 ± 3) °C.

NOTE It may be necessary to stabilise the temperature in the low temperature cabinet before commencement of freeze thaw cycling.

After (48 ± 2) h of second stage curing, remove one of the Set A specimens from the water bath and quickly remove excess water with a damp cloth. Quickly wrap the saturated test specimen in plastic (cling) film. Do not allow any part of the surface of the test specimen to dry out.

Repeat the wrapping stage with the other two saturated test specimens in Set A.

Place the three wrapped Set A specimens in the cabinet. Ensure that the distance between each test specimens, the can of aggregate and the sidewalls of the cabinet is not less than 50 mm in any direction.

Use the output of the thermocouple in the central can of aggregate to regulate the temperature of the air in the low temperature cabinet over 10 freeze thaw cycles. Complete each freeze-thaw cycle within 24 h.