

Test methods for fibres in concrete —

Part 1: Reference concretes

The European Standard EN 14845-1:2007 has the status of a
British Standard

ICS 91.100.30

National foreword

This British Standard is the UK implementation of EN 14845-1:2007.

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A list of organizations represented on this committee can be obtained on request to its secretary.

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Prüfverfahren für Fasern in Beton - Teil 1: Referenzbetone

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Foreword

This document (EN 14845-1:2007) has been prepared by Technical Committee CEN/TC 104 "Concrete and related products", 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of an identical text or by endorsement, at the latest by January 2008, and conflicting national standards shall be withdrawn at the latest by May 2008.

It has been drafted by Working Group 11 "Fibres for concrete", the secretariat of which is held by BSI.

This European Standard is one of a series dealing with test methods for assessing the performance of fibres, either steel or polymer, in concrete.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, 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 the composition and characteristics of reference concretes used to evaluate the performance of fibres in concrete.

The purpose of the reference concrete is to determine the general suitability of a fibre for use in concrete.

NOTE The end user needs to satisfy themselves about the effectiveness of the fibre in their own concrete.

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 197-1:2000, *Cement — Part 1: Composition, specifications and conformity criteria for common cements*

EN 206-1:2000, *Concrete — Part 1: Specification, performance, production and conformity*

EN 933-2, *Tests for geometrical properties of aggregates — Part 2: Determination of particle size distribution — Test sieves, nominal size of apertures*

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

EN 1766:2000, *Products and systems for the protection and repair of concrete structures — Test methods — Reference concretes for testing*

EN 12350-1, *Testing fresh concrete — Part 1: Sampling*

EN 12350-3, *Testing fresh concrete — Part 3: Vebe test*

EN 12350-4, *Testing fresh concrete — Part 4: Degree of compactability*

EN 14651, *Test method for metallic fibred concrete — Measuring the flexural tensile strength (limit of proportionality (LOP), residual)*

EN 14845-2, *Test methods for fibres in concrete — Part 2: Effect on strength of concrete*

EN 14889-1:2006, *Fibres for concrete — Part 1: Steel fibres — Definitions, specifications and conformity*

EN 14889-2:2006, *Fibres for concrete — Part 2: Polymer fibres — Definitions, specifications and conformity*

3 Principle

This European Standard prescribes the constituents and proportions for plain reference concretes to be used to evaluate the performance of fibres in concrete under standard laboratory conditions. It has been developed from EN 1766 and should be read in conjunction with that standard.

The reference concretes shall be designed to meet a prescribed flexural tensile strength, as defined in Table 1.

The performance of a fibre shall be determined in a mandatory 16 mm or 20 mm maximum aggregate size mix using the test method described in EN 14845-2 for the effect on strength of concrete, and by one of the

consistence methods specified in 6.5. There is also the option to evaluate it in any of three additional reference concretes that have different maximum cement content and/or aggregate size.

Tests using reference concretes are performed as comparative tests. That is, the performance of fibres (effect on strength and consistence) is determined by comparing a reference concrete to which fibres are added with the same reference concrete without the addition of fibres, but otherwise with the same aggregate/cement ratio and constituent materials from the same delivery.

4 Equipment

4.1 General

Reference concretes shall be made in accordance with 6.6, using the equipment described in this clause.

4.2 Concrete mixer

A forced action concrete pan-mixer shall be used to mix the concrete.

4.3 Moulds

Moulds for producing hardened concrete specimens, of non absorbent, rigid material, not attacked by cement paste, of a size specified in EN 14845-2 shall be used.

4.4 High frequency vibrating table

Suitable for compaction of the concrete in beam moulds for testing to EN 14845-2.

5 Materials

5.1 Aggregates

Aggregates shall be natural, uncrushed and silica-based with low water absorption (less than 2 % by mass) and oven dried. The aggregate grading, measured according to EN 933-2, shall conform to EN 1766:2000 Annex A, except the limits for a 16 mm or 20 mm aggregate at 0,25 mm shall be 5% to 10 % (not 3 % to 8 %).

5.2 Mixing water

Water according to EN 1008 shall be used.

5.3 Cement

Portland type CEM I class 42,5 R according to EN 197-1:2000 shall be used.

5.4 Admixtures

A plasticizer or superplasticizer admixture according to EN 934-2:2000 may be used to control the workability.

5.5 Fibres

Where fibres are to be evaluated, the fibres shall be sampled in accordance with EN 14889-1:2006, 6.2 for steel fibres or EN 14889-2:2006, 6.2 for polymer fibres.

6 Reference concrete composition and properties

6.1 General

This European Standard specifies four types of reference concrete, defined by the flexural tensile strength, maximum size of the aggregate and maximum cement content. The reference concrete(s) are selected according to the type of product or system in which the fibre is to be applied. However, all fibre manufacturers shall declare the performance of their product, using the test method described in EN 14845-2 for the effect on strength and by one of the methods specified in 6.5 for consistence in the mandatory 16 mm or 20 mm aggregate mix (with a flexural tensile strength of $4,3 \text{ MPa} \pm 0,3 \text{ MPa}$), but have the option to evaluate it in any of three other optional reference concretes that have different maximum cement content and/or aggregate size.

The proportions of the reference concrete shall be adjusted within the limits prescribed below to achieve an average flexural tensile strength within the range defined in Table 1. The average flexural tensile strength shall be taken as the average limit of proportionality of at least twelve beams tested to EN 14651.

6.2 Water/cement ratio

The water/cement ratio as defined in EN 206-1 shall be as specified in Table 1.

Table 1 — W/C ratio and cement content limits

Flexural tensile strength	Water/cement ratio		Maximum cement content
(MPa)	Maximum aggregate size		(kg/m ³)
	8 mm or 10 mm	16 mm or 20 mm	
$4,3 \pm 0,3$ (25/30) ^c	0,55 ^b	0,55 ^a	350
$5,8 \pm 0,4$ (40/50) ^c	0,45 ^b	0,45 ^b	400
a Mandatory mix. b Optional mixes. c Equivalent compressive class according to EN 1992-1-1.			

6.3 Maximum cement content

The maximum cement content shall be as defined in Table 1.

6.4 Fibre content

Where the performance of a fibre is being evaluated by incorporating it in a reference concrete, the quantity of fibres added shall be that required to achieve the level of performance in EN 14845-2.

6.5 Consistence

The consistence of the reference concrete, without fibres, shall be determined either:

- according to EN 12350-3 and shall achieve Vebe class V3 (10-6 seconds) from EN 206-1:2000, or
- according to EN 12350-4 and shall achieve Compaction class C2 from EN 206-1.

A plasticizer or superplasticizer admixture conforming to EN 934-2 is permitted to give a workable concrete mix to meet the requirements of Table 1.

Consistence should be appropriate to achieve adequate placing of concrete with freedom from bleeding or segregation. Any special requirements for surface finish of placed specimens for particular test methods using reference concrete samples will be stated in those test methods.

6.6 Specimen preparation

The preparation of a reproducible reference concrete shall be done as follows:

- prepare a concrete batch the volume of which shall be of 50 % to 90 % of the mixer capacity;
- pour all dry aggregates into the container of the mixer, add half of the batch water and mix for 2 min;
- carry on the mixing and add the cement and the other half of the batch water containing possible admixtures during the next minute.

The total mixing time shall not be more than 5 min.

In reference concretes to which fibres are added, care shall be taken to ensure that the fibres are evenly distributed throughout the mix by adding the fibres at the appropriate stage in accordance with the manufacturer's recommendations.

Test specimens shall be made according to the relevant test method of the EN 14845 series for the property under consideration. The sample of the mixed concrete shall be taken in accordance with EN 12350-1.

6.7 Concrete curing and storage

The concrete specimens shall be cured in the moulds for 24 h after casting at (20 ± 2) °C, either under polyethylene sheeting or at not less than 95 % relative humidity, then demoulded and cured for a further 27 days under water at (20 ± 2) °C.

After the curing period, the specimens shall be taken for testing.

7 Report

The following information shall be recorded for each set of reference concrete specimens:

- a) mix composition including dry aggregates and admixtures in kg/m^3 and details of mixing procedure;
- b) water/cement ratio;
- c) fibre type (including material, length, diameter and tensile strength) described according to EN 14889-1 for steel fibres or to EN 14889-2 for polymer fibres;
- d) date and time of production;
- e) origin and particle size distribution of aggregates;
- f) consistence: Vebe time in seconds; or degree of compactability;
- g) curing and storage conditions;
- h) limit of proportionality strength to nearest 0,01 MPa (average and individual values);
- i) reference to this European Standard, i.e. EN 14845-1;
- j) any deviation from this European Standard.

Bibliography

- [1] EN 934-2, *Admixtures for concrete, mortar and grout — Part 2: Concrete admixtures — Definitions, requirements, conformity, marking and labelling*
- [2] EN 1992-1-1, *Eurocode 2: Design of concrete structures — Part 1-1: General rules and rules for buildings*

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