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Test method for fibre-reinforced cementitious composites — Load-deflection curve using circular plates

Méthode d'essai des composites à base de ciment renforcés par des fibres — Courbe de charge-déformation utilisant des plaques circulaires

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Foreword

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This document was prepared by Technical Committee ISO/TC 71, *Concrete, reinforced concrete and pre-stressed concrete*, Subcommittee SC 6, *Non-traditional reinforcing materials for concrete structures*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Test method for fibre-reinforced cementitious composites — Load-deflection curve using circular plates

1 Scope

This document specifies a test method for evaluating flexural performance of fibre-reinforced cementitious composites (FRCCs) using derived parameters. These parameters are derived from the load-deflection curve obtained by testing a circular specimen supported on a concentric ring and loaded by another ring with a smaller diameter. The performance of FRCCs tested by this method is characterized for biaxial properties.

This test method provides for the determination of first-cracking load and the corresponding stress. It also provides for the determination of specimen toughness based on the area under the load-deflection curve up to the deflections at the first-cracking and peak loads. For determining the toughness value, this test method is intended primarily for use with FRCCs that exhibit deflection hardening behaviour. This test method is not intended for materials that exhibit deflection-softening behaviour.

2 Normative reference

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 1920-3:2004, *Testing of concrete — Part 3: Making and curing test specimens*

ISO 1920-4, *Testing of concrete — Part 4: Strength of hardened concrete*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
load-deflection curve
plot of load versus *net deflection* (3.2) obtained from the test of a flexural circular specimen

3.2
net deflection
deflection measured at the centre of a flexural circular specimen exclusive of any extraneous effects due to seating or twisting of the specimen on its supports or deformation of the support and loading system

3.3
toughness
energy absorbed by the specimen equivalent to the area under the *load-deflection curve* (3.1) between the load and a specified *net deflection* (3.2)

3.4
equibiaxial flexural strength
stress that a material is capable of sustaining when it is subjected to an equibiaxial stress state

Note 1 to entry: This equibiaxial stress state is caused by the pure biaxial flexure of the circular specimen loaded by the inner loading ring and outer support ring. The equibiaxial flexural strength is calculated from the *first-cracking load* (3.5) of a biaxial test carried to rupture, the original dimensions of the test specimen and Poisson's ratio.

3.5
first-cracking load
load value on the *load-deflection curve* (3.1) at the end of linear elasticity, at which cracking initiates

3.6
first-cracking deflection
δ_c
net deflection (3.2) value on the *load-deflection curve* (3.1) at the *first-cracking load* (3.5)

Note 1 to entry: This is expressed in mm.

3.7
first-cracking strength
f_t
stress value obtained when the *first-cracking load* (3.5) is inserted in the formula for modulus of rupture

Note 1 to entry: This is expressed in MPa.

3.8
peak load
maximum load on the *load-deflection curve* (3.1)

3.9
peak-load deflection
δ_p
net deflection (3.2) value on the *load-deflection curve* (3.1) at the *peak load* (3.8)

Note 1 to entry: This is expressed in mm.

3.10
Poisson's ratio
υ
negative value of the ratio of transverse strain to the corresponding axial strain in the elastic range of deformation

4 Symbols

Symbol	Unit	Description
t	mm	thickness of the circular specimen
r_0	mm	radius of the loading ring
r_1	mm	radius of the specimen
r_2	mm	radius of the support ring
f	mm	$r_1 - r_2$
P_c	N	first cracking load
P_p	N	peak load
R	N/min	loading rate
S	MPa/min	rate of the equibiaxial stress
ψ	mm^{-2}	ratio of stress to load