SLOVENSKI STANDARD
SIST EN 13412:2002

01-november-2002

Proizvodi in sistemi za zaġļ ito in popravilo betonskih konstrukcij - Preskusne metode - Doloļ evanje modula elastiļ nosti pri tlaļ ni obremenitvi

Products and systems for the protection and repair of concrete structures - Test methods - Determination of modulus of elasticity in compression

Produkte und Systeme für den Schutz und die Instandsetzung von Betontragwerken - Prüfverfahren - Bestimmung des Elastizitätsmoduls im Druckversuch

Produits et systemes de protection et de réparation des structures en béton - Méthodes d'essai - Détermination du module d'élasticité en compression

Ta slovenski standard je istoveten z: **EN 13412:2002**

ICS:

91.080.40	Betonske konstrukcije	Concrete structures

SIST EN 13412:2002 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 13412

May 2002

ICS 91.080.40

English version

Products and systems for the protection and repair of concrete structures - Test methods - Determination of modulus of elasticity in compression

Produits et systèmes de protection et de réparation des structures en béton - Méthodes d'essai - Détermination du module d'élasticité en compression

Produkte und Systeme für den Schutz und die Instandsetzung von Betontragwerken - Prüfverfahren - Bestimmung des Elastizitätsmoduls im Druckversuch

This European Standard was approved by CEN on 27 December 2001.

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, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 13412:2002 E

Contents

Foreword

This document EN 13412:2002 has been prepared by Technical Committee CEN/TC 104 "Concrete and related products", the secretariat of which is held by DIN.

This document has been prepared by CEN/TC 104/SC 8 "Products and systems for the protection and repair of concrete structures", the secretariat of which is held by AFNOR.

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 November 2002, and conflicting national standards shall be withdrawn at the latest by December 2002.

This European Standard is one of a series dealing with products and systems for the protection and repair of concrete structures.

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, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies a method for the determination of the modulus of elasticity in compression for high creep strain repair products and systems, containing polymer binders (PC) and of mortars and concretes with polymer additives (PCC).

This method is not intended for CC repair materials, for which testing according to prEN 12390–3 should be used.

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 196-1, *Methods of testing cement – Part 1: Determination of strength*.

EN 1504-1, *Products and systems for the protection and repair of concrete structures - Definition, requirements, quality control, evaluation of conformity – Part 1: Definitions*.

prEN 1504-3[1], *Products and systems for the protection and repair of concrete structures - Definition, requirements, quality control, evaluation of conformity – Part 3: Structural and non-structural repair.*

EN 12390-1, *Testing of hardened concrete – Part 1: Shape, dimensions and other requirements for specimens and moulds.*

prEN 12390-3, *Testing of hardened concrete – Part 3: Compressive strength of test specimens.*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 1504-1 and prEN 1504-3[2] and the following apply.

3.1
compressive stress
the compressive force carried at any time by the test specimen, per unit of the original cross-section

3.2
compressive strain
the ratio of the change in the distance between two reference points along the axis of the test specimen per unit length of the original distance

3.3
elastic modulus
the ratio of stress to corresponding strain below the proportional limit, where the proportional limit is the greatest stress which a material is capable of supporting without any deviation from the proportionality of compressive stress to compressive strain

[1] Under preparation.

[2] Under preparation.

3.4
secant modulus
the ratio of stress to corresponding strain, measured relative to a level of pre-stress applied to bed firmly the specimen, platens and ball seating

Accordingly, the secant modulus is based on the compressive stress required to reduce the gauge length of the test specimen by 0,2 % from a pre-stress of approximately 10 % of the expected force at 0,002 compressive strain.

3.5
creep
the additional time-dependant strain that occurs in a test specimen under a constant applied stress

4 Principle

The principle of this test is to measure the secant modulus of the specimen by the application of a controlled axial compressive load to a prism of 4:1 aspect ratio and relating longitudinal compressive strain to the compressive stress inducing it.

A high rate of loading is used for PC or PCC specimens, compared with the procedure for CC specimens given in ISO 6784 to counteract the effects of creep in the specimens, which can significantly reduce the calculated value of secant modulus.

5 Equipment

5.1 **Mortar mixer**, in accordance with EN 196-1, or **forced action pan mixer**.

5.2 **Moulds**, prisms 40 mm × 40 mm × 160 mm in accordance with EN 196-1.

5.3 **Strain gauges or compressometers**, two are required. They shall each have a gauge length of at least 50 mm a maximum sensitivity of 50 µm/m and be able to provide continuous indication of change in gauge length.

5.4 **Compression testing machine**, suitable for the testing specimens of the dimensions given in (5.1) and conforming to the requirements of prEN 12390-4.

5.5 **Standard laboratory climate**, of (21 ± 2) ºC and (60 ± 10) % RH in accordance with annex A.

6 Preparation of test specimens

The components of the product under test shall be maintained at the standard test conditions (**5.5**) for at least 24 h before mixing. A forced action mixer shall be used to prepare a batch of product in accordance with the manufacturer's recommendations.

NOTE For preference a supplier's complete pack of pre-weighted components should be used, but where this is not practicable the proportioning of components should be in accordance with the manufacturers specification.

The mixed material shall then be compacted into prism moulds and fully cured following the manufacturer's recommended procedure. At least three prisms are required as test specimens.

The specimens shall be cured and stored as described in annex A. The moulds shall be removed 24 h after preparation of the test specimens.

7 Procedure

7.1 **Conditions and conditioning**: Immediately prior to testing, the test specimens shall be conditioned for at least 24 h under the standard conditions laid down in (**5.5**).

7.2 Measurement: Measure the width and thickness of each specimen at its middle to the nearest 0,1 mm and calculate the cross-sectional area.

7.3 Fitting strain gauges: Fit two gauges to opposite cast faces of the specimen, their gauge lengths being centrally disposed over the axis of the specimen. When attaching a strain gauge to a specimen, ensure that any distortion or damage to the specimen is minimal. There shall be no slippage between the grips of mechanical strain gauges and the specimen.

7.4 Test loading: Place the specimen in the compression test machine in accordance with the procedure of prEN 12390-3.

The load shall be applied at a rate of 2 N/s until a compressive strain of approximately 0,002 m/m is indicated. Record the applied load, N_1. Using the same rate of loading, smoothly remove and then re-apply the same load at least twice to ensure that the specimen and the platens are well seated and that the strain gauges are indicating consistently.

If the individual strains are not within a range of ± 10 % of their mean value at N_1, centre the specimen again and repeat the procedure. If the individual strains are still not within a range of ± 10 % of their mean value at N_1, the loading should be repeated at a higher loading rate, to a maximum of 10 N/s.

NOTE Where the above procedure does not produce a consistent result, for the strain at N_1, this can be due to the effects of excessive creep strain. This effect can be reduced by using a faster rate of load application.

If, following repeat testing at a higher rate of loading, it is not possible to reduce the differences to within this range, do not proceed with the test.

Next, zero the strain gauges (or the strain gauge recorder) while the specimen is under a preload N_2, which shall be approximately 10 % of N_1. Measure the change in compressive strain ($\Delta\varepsilon$) as the load is quickly cycled between loads N_2 and N_1. Four cycles shall be recorded, giving four values for $\Delta\varepsilon$ and ΔN.

8 Calculation

Calculate the secant modulus by dividing the difference between the two levels of applied load (i.e. $N_1 - N_2$) by the mean of the four measurements of change of strain ($\Delta\varepsilon$), expressing this as compressive stress per unit cross-sectional area. Calculate the mean secant modulus for a minimum of three specimens originating from the same mix. Express the value of the secant modulus to the nearest 100 N/mm^2.

9 Report

The following information shall be included in the test report:

a) a reference to the test method standard;

b) name and address of the test laboratory;

c) identification number and date of the test;

d) name and address of the manufacturer or supplier of the product;

e) name and identification marks or batch number of the product;

f) date of supply of the product;

g) date of preparation of the test specimens and any deviation from the prescribed method of preparation, including the cross-sectional area of each test specimen;

h) conditions of storage of prepared specimens prior to test;

i) date of test and details of the test equipment used, including the make, type of strain gauges and capacity and the calibration details or the identification number of the apparatus;

j) the test results, including the upper (N_1) and lower (N_2) load levels used in the testing cycle, the mean compressive strain for each test specimen, the secant modulus of elasticity of each test specimen and the mean secant modulus of elasticity;

k) precision data;

l) date of test report and signature.