SLOVENSKI STANDARD
SIST EN 13791:2007

01-april-2007

Ocenjevanje tlaļ ne trdnosti konstrukcije na mestu vgradnje in betonski elementi

Assessment of in-situ compressive strength in structures and precast concrete components

Bewertung der Druckfestigkeit von Beton in Bauwerken oder in Bauwerksteilen

Evaluation de la résistance à la compression du béton en place dans les structures et les éléments préfabriqués

Ta slovenski standard je istoveten z: **EN 13791:2007**

ICS:

91.080.40	Betonske konstrukcije	Concrete structures
91.100.30	Beton in betonski izdelki	Concrete and concrete products

SIST EN 13791:2007 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 13791

January 2007

ICS 91.080.40

English Version

Assessment of in-situ compressive strength in structures and precast concrete components

Evaluation de la résistance à la compression du béton en place dans les structures et les éléments préfabriqués

Bewertung der Druckfestigkeit von Beton in Bauwerken oder in Bauwerksteilen

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Ref. No. EN 13791:2007: E

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Foreword

This document (EN 13791:2007) 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of an identical text or by endorsement, at the latest by July 2007, and conflicting national standards shall be withdrawn at the latest by July 2007.

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.

Introduction

This European Standard provides techniques for estimating in-situ compressive strength in concrete structures and precast concrete components. Testing in-situ strength takes into account the effects of both the materials and execution (compaction, curing, etc.).

These tests do not replace concrete testing according to EN 206-1.

EN 206-1 refers to the guidance of this standard for assessing the strength in structures and precast concrete components.

The following examples illustrate where this estimate of in-situ strength of concrete may be required:

— when an existing structure is to be modified or redesigned;

— to assess structural adequacy when doubt arises about the compressive strength in the structure due to defective workmanship, deterioration of concrete due to fire or other causes;

— when an assessment of the in-situ concrete strength is needed during construction;

— to assess structural adequacy in the case of non-conformity of the compressive strength obtained from standard test specimens;

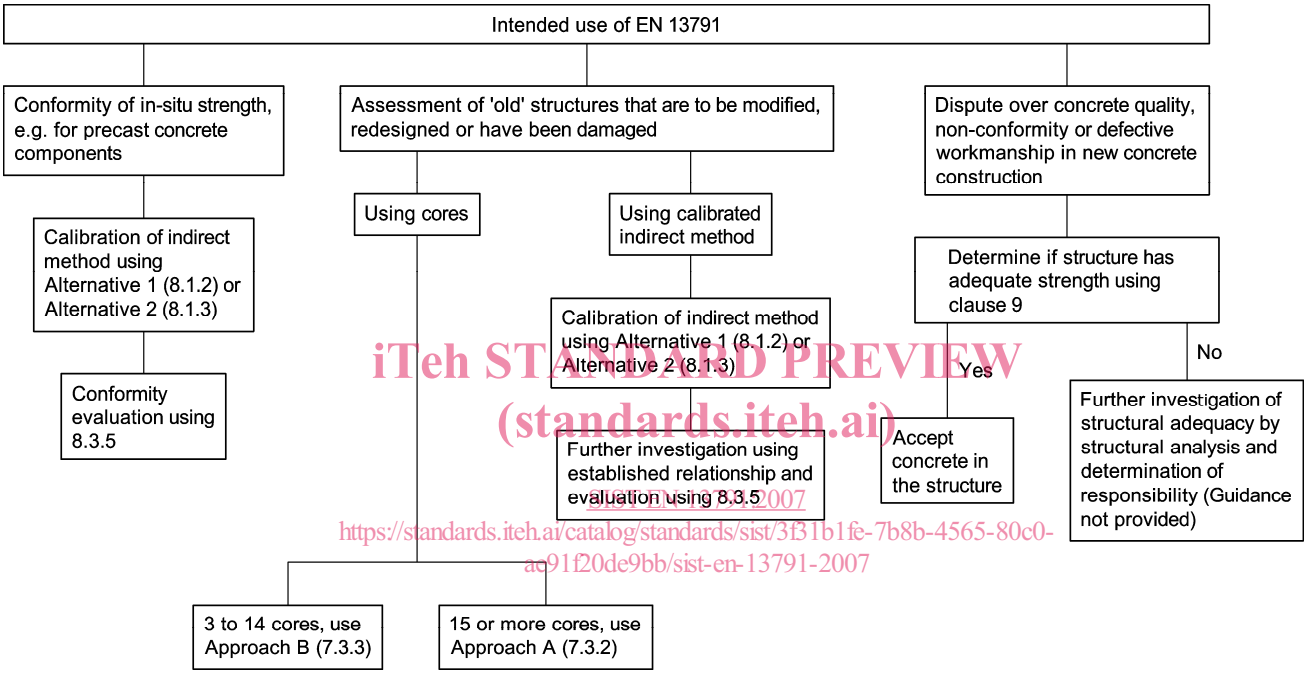
— assessment of conformity of the in-situ concrete compressive strength when specified in a specification or product standard.

Where identified in this standard, national provisions are permitted or required.

An outline of the procedures for these different uses of this standard is given in Flowchart 1.

For specific production conditions and constituent materials, development of economic design where permitted by national provisions may be possible through the assessing the partial safety factor, γ_c from knowledge of the in-situ compressive strength and the strength of standard test specimens.

When assessing compressive strengths in cases other than checking the quality of the concrete or the workmanship during execution or before accepting the structure for use, the appropriate reduction in the partial safety factor should be determined on a case-by-case basis according to national provisions.



Flowchart 1

1 Scope

This European Standard:

— gives methods and procedures for the assessment of the in-situ compressive strength of concrete in structures and precast concrete components;

— provides principles and guidance for establishing the relationships between test results from indirect test methods and the in-situ core strength;

— provides guidance for the assessment of the in-situ concrete compressive strength in structures or precast concrete components by indirect or combined methods.

This European Standard does not include the following cases:

— where indirect methods are used without correlation to core strength;

— assessment based on cores less than 50 mm in diameter;

— assessment based on less than 3 cores;

— use of microcores.

NOTE In these cases provisions valid in place of use apply.

This European Standard is not for the assessment of conformity of concrete compressive strength in accordance with EN 206-1 or EN 13369 except as indicated in EN 206-1:2000, 5.5.1.2 or 8.4.

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

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

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

EN 12390-2, *Testing hardened concrete – Part 2: Making and curing specimens for strength tests*

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

EN 12504-1, *Testing concrete in structures – Part 1: Cored specimens – Taking, examining and testing in compression*

EN 12504-2, *Testing concrete in structures – Part 2: Non-destructive testing – Determination of rebound number*

EN 12504-3, *Testing concrete in structures – Part 3: Determination of pull-out force*

EN 12504-4, *Testing concrete in structures – Part 4: Determination of ultrasonic pulse velocity*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 206-1:2000 and the following apply.

3.1
standard compressive strength
compressive strength determined on standard test specimens (cubes or cylinders) which are sampled, made, cured and tested in accordance with EN 12350-1, EN 12390-2 and EN 12390-3

3.2
core compressive strength
compressive strength of a core determined in accordance with EN 12504-1

3.3
in-situ compressive strength
strength in a structural element or precast concrete components expressed in terms of the equivalent strength of a standard cube or cylinder specimen

3.4
characteristic in-situ compressive strength
value of in-situ compressive strength below which 5 % of the population of all possible strength determinations of the volume of concrete under consideration are expected to fall

NOTE This population is unlikely to be the same population used to determine the conformity of the fresh concrete in EN 206-1.

3.5
test location
limited area selected for measurements used to estimate one test result, which is to be used in the estimation of in-situ compressive strength

3.6
test region
one or several structural elements, or precast concrete components assumed or known to be from the same population. A test region contains several test locations

4 Symbols and abbreviations

Δf	shift of the basic curve
δf	difference between the core strength and the strength value according to the basic relationship
$\delta f_{m(n)}$	mean of n, values of δf
F	pull-out force test result
f_{is}	in-situ compressive strength test result
$f_{is,\ lowest}$	lowest in-situ compressive strength test result
$f_{m(n),\ is}$	mean in-situ compressive strength of n test results
f_{ck}	characteristic compressive strength of standard specimens
$f_{ck,\ is}$	characteristic in-situ compressive strength
$f_{ck,\ is,\ cube}$	characteristic in-situ compressive strength expressed in equivalent strength of a 150 mm cube, see 7.1
$f_{ck,\ is,\ cyl}$	characteristic in-situ compressive strength expressed in equivalent strength of a 150 mm × 300 mm cylinder, see 7.1
$f_{is,\ 1}$	estimated in-situ compressive strength test result by indirect test methods when a specific relationship is established by core tests, (Alternative 1)
$f_{is,\ F}$	estimated in-situ compressive strength test result by pull-out tests calibrated by core tests, (Alternative 2)
$f_{is,\ R}$	estimated in-situ compressive strength test result by rebound hammer tests calibrated by core tests, (Alternative 2)
$f_{is,\ v}$	estimated in-situ compressive strength test result by ultrasonic pulse velocity tests calibrated by core tests, (Alternative 2)
f_F	initial value of in-situ strength obtained from the basic curve for a pull-out force, Figure 4, test result F used in the determination of the shift
f_R	initial value of in-situ strength obtained from the basic curve for a rebound hammer, Figure 2, test result R used in the determination of the shift
f_v	initial value of in-situ strength obtained from the basic curve for a pulse-velocity, Figure 3 test result v used in the determination of the shift
γ_c	partial safety factor for concrete
k	margin associated with small numbers of test results
k_1	coefficient that depends on the number of paired tests
k_2	coefficient that depends upon provisions valid in the place of use or, if none are given, a coefficient with a value of 1,48
n	number of test results
R	rebound hammer test result
s	standard deviation
v	ultrasonic pulse velocity test result

5 Principles

Assessment of in-situ compressive strength directly from core tests constitutes the reference method, see 7. The assessment of in-situ compressive strength may also be done indirectly by other tests, see 8.2 and 8.3, or by a combination of various test methods, see 8.4. Where indirect tests are used, the uncertainty associated with the relationship between the test and core test is taken into account.

The test data may be used to estimate the in-situ characteristic strength and the corresponding strength class according to EN 206-1.

6 Characteristic in-situ compressive strength in relation to compressive strength class

Table 1 gives requirements for the minimum characteristic in-situ compressive strength with respect to the compressive strength classes according to EN 206-1.

Table 1 — Minimum characteristic in-situ compressive strength for the EN 206-1 compressive strength classes

Compressive strength class according to EN 206-1	Ratio of in-situ characteristic strength to characteristic strength of standard specimens	Minimum characteristic in-situ strength N/mm^2	
		$f_{ck,\ is,\ cyl}$	$f_{ck,\ is,\ cube}$
C8/10	0,85	7	9
C12/15	0,85	10	13
C16/20	0,85	14	17
C20/25	0,85	17	21
C25/30	0,85	21	26
C30/37	0,85	26	31
C35/45	0,85	30	38
C40/50	0,85	34	43
C45/55	0,85	38	47
C50/60	0,85	43	51
C55/67	0,85	47	57
C60/75	0,85	51	64
C70/85	0,85	60	72
C80/95	0,85	68	81
C90/105	0,85	77	89
C100/115	0,85	85	98

NOTE 1 The in-situ compressive strength may be less than that measured on standard test specimens taken from the same batch of concrete.

NOTE 2 The ratio 0,85 is part of γ_c in EN 1992-1-1: 2004.