ILNAS

Institut luxembourgeois de la normalisation
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ILNAS-EN 12390-10:2018

Testing hardened concrete - Part 10: Determination of the carbonation resistance of concrete at atmospheric levels of carbon dioxide

Prüfung von Festbeton - Teil 10: Bestimmung des Karbonatisierungswiderstandes von Beton bei atmosphärischer

Essais pour béton durci - Partie 10 : Détermination de la résistance à la carbonatation du béton à des niveaux atmosphériques de dioxyde de carbone

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National Foreword

This European Standard EN 12390-10:2018 was adopted as Luxembourgish Standard ILNAS-EN 12390-10:2018.

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- Participate in the design of standards
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Prüfung von Festbeton - Teil 10: Bestimmung des Karbonatisierungswiderstandes von Beton bei atmosphärischer Konzentration von Kohlendioxid

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (EN 12390-10:2018) 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of an identical text or by endorsement, at the latest by June 2019, and conflicting national standards shall be withdrawn at the latest by June 2019.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes CEN/TS 12390-10:2007.

The series EN 12390, *Testing hardened concrete,* includes the following parts:

— *Part 1: Shape, dimensions and other requirements for specimens and moulds*

— *Part 2: Making and curing specimens for strength tests*

— *Part 3: Compressive strength of test specimens*

— *Part 4: Compressive strength — Specification for testing machines*

— *Part 5: Flexural strength of test specimens*

— *Part 6: Tensile splitting strength of test specimens*

— *Part 7: Density of hardened concrete*

— *Part 8: Depth of penetration of water under pressure*

— *Part 10: Determination of the carbonation resistance of concrete at atmospheric levels of carbon dioxide*

— *Part 11: Determination of the chloride resistance of concrete, unidirectional diffusion*

— *Part 12: Determination of the carbonation resistance of concrete — Accelerated carbonation method* (in preparation)

— *Part 13: Determination of the secant modulus of elasticity in compression*

— *Part 14: Semi-adiabatic method for the determination of heat released by concrete during its hardening process*

— *Part 15: Adiabatic method for the determination of heat released by concrete during its hardening process* (in preparation)

— *Part 16: Determination of the shrinkage of concrete* (in preparation)

— *Part 17: Determination of creep of concrete in compression* (in preparation)

and the following Technical Specification:

— *Part 9: Freeze–thaw resistance — Scaling*

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

In reinforced and prestressed concrete structures, conventional steel reinforcement needs to be protected by sufficient concrete cover to ensure that the intended working life will be achieved. Corrosion of reinforcement induced by carbonation can play a significant role in a structure's serviceability and consequently carbonation resistance of concrete, in particular of the cover zone, is an important property to be quantified.

This test may be used to measure the carbonation rate of any freshly cast concrete. It may be used to assess the impact of a change of a constituent, e.g. cement type, addition, or the impact of a change in mix proportions, e.g. w/c ratio, cement content, fines content.

The rate of carbonation determined by this test procedure may be used as an input into a model that estimates the start of corrosion of reinforcement.

When assessing the durability performance of a concrete with unknown carbonation resistance or a concrete with one or more unfamiliar constituents, it may be necessary to determine if this concrete/constituents gives a similar or better carbonation resistance than currently accepted concretes/constituents. CEN/TR 16563 sets out basic principles to be followed by equivalent durability procedures. From a European perspective, it makes sense to have common test procedures and common assessment procedures. This European Standard is currently the recommended European method for determining carbonation resistance at natural levels of carbon dioxide and it is recommended as a method to be used when determining the 'equivalent durability' with respect to carbonation.

Concrete may also be classified on the basis of its carbonation resistance. As this Standard provides test procedures, it only describes the production of standardized test results; how these test results are used to determine a class is not within the scope of this Standard.

For standardization purposes, the carbon dioxide concentration in the climate controlled chamber test is fixed at 400 ppm, which is an increase of 50 ppm over the value used in the previous version of this Standard; however, atmospheric levels of carbon dioxide are not constant in location or time. Carbon dioxide concentration in some urban and industrial areas may exceed 400 ppm.

1 Scope

This document specifies a method of determining the carbonation rate of a concrete, expressed in mm/√a.

This document establishes a procedure where a standardized climate controlled chamber is used and where specimens are placed on a natural exposure site protected from direct rainfall. The standardized climate controlled chamber procedure is the reference method.

These procedures are applicable for the initial testing of concrete, but they are not applicable for factory production control.

2 Normative references

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.

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*

3 Terms and definitions

No terms and definitions are listed in this document.

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

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

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

4 Principle

Pairs of beams of concrete (or two cubes per test age) from the same batch of concrete are stored in a climate controlled chamber as specified in 5.4 or on a natural exposure site as specified in 5.5. After defined periods of exposure, an approximately 50 mm thick slice of the beam is broken off at each test age and tested for its carbonation depth. If cubes are being used, they are broken in half and one half of each cube is used to measure the carbonation depth, the other half being discarded.

The carbonation depth is measured at three locations on each face of each beam/cube giving a potential total of 12 measurements per specimen and potentially 24 measurements for the two specimens. The mean carbonation depth of all measurements is calculated. The remains of the beams are returned to the climate controlled chamber for testing at other pre-defined ages. Using at least three sets of measurements taken at 3 months, 6 months and 1 year, the rate of carbonation expressed as mm/√a is determined.