FINAL DRAFT
International Standard

ISO/FDIS 16311-1

Maintenance and repair of concrete structures —

Part 1:
General principles

Entretien et réparation des structures en béton —

Partie 1: Principes généraux

ISO/TC **71**/SC **7**

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Contents

Page

Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 71, *Concrete, reinforced concrete and pre-stressed concrete*, Subcommittee SC 7, *Maintenance and repair of concrete structures.*

This second edition cancels and replaces the first edition (ISO 16311-1:2014), which has been technically revised.

The main changes are as follows:

— the definition of “repair” has been updated.

A list of all parts in the ISO 16311 series can be found on the ISO website.

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.

Introduction

In the context of this document, maintenance and repair are two closely related activities aimed at securing that a concrete structure (hereinafter referred to as “structure”) is retained in a state in which it can perform its required functions, while in an acceptable and safe condition. Maintenance can sometimes be used as a general term that also covers repair as a distinct activity to restore worn, damaged, or deteriorated parts. For a well-designed and well-executed concrete structure with proper maintenance, repair should not be necessary within the design service life of the structure.

This document covers the activities necessary to retain the performance of the structure above the required levels during its service life, such as:

— maintenance planning for existing structures;

— assessment of structure including investigation and evaluation of the performance of structure;

— planning and designing repair in case it is required due to wear, damage, or deterioration;

— execution of repair including preparation, execution, and documentation.

The main scope of this document is the maintenance and repair of existing structures. The goal of maintenance and repair strategies is to plan and execute systematic routines that minimize degradation of performance of a structure during its service life in the most cost-effective manner.

This document does not address newly built structures for which it is recommended that a maintenance plan should be established at the design stage. However, a so called “birth certificate” for newly built structures will be useful in later planning of maintenance and repair. Reference is given to ISO 16204, where this is covered.

This document provides the framework of maintenance activities for all kinds of structures or their components and gives general principles of each activity. As shown in Figure 1, this document is the first of four parts dealing with maintenance and repair of concrete structures. The subsequent three parts, namely “Assessment of existing structures”, “Design of repair”, and “Execution of repair” are the operational parts of this set of documents giving detailed requirements and guidelines (an extended hierarchy of the parts and other related International Standards are shown in Annex A).

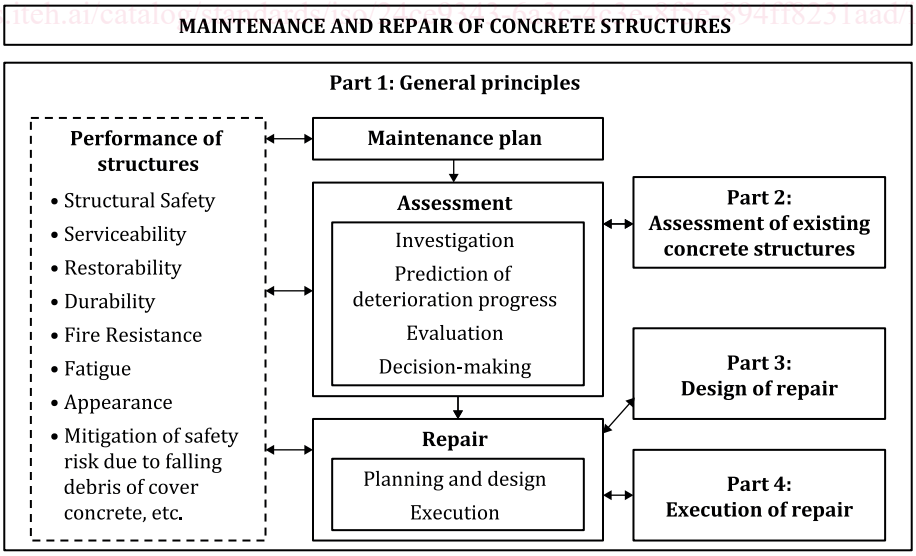


Figure 1 — Relationship between each part of the ISO 16311 series

Maintenance and repair of concrete structures —

Part 1:
General principles

1 Scope

This document presents the framework and general principles for maintenance and repair of all kinds of existing concrete structures — un-reinforced and reinforced concrete, prestressed concrete and steel-concrete composite structures, or their structural members.

In this document, deterioration is clearly distinguished from damage occurring in a short period and not developing over subsequent time, such as cracking and scaling due to earthquakes or impact loading, etc. Deterioration is mainly dealt with as a target for the maintenance activities.

This document also provides the basic concept of repair carried out to restore structural performance of existing structures.

This document does not cover those aspects of maintenance and repair that are related to serviceability and aesthetics without direct impact on durability and service life, e.g. cleaning of drains, removal of vegetation, refreshment of paint, etc.

This document also does not cover repair of defects during execution of new structures.

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.

ISO 16311-2, *Maintenance and repair of concrete structures — Part 2: Assessment of existing concrete structures*

ISO 16311-3, *Maintenance and repair of concrete structures — Part 3: Design of repairs and prevention*

ISO 16311-4, *Maintenance and repair of concrete structures — Part 4: Execution of repairs and prevention*

ISO 22040, *Life cycle management of concrete structures*

3 Terms and definitions

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

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

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

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

3.1
amended service life
revised service life period of a structure-in-service during which it meets prescribed performance requirements for duration specified by the owner, possibly representing an amendment of the original design service life

Note 1 to entry: A change from the original design service life can arise from changing owner requirements, accelerated deterioration of a structure or its components such that they do not meet prescribed performance requirements, a usage change affecting performance requirements, or the owner's selection of maintenance and repair scenarios that will possibly shorten or extend the original design service life period.

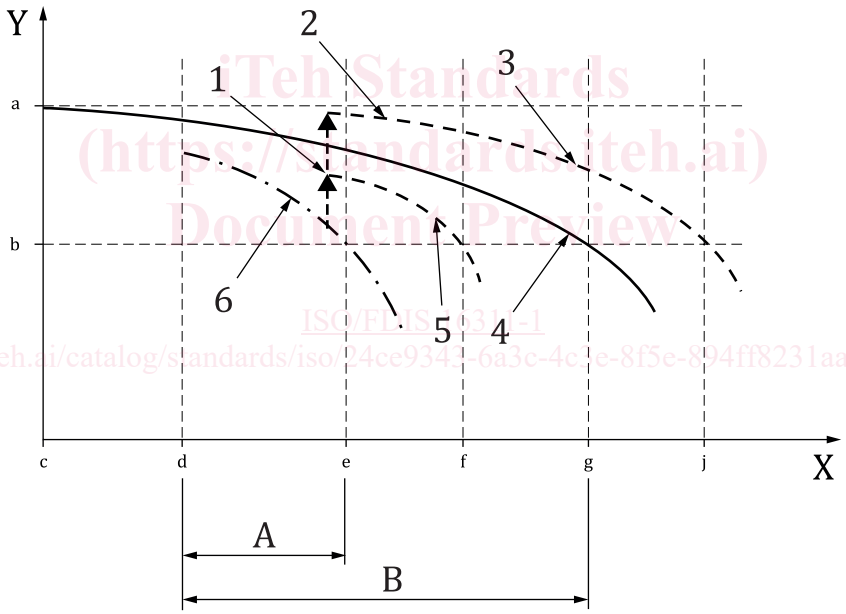
Note 2 to entry: See Figure 2.

3.2
assessment
set of activities performed in order to verify the reliability of an existing structure for future use

[SOURCE: ISO 13822:2010, 3.1]

3.3
design service life
period of time specified in design of structure for which a structure or its members is to be used for its intended purpose without major repair being necessary

Note 1 to entry: See Figure 2, in which two scenarios A and B are indicated for example.



Key
X period of time
Y performance
A remaining service life
B remaining design service life
1 repair in scenario A
2 repair in scenario B
3 performance estimated in scenario B
4 performance estimated at design stage
5 performance estimated in scenario A
6 performance estimated at assessment stage
[a] Initial performance.

b Required performance.

c Construction stage.

d Assessment stage.

e Predicted service life.

f Amended service life by scenario A of short-term repair.

g Design service life.

j Amended service life by scenario B of life extension.

Figure 2 — Definitions of service life

3.4
deterioration
process that adversely affects the performance of a structure, including reliability over time due to defects and damages caused by

— naturally occurring chemical, physical, biological, or other environmental actions,

— repeated mechanical actions such as those causing fatigue,

— wear due to use, abuse, and others, and

— improper operation and maintenance of the structure

[SOURCE: ISO 13822:2010, 3.3, modified]

3.5
durability
capability of a structure or any of its members to satisfy, with planned maintenance, the required performance over a specified period of time under the influence of the environmental action

Note 1 to entry: "durability" is often used as qualitative term to express condition in which structure maintains its required performance, such as structural safety, serviceability, and appearance, during the service life.

[SOURCE: ISO 13823:2008, 3.10, modified]

3.6
inspection
conformity evaluation by observation and judgment accompanied as appropriate by measurement, testing or gauging

Note 1 to entry: For structures, this evaluation consists of actions collecting information on the current state of a structure through observation and simplified non-destructive or destructive testing supplemented with materials and structural testing, as required.

3.7
investigation
collection of information through inspection, document search, load testing and other testing

3.8
maintenance
set of activities taken to check, evaluate the performance of a structure, and preserve/restore it so as to satisfy performance requirements in service

3.9
maintenance category
class of maintenance depending on importance, service life, environmental conditions, maintainability of the structures, etc.

Note 1 to entry: See Annex C for maintenance category.

3.10
maintenance plan
plan realizing maintenance strategy in order to ensure that the structure retain the performance within the specified tolerances throughout its service life

Note 1 to entry: This includes planning not only for assessment but also for repair or other remedial actions.

3.11
monitoring
frequent or continuous, normally long-term, observation or measurement with recording of appropriate data for deterioration and/or performance of structure using appropriate equipment

3.12
predicted service life
period of time estimated based on activities of assessment, such as recorded performance, previous experience, tests or modelling

Note 1 to entry: See Figure 2.

3.13
prevention
remedial action to prevent or slow down the further deterioration of a structure or structural member and to reduce the possibility of damage to the user or any third party, inhibiting the progress of deterioration, and proactively preventing deterioration

3.14
remaining design service life
period from the time of a given investigation of a structure till the end of its design service life

Note 1 to entry: See Figure 2.

3.15
remaining service life
period from the time of a given assessment of a structure until the end of its predicted service life

Note 1 to entry: See Figure 2.

3.16
remedial action
action carried out with the objective of arresting or slowing down the deterioration process, restoring or improving the performance of structure, or reducing the danger of damage or injury to the user or any third party

3.17
repair
restoration of a structure or its components to an acceptable condition by the renewal or replacement of worn, damaged, or deteriorated components including prevention and protection

Note 1 to entry: Repair is adopted to restore structural performance and to mitigate safety risks up to the initially required design level and to achieve the intended service life.

3.18
repair plan
plan for establishing the method and level of repair, determining the materials, sectional dimensions, and execution methods, specifying the control items during execution in consideration of the policy and level of repair

3.19
safety from risks due to falling debris
hazards of damage and/or injury caused by concrete fragments and surface coating (finishing) materials, etc. falling from a deteriorated structure