International Standard

ISO 16311-1

Maintenance and repair of concrete structures —

Part 1: General principles

Entretien et réparation des structures en béton —

Partie 1: Principes généraux

Second edition
2024-05

Reference number
ISO 16311-1:2024(en)

© ISO 2024



COPYRIGHT PROTECTED DOCUMENT

© ISO 2024

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword ..... **v**

Introduction ..... **vi**

1 Scope **1**

2 Normative references **1**

3 Terms and definitions **1**

4 Basis of maintenance and repair **4**
4.1 General 4
4.2 Procedure of maintenance and repair 5
4.3 Competence of personnel 5

5 Maintenance plan **5**
5.1 General 5
5.2 Timing of maintenance planning for structure 6
5.3 Maintenance category 6
5.4 Formulation of maintenance plans 6

6 Assessment **6**
6.1 General 6
6.2 Assessment plan 7
6.2.1 Preparation of assessment plan 7
6.2.2 Category of assessment 7
6.2.3 Level of assessment 7
6.3 Investigation 8
6.4 Registration of condition 8
6.5 Evaluation and decision making 8

7 Repair **9**
7.1 General 9
7.2 Planning and design 9
7.2.1 General 9
7.2.2 Option of remedial actions 9
7.2.3 Factors to consider 10
7.2.4 Choice of appropriate strategies 10
7.2.5 Choice of appropriate methods 11
7.2.6 Properties of materials, products and systems 11
7.2.7 Other remedial actions 11
7.3 Execution 12
7.3.1 General 12
7.3.2 General requirements 12
7.3.3 Structural stability before, under and after execution 12
7.3.4 Preparation of concrete substrate and reinforcement 12
7.3.5 Application of materials, products and systems 13
7.3.6 Quality control 13
7.3.7 Maintenance following completion of repair 13

8 Recording **13**
8.1 General 13
8.2 Period of preservation 13
8.3 Method of recording 13
8.3.1 Format of records and its accessibility 13
8.3.2 Items included in records 13
8.3.3 Records concerning repair 14

Annex A (informative) **Extended hierarchy of "standards for maintenance and repair of concrete structures" with national legislation and other related International Standards** **15**

Annex B (informative) **Hierarchy of terms** **16**

© ISO 2024 – All rights reserved

Annex C (informative) **Maintenance category** **17**
Bibliography **19**

© ISO 2024 – All rights reserved

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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.

© ISO 2024 – All rights reserved

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 repairs", and "Execution of repairs" 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).

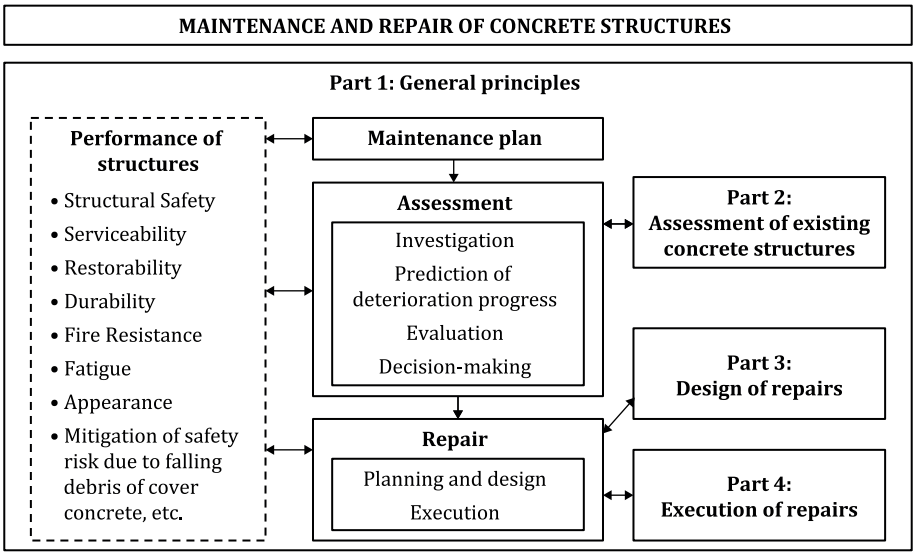


Figure 1 — Relationship between each part of the ISO 16311 series

© ISO 2024 – All rights reserved

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*

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

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/

© ISO 2024 – All rights reserved