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General practices for the repair of water-leakage cracks in concrete structures

Pratiques générales pour la répartition des fissures dues à l'eau dans les structures en béton

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

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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 documents 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.*

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.

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Introduction

This document is intended to provide an informative outline of practice for the repair of water-leakage cracks of concrete structures. There are two types of cracks that can form in a concrete structure; dry cracks and water-leakage (wet) cracks. Cracks normally form when the structural element is subject to phenomena such as dry-shrinkage and formation of joints. In the typical above grade sections of the concrete structure, dry cracks are more easily controlled and repaired with a well-defined maintenance method. When cracks are formed by the effect of hydrostatic pressure and the interface of the crack is subject to constant wetness, these cracks are designated as water-leakage cracks. The ingress of water through cracks often leads to increase of humidity in the building interior and this can result in a drastically accelerated degradation of durability for the concrete structure. In extreme cases, the presence of water can generate harmful effects that cause health problems to the users, rendering the building completely uninhabitable.

In the current state, it is difficult to secure a proper repair method of water-leakage cracks because of insufficient knowledge and understanding of the degradation factors (i.e. environmental conditions, the influences of various human activities, etc.), at an institutional level. There are already a number of repair techniques and application methods that are commonly used in application, but the required conditions for properly repairing and sealing the water-leakage cracks have often been proven to be difficult. Even in some cases where the repair procedures have been followed through properly with skilled workmanship, the performance level of the repair method may be insufficient and lead to reopening of the leakage crack. This can in turn lead to increase in maintenance and labour costs and decrease in the property value of the building structures.

Past records of remedial actions for cracks and damage in concrete structures have shown varying degrees of results; some have shown failure, some have had minor success and, in some cases, an adequate solution was implemented. However, the cases of successful repair methods cannot serve as a universal model for all cases of cracks and leakage due to the diversity of environmental degradation factors existing in the construction field. In this regard, a standardized practice for selecting appropriate leakage repair materials and methods in construction sites can be used. It is highly anticipated that a newly proposed awareness and understanding of these issues will prevent further unnecessary increase in maintenance costs, expenditures and results in improved durability performance of concrete structures.

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General practices for the repair of water-leakage cracks in concrete structures

1 Scope

This document provides a guideline for the selection of a proper grout material to repair water leakage through cracks and other deformities in concrete structures. The factors relevant to the quality control of maintenance and repair of water-leakage cracks are as the following;

a) conditions of water-leakage cracks;

b) performance requirements for repair materials;

c) different types of repair materials (grouts);

d) procedures followed to select the appropriate repair materials;

e) execution of different types of repair methods;

f) performance assessments of applied materials and methods;

g) data collection.

This document does not include any details on the repair of dry cracks and the causes of cracks. The details on dry crack repair are covered in ISO 16311-4.

A flow chart for maintenance of water-leakage cracks is shown in Figure 1.

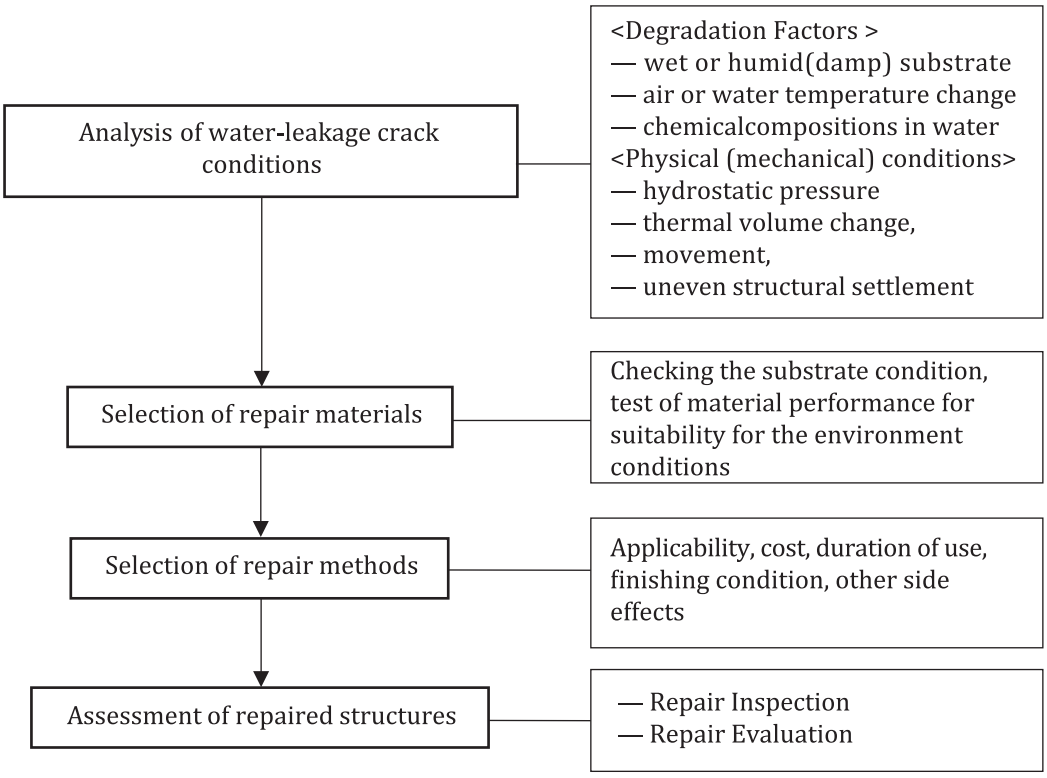


Figure 1 — Flow chart for maintenance of water-leakage chart

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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*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16311-2 and the following apply.

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

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

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

3.1
water-leakage crack
gap or split in a concrete substrate accompanied by intermittent or continuous contact of water present across the interface of the gap/split surface

3.2
leakage
amount or flowing state of liquid(water) that is entering into the interior of the concrete structure by means of a crack, hole, joint or other structural fault

3.3
thermal stability
ability to withstand long time exposure to elevated temperature

[SOURCE: IEC 60050:2010, 212-12-32]

3.4
washout resistance
property of the water-leakage crack (3.1) repair material related to the ability to withstand quantitative and qualitative loss of materials produced by the pressure and flow velocity of water

3.5
watertightness
repair material's waterproofing performance in consideration to its impermeability, adhesion strength to the concrete substrate surface and cohesive strength, while being subject to the influence of hydrostatic pressure

4 Conditions of water-leakage cracks

4.1 Types of water-leakage cracks

Leakage type and degree, and crack size (width) classification can be difficult as there are variances in leakage crack control methods with different repair material and methods. Leakage types can be classified as damp, seepage and flow, but specific amount of water leakage for the corresponding leakage types also varies. Optimal grout injection method and material selection through evaluation and testing can be applied for the respective classification of cracks (fine, medium and large cracks) in relation to different leakage types and degrees (damp, seepage and flow). In this document, a leakage type and degree classification system from ICRI 340.1-2006 is provided. The reference also provides an information on the possible crack size classification (crack width) that corresponds to the leakage types and degrees. This information is provided in Table 1.

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