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## Requirements for seismic assessment and retrofit of concrete structures

*Exigences relatives à l'évaluation sismique et à la réhabilitation des  
structures en béton*

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## 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 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](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

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](http://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 16711:2015), which has been technically revised.

The main change compared to the previous edition is the addition of a new paragraph in 5.3.

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](http://www.iso.org/members.html).

## Introduction

Earthquakes bringing damage to structures have occurred frequently in many areas of the world. Heavy damage caused by earthquakes are concentrated on vulnerable structures. Due to these damaging earthquakes, human lives are likely to be lost. Confusion in everyday life and stagnation of economic activities also occur.

As the result of the direct action of earthquakes, structures can collapse or overturn in earthquake-prone areas. However, given a main shock occurs, it is expected that through seismic assessment and retrofit of concrete structures, human life losses, economical losses and structural collapses can be mitigated and/or prevented and quick recovery can be attained.

In some countries, such as Japan and the USA, the framework for the identification of vulnerable structures before and after an earthquake, seismic retrofit decision-making and construction exists. In addition, the standards for seismic assessment technology and for seismic retrofit technology have already been established in these countries. Furthermore, technical manuals have been established in order to apply the standards to practical work. Therefore, based on these standards, the social system is built where a country, a district and a local administrative agency (authorities), the owner of the structure, a user, a retrofit designer, a retrofit work supervisor, a retrofit work supplier and other people concerned by this matter share a purpose of the seismic retrofit and the information about the effect of seismic retrofit. Also, the owner of the structure can judge the necessity of appropriate retrofit and a seismic retrofit execution is carried out smoothly.

However, it is not so frequent that a huge earthquake disaster occurs in a specific country or an area. These conditions disturb conducting seismic assessment, seismic retrofit work and smooth social decision making to conduct seismic retrofit. As a result, it is feared that the earthquake disaster expands and the recovery from the disaster is delayed when a large earthquake disaster happens once.

Therefore, it is necessary to establish a principle of the seismic assessment, decision making of the seismic retrofit, the framework of the procedure for screening the vulnerable structures, seismic retrofit execution. This document provides the requirements of standards for comprehensive evaluation of the seismic damage/expected damage of existing reinforced concrete structures and repair/retrofit. In other words, this document provides the standard work items related to seismic assessment and retrofit and standard procedures in each stage. It clarifies the contents and the scope of each duty.

In this document, the seismic performance of an existing reinforced concrete structure is expressed in terms of the intensity of earthquake motions that lead the structures to the safety limit state<sup>1)</sup> in principle. As the result, whether the existing reinforced concrete (referred to as RC, hereafter) structures fulfil the provisions of the design standard in the specific country or area does not matter. That is the feature of this document.

The retrofit can be also conducted based on seismic performance, not on whether the seismic retrofit meets an existing standard. Because this document sets such rational performance requirements, the vulnerable parts which should be reinforced are clearly identified.

National and regional standards are generally more prescriptive in nature than International Standards and vary somewhat from region to region.

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1) Ultimate limit state is mainly considered. However, other limit states can be considered such as seismic damage control limit state when time history analysis is used.

