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Bases for design of structures — General principles on risk assessment of systems involving structures

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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).

Attention is drawn to the possibility that some of the elements of 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).

Any trade name used in 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 98, *Bases for design of structures*, Subcommittee SC 2, *Reliability of structures*.

This second edition cancels and replaces the first edition (ISO 13824:2009), which has been technically revised. The main changes compared to the previous edition are as follows:

— risk-informed approach has been newly introduced to risk assessment in order to comply with the latest edition of ISO 2394 (ISO 2394:2015);

— requirements for treatment of uncertainty in risk estimation have been updated by introducing requirements related to sensitivity analysis;

— requirements for risk treatment have been updated by emphasizing the importance of optimization of prevention and mitigation measures including emergency preparedness;

— new informative annexes on examples of risk estimation of undesirable consequences caused by human-induced or natural events have been added.

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

Systems involving structures in public and private sectors depend on civil engineering technologies and structures. Structures support missions and business functions of whole systems.

Structures are subject to multiple natural, technological and malevolent human-induced hazards. Hazards can have adverse impacts on performance of systems involving structures, quality of life, stakeholders' assets inside or near structures, operations and operability, functions and reputation, structural safety and sustainability of environment.

Given the significance of hazards, it is imperative that all stakeholders such as owners, occupants, designers, operators, regulators at all levels and at all phases of the lifecycle of systems involving structures understand their responsibilities for achieving adequate structural safety, structural functionality and managing risk.

This document provides a common basis for assessing risk relevant to planning, design, assessment, maintenance, decommissioning and removal of structures, in accordance with ISO 31000.

In risk assessment, hazard identification and the estimation of consequence are primary procedures. For these, it is essential to assess the risk of systems involving structures rather than just the structures, since structural failure has significant consequences for systems, and a failure of systems such as fire protection systems can cause serious damages. However, actions for risk treatment are taken within the scope of structural design. Such considerations are reflected in the title of this document.

This document is intended to serve as a basis, along with other relevant standards on risk management, for those assessing risk for systems involving structures.

Bases for design of structures — General principles on risk assessment of systems involving structures

1 Scope

This document specifies general principles of risk assessment for systems involving structures. The focus is on strategic and operational decision-making related to design, assessment, maintenance and decommissioning of structures. This also includes formulation and calibration of related codes and standards. Systems involving structures can expose stakeholders at various levels in society to significant risks. The aim of this document is to facilitate and enhance decision-making with regard to monitoring, reducing and managing risks, and preparing for emergency in an efficient, cost-effective and transparent manner. Within the broader context of risk management, risk assessment provides decision-makers with procedures to determine whether or not, and in what manner, it is appropriate to treat risks.

This document provides a general framework as well as a procedure for identifying hazards and estimating, evaluating and treating risks of structures and systems involving structures. This document also provides a basis for code writers as well as designers to set reasonable target-reliability levels, such as stated in ISO 2394, based on the result of risk considerations. For existing structures, it is intended that assessment of the risks associated with the events that were not considered in the original design or with changes in use be implemented according to the principles stated in this document. This document can also be used for risk assessment of exceptional structures upon specific adaptation and detailing, the design of which is not usually within the scope of existing codes.

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 2394, *General principles on reliability for structures*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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
acceptable risk
level of *risk* (3.9) that an individual or society accepts or tolerates to secure certain benefits

3.2
cost/benefit analysis
analysis contributing to decision-making on whether to adopt a project or a plan by quantifying and comparing its costs and benefits

3.3
extraordinary event
very rare event that causes very severe consequences