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General principles on reliability for structures

Principes généraux de la fiabilité des constructions

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Contents

Page

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Internet central@iso.ch
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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 2394 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 2394:1986), which has been technically revised.

Annexes A to F of this International Standard are for information only.

Introduction

This International Standard constitutes a common basis for defining design rules relevant to the construction and use of the wide majority of buildings and civil engineering works, whatever the nature or combination of the materials used. However, their application to each type of material (concrete, steel, timber, masonry, etc.) will require specific adaptation to ensure a degree of reliability which, as far as possible, is consistent with the objectives of the code drafting committees for each material.

This International Standard is intended to serve as a basis for those committees responsible for the task of preparing national standards or codes of practice in accordance with the technical and economic conditions in a particular country, and which take into account the nature, type and conditions of use of the structure and the properties of the materials during its design working life. It will also provide a common basis for other International Standards (e.g. ENV 1991-1 EC1) dealing with load-bearing structures. Thus it has a conceptual character and it is of a fairly general nature.

It is important to recognize that structural reliability is an overall concept comprising models for describing actions, design rules, reliability elements, structural response and resistance, workmanship, quality control procedures and national requirements, all of which are mutually dependent.

The modification of one factor in isolation could therefore disturb the balance of reliability inherent in the overall concept.

It is therefore important that the modification of any one factor should be accompanied by a study of the implications relating to the overall reliability concept.

General principles on reliability for structures

1 Scope

This International Standard specifies general principles for the verification of the reliability of structures subjected to known or foreseeable types of action. Reliability is considered in relation to the performance of the structure throughout its design working life.

The general principles are applicable to the design of complete structures (buildings, bridges, industrial structures, etc.), the structural elements making up the structure and the foundations.

This International Standard is also applicable to the successive stages in construction, namely the fabrication of structural elements, the transport and handling of the structural elements, their erection and all work on site, as well as the use of the structure during its design working life, including maintenance and repair.

To allow for the differences in design practice between different countries, the national standards or codes of practice may be simpler or more detailed in comparison with this International Standard.

Generally the principles are also applicable to the structural appraisal of existing constructions or assessing changes of use. However in some respects this is associated with special aspects of the basic variables and calculation models. Such aspects are considered in clause 10.

NOTE — When this International Standard is applied in a particular country for the development of its standards, it is admissible not to use those clauses which are not in accordance with the regulations of that particular country.

2 Definitions

For the purposes of this International Standard, the following definitions apply.

NOTE — An alphabetical index of the definitions is given in annex H.

2.1 General terms

2.1.1 structure: Organized combination of connected parts designed to provide some measure of rigidity.

2.1.2 structural element: Physically distinguishable part of a structure.

EXAMPLES: Column, beam, plate.

2.1.3 structural system: Load-bearing elements of a building or civil engineering works and the way in which these elements function together.

2.1.4 compliance: Fulfilment of specified requirements.

2.1.5 life cycle: Total period of time during which the planning, execution and use of a construction works takes place. The life cycle begins with identification of needs and ends with demolition.

2.2 Terms relating to design in general

2.2.1 design situation: Set of physical conditions representing a certain time interval for which the design demonstrates that relevant limit states are not exceeded.

2.2.2 persistent situation: Normal condition of use for the structure, generally related to its design working life.

NOTE — "Normal use" includes possible extreme loading conditions due to wind, snow, imposed loads, earthquakes in areas of high seismicity, etc.

2.2.3 transient situation: Provisional condition of use or exposure for the structure.

EXAMPLE: During its construction or repair, which represents a time period much shorter than the design working life.

2.2.4 accidental situation: Exceptional condition of use or exposure for the structure.

EXAMPLES: Flood, land slip, fire, explosion, impact or local failure, which represent in most cases a very short time period (apart from situations where a local failure may remain undetected during a longer period).

2.2.5 serviceability: Ability of a structure or structural element to perform adequately for normal use under all expected actions.

2.2.6 failure: Insufficient load-bearing capacity or inadequate serviceability of a structure or structural element.

2.2.7 reliability: Ability of a structure or structural element to fulfil the specified requirements, including the working life, for which it has been designed.

2.2.8 reference period: A chosen period of time which is used as a basis for assessing values of variable actions, time-dependent material properties, etc.

2.2.9 limit state: A state beyond which the structure no longer satisfies the design performance requirements.

NOTE — Limit states separate desired states (no failure) from undesired states (failure).

2.2.10 ultimate limit state: A state associated with collapse, or with other similar forms of structural failure.

NOTE — This generally corresponds to the maximum load-carrying resistance of a structure or structural element but in some cases to the maximum applicable strain or deformation.

2.2.11 serviceability limit state: A state which corresponds to conditions beyond which specified service requirements for a structure or structural element are no longer met.

2.2.12 irreversible limit state: A limit state which will remain permanently exceeded when the actions which caused the excess are removed.

2.2.13 reversible limit state: A limit state which will not be exceeded when the actions which caused the excess are removed.

2.2.14 structural integrity (structural robustness) : Ability of a structure not to be damaged by events like fire, explosions, impact or consequences of human errors, to an extent disproportionate to the original cause.

2.2.15 design working life: Assumed period for which a structure or a structural element is to be used for its intended purpose without major repair being necessary.

2.2.16 maintenance: Total set of activities performed during the design working life of a structure to enable it to fulfil the requirements for reliability.