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## General principles on the design of structures for durability

*Principes généraux du calcul des constructions pour la durabilité*



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Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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.

ISO 13823 was prepared by Technical Committee ISO/TC 98, *Bases for design of structures*, Subcommittee SC 2, *Reliability of structures*.

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## Introduction

The limit-states method, as developed in ISO 2394, has been adopted and used for preparing and harmonizing national and regional structural design standards and codes around the world. Although ISO 2394 includes durability in its principles, the limit-states method has not been developed for failures due to material deterioration to the extent that it has for failures due to actions such as gravity, wind, snow and earthquake. Also, many premature failures have occurred because of a lack of understanding of material deterioration in the structural engineering profession.

The first objective in developing this International Standard is to improve the evaluation and design of structures for durability by the incorporation of building-science principles into structural-engineering practice. These principles are now being taught in engineering courses in many countries. This goal is achieved by the incorporation of these principles into the limit-states method currently used in structural engineering practice and defined in ISO 2394, and by the use of a common, user-friendly terminology for physical phenomena.

Developments have recently taken place in mathematical modelling of the mechanisms that cause material deterioration and failure. There is a need to harmonize the use of these models in practice by using the limit-states method and a common terminology.

The second objective in developing this International Standard is to provide a framework for the development of mathematical models to predict the service life of components of the structure. Such models are currently being developed, for example, for concrete slabs subjected to chloride diffusion from de-icing salts. These models are material-dependent and, therefore, are being developed by other ISO/TCs. The goal of this International Standard is to ensure that all analytical models are incorporated into the limit-states method, the same as currently used for the verification and design of structures for gravity, wind, snow and earthquake actions.

While this International Standard does not address design procedures for durability, it lays a solid foundation by identifying a process starting from the structure's environment, followed by mechanisms that transfer this environment into environmental actions on component materials leading to action effects, such as damage (see Figure 1). It is necessary to take this cause-and-effect process into account in developing methods for the prediction of service life.

This International Standard is intended to serve a similar unification role as ISO 2394 has had over the past 30 years for the verification and design of structures against failure due to mechanical actions, such as gravity, wind, snow and earthquake.

This International Standard does not directly address sustainability for structures, except through referencing in notes in 8.4 and Clause 10. Most considerations of sustainability, such as the choice of material as it affects waste and energy consumption, are outside the scope of this International Standard. Sustainability considerations in the future, however, are expected to increase the emphasis on choice of materials, technologies, inspectability, maintenance, repair and replacement in the planning and design of structures.

It is intended that this International Standard be used in parallel with ISO 15686 (all parts) on service-life planning for buildings and construction assets. Service-life prediction for structures based on experience and testing are contained in ISO 15686 (all parts). Service-life prediction of structures based on the modelling of durability, in addition to experience and testing, using conceptual as well as mathematical models, are described in this International Standard.