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General principles on reliability for structures — Vocabulary

Principes généraux de la fiabilité des constructions — Vocabulaire

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Contents

Page

Foreword

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This document was prepared by Technical Committee ISO/TC 98, *Bases for design of structures*, Subcommittee SC 01, *Terminology and symbols.*

This second edition cancels and replaces the first edition (ISO 8930:1987), which has been technically revised.

The main changes compared to the previous edition are as follows:

— terms and definitions from the revised ISO 2394:2015 have been updated;

— terms and definitions from all other TC98 standards have been added;

— languages other than English have been deleted.

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

General principles on reliability for structures — Vocabulary

1 Scope

This document establishes the common vocabulary of the principal terms used in the field of reliability of structures and design actions used within ISO TC98 documents on bases for design of structures.

2 Normative references

There are no normative references in this document

3 Terms and definitions

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

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

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

3.1 General

3.1.1
assessment
total set of activities performed in order to verify the *reliability* (3.2.19) of an existing *structure* (3.1.31)

[SOURCE: ISO 2394:2015, 2.1.12]

3.1.2
compliance
fulfilment of specified *requirements* (3.1.23)

[SOURCE: ISO 2394:2015, 2.1.6]

3.1.3
component
part of the *structure* (3.1.31) and non-structural part that can affect the *durability* (3.5.2) of the structure

[SOURCE: ISO 13823:2008, 3.6, modified — "any" has been deleted and "may" has been changed to "can".]

3.1.4
consumer
participant of the building process purchasing a *lot* (3.10.18) for further procedure or use

[SOURCE: ISO 12491:1997, 3.47, modified — "any" has been deleted.]

3.1.5
cultural resource
structure (3.1.31), building, landscape, archaeological site, or other engineering works, that have been formally recognized for its *heritage value* (3.12.7)

[SOURCE: ISO 13822:2010, I.3.3]

3.1.6
design service life
service life (3.1.25) specified in design for which a *structure* (3.1.31) or a *structural member* (3.1.30) is used for its intended purpose with planned maintenance, but without substantial *repair* (3.1.22) being necessary

Note 1 to entry: Design service life is also called design working life.

3.1.7
estimation
operation of assigning, from observations on a sample, numerical values to the parameters of a distribution chosen as the statistical model of the *population* (3.1.18) from which this sample was taken

[SOURCE: ISO 12491:1997, 3.22]

3.1.8
geotechnical work
work that includes soil or *rock* (3.1.24) as primary *components* (3.1.3) with or without structural parts made of concrete, steel, or other materials

[SOURCE: ISO 23469:2005, 3.24]

3.1.9
heritage structure
existing *structure* (3.1.31) or structural *component* (3.1.3) of a heritage resource that has been recognized by the appropriate authorities for its *heritage value* (3.12.7)

[SOURCE: ISO 13822:2010, I.3.6]

3.1.10
inspection
on-site examination within the scope of *quality control* (3.1.20) and condition *assessment* (3.1.1) aiming to assess the present condition of a *structure* (3.1.31)

[SOURCE: ISO 2394:2015, 2.1.17]

3.1.11
investigation
collection and evaluation of information through *inspection* (3.1.10), document search, *load testing* (3.8.3.9) and other testing

[SOURCE: ISO 13822:2010, 3.6]

3.1.12
life cycle
process of life incorporating initiation, project definition, design, construction, commissioning, operation, maintenance, refurbishment, replacement, deconstruction, and ultimate disposal, recycling, or re-use of the *structure* (3.1.31) (or parts thereof), including its *components* (3.1.3), *systems* (3.1.32), and building services

[SOURCE: ISO 2394:2015, 2.1.7]

3.1.13
life cycle maintenance
combination of all technical and associated administrative *actions* (3.6.1.2) during a *component*'s (3.1.3) *service life* (3.1.24) with the aim of retaining it in a state in which it can perform its required functions

[SOURCE: ISO 13823:2008, 3.15, modified — the term has been changed from "maintenance" to "life cycle maintenance".]

3.1.14
model
simplified conceptual or mathematical idealization or test set-up simulating the *structure environment* (3.5.5), *transfer mechanisms* (3.5.4), *environmental action* (3.6.1.8), *action effects* (3.6.13.1) and structural behaviour that can lead to *failure* (3.8.1.1)

[SOURCE: ISO 13823:2008, 3.16]

3.1.15
monitoring
frequent or continuous, normally long-term, observation or measurement of structural conditions or *actions* (3.6.1.2) or structural response

[SOURCE: ISO 2394:2015, 2.1.16]

3.1.16
parapet
low wall built along the *crest* (3.6.7.5) of a seawall

[SOURCE: ISO 21650:2007, 2.44]

3.1.17
pipeline
long tube or a network of tubing used for the transportation of fluid, gas, or solid mixed with fluid or gas

[SOURCE: ISO 23469:2005, 3.40]

3.1.18
population
totality of units under consideration for which the same probabilistic descriptions (mean values, etc.) are valid

[SOURCE: ISO 2394:2015, 2.1.22, modified — "set of entities" has been changed to " totality of units".]

3.1.19
producer
participant of the building process supplying a *lot* (3.10.18) for further procedure or use

[SOURCE: ISO 12491:1997, 3.46, modified — "any" has been deleted.]

3.1.20
quality control
activities to control quality of design, execution, use, and decommissioning of a *structure* (3.1.31)

[SOURCE: ISO 2394:2015, 2.1.28]

3.1.21
rehabilitation
repairing (3.1.22) or upgrading of an existing *structure* (3.1.31)

[SOURCE: ISO 2394:2015, 2.1.15]

3.1.22
repair
restoring the condition of a *structure* (3.1.31) that has been damaged or deteriorated

[SOURCE: ISO 2394:2015, 2.1.14, modified — "(of a structure)" has been delete from the term.]

3.1.23
requirement
demand with respect to structural aspects like safety for people and environment, functionality, usage, and commitment of resources and cost efficiency

[SOURCE: ISO 2394:2015, 2.1.5]

3.1.24
rock
aggregate of one or more minerals

[SOURCE: ISO 21650:2007, 2.57]

3.1.25
service life
actual period of time during which a *structure* (3.1.31) or any of its *components* (3.1.3) satisfy the design performance *requirements* (3.1.23) without unforeseen major *repair* (3.1.22)

Note 1 to entry: Service life is also called working life.

[SOURCE: ISO 13823:2008, 3.21]

3.1.26
span
effective span of horizontal or inclined members assuming conditions of simple support which is the overhang for cantilevers and the shorter span for two-way spanning slabs

[SOURCE: ISO 4356:1977, B.11, modified — the definition has been slightly reworked editorially.]

3.1.27
stone
quarried or artificially broken *rock* (3.1.24) for use in construction, either as an aggregate or cut into shaped blocks as dimension stone

[SOURCE: ISO 21650:2007, 2.70]

3.1.28
storey height
vertical distance between the points of support of horizontal supporting members at successive floor levels

[SOURCE: ISO 4356:1977, B.12]

3.1.29
structural engineering context
background or reasons why the *risk* (3.11.17) *assessment* (3.1.1) is implemented from structural perspectives

[SOURCE: ISO 13824:2020, 3.19]

3.1.30
structural member
physically distinguishable part of a *structure* (3.1.31), e.g. column, beam, plate, foundation

[SOURCE: ISO 2394:2015, 2.1.2]

3.1.31
structure
arrangement of materials that is expected to withstand certain *actions* (3.6.1.2) and to perform some intended function

[SOURCE: ISO 13824:2009, 3.21]

3.1.32
system
bounded group of interrelated, interdependent, or interacting members forming an entity that achieves a defined objective in its environment through interaction of its parts and interactions of its parts with the environment

[SOURCE: ISO 2394:2015, 2.1.3]

3.1.33
unit
defined quantity of building material, *component* (3.1.3) or element of a building or other civil engineering work that can be individually considered and separately tested

[SOURCE: ISO 12491:1997, 3.3]

3.1.34
upgrading
modifications of an existing *structure* (3.1.31), construction works, and procedures to improve its *structural performance* (3.8.3.21) or facilitate its use for new purposes

[SOURCE: ISO 2394:2015, 2.1.13]

3.1.35
utilization plan
plan containing the intended use (or uses) of the *structure* (3.1.31) and listing the operational conditions of the structure including maintenance *requirements* (3.1.23) and the corresponding performance requirements

[SOURCE: ISO 2394:2015, 2.1.44]

3.2 Reliability of structures

3.2.1
alternate load path
ALP
alternative for a load to be transferred from a point of application to a point of *resistance* (3.8.1.6)

[SOURCE: ISO 2394:2015, 2.2.33]

3.2.2
characteristic value
value of a parameter (either an *action* (3.6.1.2), or a property of a member or a material) that has a specified probability of not being exceeded

[SOURCE: ISO 4356:1977, B.3, modified — "transcended unfavourably" has been changed to "exceeded".]

3.2.3
code calibration
determination of the *reliability elements* (3.2.22) in a given code format in order to reach the *reliability target* (3.2.24)

[SOURCE: ISO 2394:2015, 2.2.36]

3.2.4
design value
value used in semi-probabilistic methods obtained by modifying the characteristic value by a partial factor or, in special circumstances, by direct assessment

3.2.5
deterministic method
calculation method in which the *basic variables* (3.8.3.2) are treated as non-random

3.2.6
ductility
ability to deform beyond the elastic limit under cyclic loadings without significant reduction in strength or energy absorption capacity

[SOURCE: ISO 3010:2017, 3.3]

3.2.7
exposure event
event which can cause *damage* (3.11.5) or otherwise affect the *performance indicators* (3.2.15) for the *structure* (3.1.31)

[SOURCE: ISO 2394:2015, 2.1.11, modified — "may" has been changed to "can".]

3.2.8
environmental influence
physical, chemical, or biological influences which can deteriorate the materials constituting a *structure* (3.1.31), which in turn can affect its *serviceability* (3.4.10) and safety in an unfavourable way

[SOURCE: ISO 2394:2015, 2.3.18, modified — "may" has been changed to "can".]

3.2.9
first order reliability method / second order reliability method
FORM / SORM
numerical methods used for the determination of the *reliability* (3.2.19) index β

[SOURCE: ISO 2394:2015, 2.2.28, modified — the term has been changed from "First/Second Order Reliability Methods" to "first order reliability method / second order reliability method".]

3.2.10
key element

structural member (3.1.30) upon which the *ultimate limit state* (3.4.12) performance of the *structure* (3.1.31) depends

[SOURCE: ISO 2394:2015, 2.2.35]

3.2.11
member reliability
reliability (3.2.19) of a single *structural member* (3.1.30) which has one single dominating *failure mode* (3.8.1.2)

[SOURCE: ISO 2394:2015, 2.1.20]

3.2.12
nominal value
value fixed on a non-statistical basis, for instance, on acquired experience or on physical constraints

[SOURCE: ISO 2394:2015, 2.2.32]

3.2.13
partial factor format
calculation format in which allowance is made for the uncertainties and variabilities assigned to the *basic variables* (3.8.3.2) by means of representative values, partial factors and, if relevant, additive quantities

[SOURCE: ISO 22111:2007, 3.19]

3.2.14
performance criteria
set of conditions for specifying the response of a *structural system* (3.8.3.22) to meet the expected state defined by engineering parameters, such as acceptable displacements, strains or stresses, that characterize the *performance objectives* (3.2.16) of design

[SOURCE: ISO 23469:2005, 3.37, modified — "geotechnical work" has been changed to "structural system".]

3.2.15
performance indicator
parameter describing a certain property of the *structure* (3.1.31) or a certain characteristic of the structural behaviour

[SOURCE: ISO 2394:2015, 2.1.25]

3.2.16
performance objective
expression of the expected performance of a facility in order to fulfil its purposes and functions

[SOURCE: ISO 23469:2005, 3.38]

3.2.17
permissible stress method
calculation method in which the stresses occurring under the expected maximum loads are compared with some fraction of the *resistance* (3.8.1.6) of the materials

Note 1 to entry: Also called allowable stress method.

3.2.18
probabilistic method
verification methods in which the relevant *basic variables* (3.8.3.2) are treated as random variables, random processes, and random fields, discrete or continuous

[SOURCE: ISO 2394:2015, 2.2.21]

3.2.19
reliability
ability of a *structure* (3.1.31) or *structural member* (3.1.30) to fulfil the specified *requirements* (3.1.23), during the *service life* (3.1.25), for which it has been designed

Note 1 to entry: Reliability is often expressed in terms of probability.

Note 2 to entry: Reliability covers safety, *serviceability* (3.4.10) and *durability* (3.5.2) of a structure.

[SOURCE: ISO 2394:2015, 2.1.8]

3.2.20
reliability class
class of *structures* (3.1.31) or *structural members* (3.1.30) for which a particular specified degree of *reliability* (3.2.19) is required

[SOURCE: ISO 2394:2015, 2.1.35]

3.2.21
reliability differentiation
socio-economic optimization of the resources to be used to build construction works, taking into account all the expected consequences of *failures* (3.8.1.1) and the cost of the construction

[SOURCE: ISO 2394:2015, 2.1.36]

3.2.22
reliability elements
numerical quantities used in the partial factors format, by which the specified target *reliability* (3.2.19) is assumed to be reached

[SOURCE: ISO 2394:2015, 2.2.29, modified — Note 1 to entry has been deleted.]

3.2.23
reliability-based design
design procedure that is subjected to prescribed *reliability* (3.2.19) level of the *structure* (3.1.31)

[SOURCE: ISO 2394:2015, 2.1.19]

3.2.24
reliability target
specified average acceptable *failure* (3.8.1.1) probability that is to be reached as close as possible

[SOURCE: ISO 2394:2015, 2.1.45, modified — Note 1 to entry has been deleted.]

3.2.25
robustness
damage (3.11.5) insensitivity or ability of a *structure* (3.1.31) to withstand adverse and unforeseen events (like fire, explosion, impact) or consequences of human errors without being damaged to an extent disproportionate to the original cause

[SOURCE: ISO 2394:2015, 2.1.46, modified — "ability of a structure..." is modified to "damage insensitivity or ability of a structure ..."]

3.2.26
sampling inspection
inspection (3.1.10) in which decisions are made to accept or not accept a *lot* (3.10.18), based on results of a sample selected from that lot

[SOURCE: ISO 12491:1997, 3.41]

3.2.27
scenario
qualitative description of a series of events in time and space and their inter-relationship given the occurrence of a *hazard* (3.11.8)

[SOURCE: ISO 13824:2009, 3.18]

3.2.28
site load
load applied provisionally to the *structure* (3.1.31) during construction

3.2.29
system reliability
reliability (3.2.19) of a *system* (3.1.32) of more than one relevant *structural member* (3.1.30) or a structural member which has more than one relevant *failure mode* (3.8.1.2) end

[SOURCE: ISO 2394:2015, 2.1.21, modified — "end" added at the end of the definition.]

3.2.30
target reliability level
level of *reliability* (3.2.19) required to ensure acceptable safety and *serviceability* (3.4.10)

[SOURCE: ISO 13822:2010, 3.17]

3.3 Design situations

3.3.1
accidental design situation
accidental situation
design situation involving possible exceptional conditions for the *structure* (3.1.31) in use or exposure, including flooding, fire, explosion, impact, mal-operation of *systems* (3.1.32), or local *failure* (3.8.1.1)

[SOURCE: ISO 2394:2015, 2.2.4, modified — second term has been added.]

3.3.2
design situation
assessment situation
set of physical conditions representing a certain time interval for which it shall be demonstrated that relevant *limit states* (3.4.1) are not exceeded

[SOURCE: ISO 2394:2015, 2.2.1, modified — second term has been added.]

3.3.3
level of verification
level of the verification used to assess the *compliance* (3.1.2) with the objectives for all design situations (3.3.2)

[SOURCE: ISO 2394:2015, 2.2.27, modified — Note 1 to entry has been deleted.]

3.3.4
persistent design situation
normal condition of use for the *structure* (3.1.31)

[SOURCE: ISO 2394:2015, 2.2.2]

3.3.5
seismic design situation
design situation (3.3.2) involving the exceptional conditions when the *structure* (3.1.31) is subjected to a seismic event

[SOURCE: ISO 2394:2015, 2.2.5]

3.3.6
structural safety
ability (of a structure or *structural member* (3.1.30)) to avoid exceedance of *ultimate limit states* (3.4.12), including the effects of specified accidental phenomena, with a specified level of *reliability* (3.2.19), during a specified period of time

[SOURCE: ISO 2394:2015, 2.1.9]

3.3.7
transient design situation
transient situation
provisional condition of use or exposure for the *structure* (3.1.31), for example, during its construction or *repair* (3.1.22), representing a time period much shorter than the *design service life* (3.1.6)

[SOURCE: ISO 2394:2015, 2.2.3, modified — second term has been added.]

3.4 Limit states

3.4.1
limit state
states beyond which a *structure* (3.1.31) no longer satisfies the design *requirements* (3.1.23)

[SOURCE: ISO 2394:2015, 2.2.7]

3.4.2
limit state method
calculation method in which an attempt is made to prevent the *structure* (3.1.31) attaining certain *limit states* (3.4.1)

Note 1 to entry: The allowable stresses method is sometimes used with the same meaning.

3.4.3
condition limit state
well-defined and controllable *limit state* (3.4.1) without direct negative consequences, which is often an approximation to a real limit state that cannot be well defined or is difficult to calculate

[SOURCE: ISO 2394:2015, 2.2.13, modified — Note 1 to entry has been deleted.]

3.4.4
initiation limit state
state that corresponds to the initiation of significant *deterioration* (3.12.3) of a *component* (3.1.3) of the *structure* (3.1.31)

Note 1 to entry: Initiation *limit state* (3.4.1) is one of the examples of *condition limit state* (3.4.3).

[SOURCE: ISO 13823:2008, 3.13, modified — second term has been deleted and Note 1 to entry has been completely changed.]

3.4.5
irreversible limit state
limit state (3.4.1) which will remain permanently exceeded when the *actions* (3.6.1.2) which caused the exceedance are no longer present

[SOURCE: ISO 2394:2015, 2.2.11]

3.4.6
limit state function
function $g(X_1, X_2, ..., X_n)$ of the *basic variables* (3.8.3.2), which characterizes a *limit state* (3.4.1) when $g(X_1, X_2, ..., X_n) = 0$, and also indicates that a *structure* (3.1.31) is in favourable state when $g(X_1, X_2, ..., X_n) > 0$, and unfavourable state when $g(X_1, X_2, ..., X_n) < 0$

3.4.7
reversible limit states
limit states (3.4.1) which will not be exceeded when the *actions* (3.6.1.2) which caused the exceedance are no longer present

[SOURCE: ISO 2394:2015, 2.2.12]

3.4.8
threshold
limit value, which can be a function of time, beyond which a *structure* (3.1.31) or a structural *component* (3.1.3) is in an unfavourable state

[SOURCE: ISO 13822:2010, E.2.4]

3.4.9
strength
ability of a cross-section or an element of a *structure* (3.1.31) to withstand *actions* (3.6.1.2) without mechanical *failure* (3.8.1.1)

[SOURCE: ISO 22111:2007, 3.26]

3.4.10
serviceability
ability of a *structure* (3.1.31) or *structural member* (3.1.30) to perform adequately for a normal use under all expected *actions* (3.6.1.2)

[SOURCE: ISO 2394:2015, 2.1.32]

3.4.11
serviceability limit state
limit state (3.4.1) concerning the criteria governing the functionalities related to normal use

[SOURCE: ISO 2394:2015, 2.2.10]

3.4.12
ultimate limit state
limit states (3.4.1) concerning the maximum load-bearing capacity or deformation

[SOURCE: ISO 2394:2015, 2.2.8, modified — "or deformation" has been added to the definition.]

3.5 Durability

3.5.1
degradation
material *deterioration* (3.12.3) or deformation that leads to adverse changes in a critical property of a *component* (3.1.3)

[SOURCE: ISO 13823:2008, 3.7]

3.5.2
durability
capability of a *structure* (3.1.31) or any *structural member* (3.1.30) to satisfy with planned maintenance the design performance *requirements* (3.1.23) over a specified period of time under the influence of the *environmental actions* (3.6.1.8)

[SOURCE: ISO 2394:2015, 2.1.10]

3.5.3
predicted service life
service life (3.1.24) estimated from recorded performance, previous experience, tests or modelling

[SOURCE: ISO 13823:2008, 3.18]

3.5.4
transfer mechanism
mechanism by which influences in the *structure environment* (3.5.5) are, over time, transferred into *agents* (3.9.1) on and within *components* (3.1.3) or prevent such transfer

[SOURCE: ISO 13823:2008, 3.24]

3.5.5
structure environment
external or internal influences (e.g. rain, de- icing salts, UV, humidity) on a *structure* (3.1.31) that can lead to an *environmental action* (3.6.1.8)

[SOURCE: ISO 13823:2008, 3.23]