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Unified design standard for reliability of railway engineering structures

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1 General

1.0.1 This standard is formulated to unify the basic principles, basic requirements and basic methods of reliability design of railway engineering structures, so that railway engineering meets the requirements of sustainable development, and achieves safety, reliability, advanced technology, reasonable economy, and quality assurance.

1.0.2 This standard applies to the design of engineering structures and components such as railway bridges and culverts, tunnels, roadbeds, and tracks, as well as the reliability assessment of existing structures.

1.0.3 The limit state design method based on probability theory and expressed by sub-item coefficients should be used in the design of railway engineering structures; when statistical data is lacking, other design methods can be used for design based on reliable engineering experience or necessary experimental research.

1.0.4 When formulating relevant standards for reliability design of railway engineering structures, the provisions of this standard shall be complied with.

1.0.5 The investigation, design, construction, use and maintenance of railway engineering structures shall be subject to effective quality management and control, so that the structures meet the specified reliability requirements.

1.0.6 The reliability design of railway engineering structures shall not only meet the requirements of this standard, but also meet the provisions of the current relevant national standards.

2.1.1 Reliability reliability

The ability of a structure to complete a predetermined function within a specified time and under specified conditions.

2.1.2 degree of reliability

The probability that the structure will complete the intended function within the specified time and under the specified conditions.

2.1.3 probability of failure probability of failure

The probability that a structure cannot complete its intended function within a specified time and under specified conditions.

2.1.4 reliability index

The numerical index to measure the structural reliability, the relationship between the reliability index beta and the failure probability Pf is beta=-Phi-1(Pf), where Phi-1(.) is the inverse function of the standard normal distribution function.

2.1.5 design working life

Under normal use and maintenance conditions, the design-specified structure or component can be used for the intended purpose without major repairs.

2.1.6 design reference period design reference period

A time parameter chosen to determine the value of a variable action, etc.

2.1.7 assessed working life

The service life of the existing structure estimated by the reliability assessment under specified conditions.

2.1.8 Safety class safety class

Design grades with different reliability setting levels divided according to the severity of the consequences of engineering structure damage.

2.1.9 Design situation design situation

A group of design conditions representing the actual situation in a certain period of time, and the design should be such that the structure does not exceed the relevant limit state under this group of conditions.

2.1.10 limit state limit state

A structure or component cannot meet a certain functional requirement specified in the design beyond a specific state, and this specific state is the limit state of the function.

2.1.11 limit state equation limit state equation

When the structure or component is in the limit state, the relational expressions of the relevant basic variables.

2.1.12 Ultimate limit state of carrying capacity

A state in which a structure or component has reached its maximum load-bearing capacity or has undergone deformation that is not suitable for continued load-bearing.

2.1.13 Normal use limit state serviceability limit state

A state in which a structure or member has reached a specified limit of normal service or durability.

2.1.14 Reversible normal serviceability limit state reversible serviceability limit state

When the action that exceeds the normal use requirements is removed, the excess state produced by the action can be restored to the limit state of normal use.

2.1.15 Irreversible normal serviceability limit state irreversible serviceability limit state

When the action that exceeds the normal use requirements is removed, the beyond state produced by the action cannot be restored to the limit state of normal use.

2.1.16 fatigue limit state fatigue limit state

The limit state in which the structure or component fails due to repeated loading and is not suitable for continued bearing.

2.1.17 importance factor of structure

Additional adjustment factors for action effects as specified by the safety class of the structure.

2.1.18 basic variable basic variable

A defined set of variables representing physical quantities used to characterize actions and environmental influences, properties of materials and soils, and geometric parameters.

2.1.19 Function function performance function

A function with respect to elementary variables that characterizes a structural function.

2.1.20 probability distribution probability distribution

The statistical law of the value of a random variable is generally represented by a probability density function or a probability distribution function.

2.1.21 Statistical parameter

In the probability distribution, it is used to represent the numerical characteristics of the average level and dispersion degree of the value of the random variable.

2.1.22 Quantile value fractile

The value corresponding to a certain probability of the probability distribution function of a random variable.

2.1.23 characteristic value

The value under a certain guarantee rate or cross-threshold rate determined by statistical methods.

2.1.24 nominal value nominal value

Value determined by non-statistical methods.

2.1.25 calibration method calibration method

Through the inverse analysis of the existing structure or component safety reserve, the method of determining the target reliable index adopted by the design.

2.1.26 action

Concentrated or distributed forces exerted on a structure (direct action, also called load) and causes of imposed or constrained deformation of the structure (indirect action).

2.1.27 geotechnical action

The effect of surrounding rock, foundation, slope, groundwater or surface water on the structure.

2.1.28 effect of action

The response of a structure or member to an action.