INTERNATIONAL STANDARD

ISO
12122-1

Timber structures — Determination of characteristic values —

Part 1:
Basic requirements

Structures en bois — Détermination des valeurs caractéristiques —

Partie 1: Exigences de base

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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).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 165, *Structural Timber*.

ISO 12122 consists of the following parts, under the general title *Timber structures — Determination of characteristic values*:

— *Part 1: Basic requirements*

— *Part 2: Sawn timber*

Introduction

This International Standard sets out a framework to establish characteristic values from test results on a sample drawn from a clearly defined reference population. The characteristic value is an estimate of the property of the reference population with a consistent level of confidence prescribed in this part of ISO 12122.

It is the intention that this part of ISO 12122 can be used on any structural product including but not limited to: sawn timber, glulam, structural composite lumber, I-beams, wood-based panels, poles, and round timber. Whenever it is used, this part of ISO 12122 alerts the user to the basic requirements for the determination of consistent characteristic values, but for some classes of products, additional requirements set out in other parts or Annexes to this part give further mandatory detail and explanation. It permits the evaluation of characteristic values on testing of commercial sized specimens.

In some cases, characteristic values determined in accordance with this part of ISO 12122 may be modified to become a design value.

This part of ISO 12122 has the following Annexes:

Annex A presents detail on a number of statistical methods that may be used in the evaluation of characteristic values.

Annex B presents a commentary on the provisions in this part of ISO 12122.

Annex C presents examples of the use of the statistical methods.

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Timber structures — Determination of characteristic values —

Part 1:
Basic requirements

1 Scope

This International Standard gives methods for the determination of characteristic values for a defined population of timber products, calculated from test values.

It presents methods for the determination of

a)   characteristic value of mean-based properties, and

b)   characteristic value of 5th percentile-based properties.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

AS/NZS 4063.2, *Characterisation of structural timber — Part 2: Determination of characteristic values*

ASTM D2915, *Sampling and data-analysis for structural wood and wood-based products*

EN 14358, *Timber structures — Calculation of characteristic 5th percentile values and acceptance criteria for a sample*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
characteristic value
value of a property taken to represent the property of a designated population using a process of sampling, testing of specimens, and analysis

3.2
characteristic value of mean-based property
two alternative presentations of characteristic value for mean-based properties are possible:

a)   the mean property obtained from results of tests on the defined product;

b)   the mean property with 75 % confidence obtained from results of tests on the defined product

3.3
characteristic value of 5th percentile-based strength property
5th percentile value with 75 % confidence strength property obtained from results of tests on the defined product

3.4
population
all of the structural timber product that meets the description of the population

Note 1 to entry: See Annex B for some examples of the use of the term population.

3.5
sample
number of single members of the population, selected to represent the population

Note 1 to entry: See Annex B for some examples of the use of the term sample.

3.6
specimen
single element used in a test; the element may be a complete member, a member that has been trimmed to length, or a part of a member fabricated for a specific test

Note 1 to entry: See Annex B for some examples of the use of the term specimen.

4 Symbols and abbreviated terms

Symbols defined in the relevant ISO product or test standard shall be used.

In addition, the following apply:

f_m is the characteristic bending strength

$k_{mean,\,0,75}$ is a multiplier to give the mean property with 75 % confidence and is given in Table A1

$k_{0,05,\,0,75}$ is a multiplier to give the 5th percentile value with 75 % confidence for a 5th percentile-based property and is given in Table A2

M is the moment capacity

n is the number of specimens in the test data

V is the coefficient of variation of the test data

X_Δ is the target difference between the reported characteristic value and the test result 5th percentile

X_i is a generalized test value

X_{mean} is the average of the individual test values (X_i)

$X_{mean,\,0,75}$ is the mean property with 75 % confidence

$X_{0,05}$ is the 5th percentile value from the test data

$X_{0,05,\,0,75}$ is the 5th percentile value with 75 % confidence

Z is the section modulus

5 Reference population

The population to which the characteristic value applies shall be fully described. The description shall reference all of the attributes that may affect either the strength or stiffness and restrict the pieces to the grouping for which the characteristic value is required. These include but are not limited to:

a) reference to the relevant product standard or specification;

b)   species or species grouping;

c)   designation of grade of the product;

d)   size or size range of the product;

e)   moisture condition of the product;

f)   treatment of the product;

g)   period in which the product was manufactured.

The reference population shall be a grouping from which it is possible to draw a representative sample, and on which it is possible to perform tests on specimens to characterize the required properties.

6   Sampling

6.1   Sampling method

The sampling method shall aim to produce a sample that is representative of the variants in the defined reference population that may affect the tested properties. The sampling shall minimize selection bias, and shall be appropriate to the purpose of the characteristic value and the nature of the reference population.

The sampling method shall be documented. The documentation shall include details of the steps taken to ensure that each of the variants listed in the population as described in Clause 5 is included in the representative sample.

6.2   Sample size

The sample shall be large enough to cover variants of the product that impact on the tested properties, and give statistical significance to the result.

NOTE 1   Materials with larger assumed or assigned population coefficient of variation, (V), of the tested properties should have a larger sample size.

NOTE 2   Some product standards may define a minimum number of tests that must be undertaken to determine characteristic values to be used with described products.

NOTE 3   Annex B gives some guidance on selecting sample size.

NOTE 4   For some populations, a number of different sub-groups within the population may need to be sampled (e.g. different cross-sectional sizes). In these cases, the size of each of the sub-groups may have to be sufficient to allow meaningful pooling of the results as indicated in Annex A.

NOTE 5   Where characteristic values are to support limit states (or LRFD) design, the sample size should be appropriate for the statistical method selected to determine the 5th percentile value strength (full distribution or tail-fit). However, where the data are used to support a full reliability design method, the sample size should be appropriate to also enable the full statistical distribution of the property to be defined.

7   Sample conditioning

Test data from the samples shall be compatible with the definition of the population by

a)   compliance with the specification of the reference population at the time of testing in accordance with 7.1 and 7.2, or

b)   adjustment of test data in accordance with 8.2 where compliance with 7.1 or 7.2 is not achieved.

7.1 Sample moisture content

The sample shall be stored so that the moisture content at the time of test is appropriate to the description of the reference population as detailed in Clause 5.

7.2 Sample temperature

The sample shall be stored and tested so that the temperature at the time of test is appropriate to the description of the reference population as detailed in Clause 5.

8 Test data

8.1 Test method

The test data shall be derived in accordance with an appropriate test method for the properties and for the reference population.

NOTE 1   For tests on some product types, discrimination of results on the basis of failure mode may be required to ensure that the results are compatible with objectives of the test program and the property being determined.

NOTE 2   Test methods involve many variables that may affect results including loading configuration and rates, specimen positioning and measurement methods. The selection of these variables must be appropriate to the objectives of the testing, and may require some adjustments specified in 8.2.

8.2 Test data compatible with product description

Where the characteristic value is applicable to a standard size or moisture content, adjustments to the raw test data may be required. Any adjustment shall be in accordance with appropriate behaviour models and shall be detailed in the report.

NOTE   Annex B gives examples of the types of adjustment that may be necessary in response to variation of the specimens from the description of the reference population.

Where test data from a number of different data subsets are to be combined, the basis for the combination shall satisfy the following requirements:

a)   The data shall be derived from similar subsets that are standardized using the same adjustment models, and shall satisfy statistical tests for combining the subsets into a single data set;

b)   Transformation methods shall be in accordance with appropriate behaviour models and shall be detailed in the report.

NOTE   Annex A gives requirements for combining or pooling of data from a number of different test programs.

9 Evaluation of characteristic values for structural properties

9.1 Structural properties

Characteristic values for properties shall be reported in one of two ways according to the use of the product:

a)   Material properties — where the determined property is multiplied by a geometric parameter to give a component capacity, or component stiffness;

b)   Component properties — where the determined property is a component capacity or component stiffness.

Characteristic values for structural properties shall be classified as those based on the mean of test results and those based on the 5th percentile of test results in accordance with 3.2 and 3.3.

9.2 Characteristic value based on the mean

The mean value of the test values shall be evaluated as either a) or b):

a) the arithmetic average of the test values as

$$X_{\text{mean}} = \frac{\sum X_i}{n} \tag{1}$$

where

X_{mean} is the average of the individual test values (X_i);

X_i is a generalized test value;

n is the number of test values.

b) the mean value of a statistical distribution fitted through the test data

For mean-based strength characteristic values, the mean property with 75 % confidence obtained from results of tests shall be evaluated.

NOTE   Suitable methods for estimating the mean with 75 % confidence are presented in Annex A.

The characteristic values for modulus of elasticity or modulus of rigidity shall be the mean value.

9.3 Characteristic value based on the 5th percentile test value

The 5th percentile value of the test values shall be evaluated as

a) the non-parametric estimate of the 5th percentile of the test data found by ranking the test data and from the cumulative frequency of the test data selecting the interpolated value at the 5th percentile (see A.2.1 and A.2.2), or

b) the estimate of the 5th percentile of the test data found by fitting an accepted statistical distribution through the test data and selecting the 5th percentile point from the fitted distribution (see A.2.3).

The 5th percentile value with 75 % confidence shall be evaluated.

NOTE   Suitable methods for estimating the 5th percentile value with 75 % confidence are presented in Annex A.

10 Report

10.1 General

The report shall include details of the reference population definition, sampling program, description of test pieces, the test method and analysis methods used, and the characteristic values in accordance with 10.2 to 10.6.

10.2 Reference population

The reference population shall be defined as given in Clause 5. Each attribute used to define the reference population shall be detailed in the report. Each of the attributes in the reference population that may affect either the strength or stiffness shall be presented in the report.

10.3 Sampling

The sampling method used to select the test sample shall be described.

The justification of the sample size selected shall be presented. (See 6.2.)

10.4 Test methods

Reporting of testing methods shall either

a)   refer to the test standard used, or

b)   fully document the test procedures used.

Reporting of test specimen preparation shall include a statistical summary of the characteristics of the sample (e.g. moisture content, temperature, grade marks). This data shall be in sufficient detail to enable the data to be adjusted to different conditions if required.

The test results shall be presented in the report in enough detail to enable the statistical analysis to be checked or repeated. Any adjustment of the test results to ensure compatibility with the product description shall be fully documented, together with references for the modification methods and factors used.

Where applicable for the reference population and the tests undertaken, failure modes in strength tests shall be reported.

10.5 Analysis methods

The analysis method shall be described in detail. For characteristic strength values, the method for estimation of the 5th percentile value with 75 % confidence shall be referenced.

Where pooled data are used, the method of combination of the data shall be described.

Where a distribution is fitted to the test data, all of the defining parameters of the fitted distribution shall be reported, together with goodness of fit parameters.

10.6 Characteristic values

The characteristic values shall be reported together with the V of the data that led to their calculation.