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Timber structures — Joints made with mechanical fasteners — Quasi-static reversed-cyclic test method

Structures en bois — Joints réalisés avec des connecteurs mécaniques — Méthode d'essai cyclique réversible quasi statique

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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 16670 was prepared by Technical Committee ISO/TC 165, *Timber structure*.

Introduction

Evaluation of the structural performance of joints under reversed-cyclic loading has become a requirement in seismic design. The objective of this International Standard is to provide a cyclic test procedure as a basis for the development of characteristics of joints for use in seismic design. The cyclic displacement schedule was developed in consultation with a group of international experts with the intention that the cyclic displacement schedule shall produce

a) data that sufficiently describes the elastic and inelastic properties of the joint, and

b) representative demands imposed on joints by earthquakes.

Supplementary information is given in Annex A to provide the rationale behind the cyclic displacement schedule, recommendations for cases for which a modified schedule would be more appropriate, and typical test results obtained on a joint by following this cyclic displacement schedule.

Timber structures — Joints made with mechanical fasteners — Quasi-static reversed-cyclic test method

1 Scope

This International Standard is intended to provide a cyclic test method as a basis for the derivation of parameters which are required in seismic design of timber structures. The method includes procedures to develop the envelope curves (backbone or skeleton curves; an example is given in Clause A.5.) for joints subjected to a cyclic displacement schedule which produces representative demands imposed on the joints by earthquakes. It does not include criteria for parameters which are, at times, stipulated in national standards or building codes.

This standard is intended for joints subjected to lateral load ans is not applicable to joints subjected to withdrawal forces.

This International Standard is applicable to joints made with mechanical fasteners used in timber structures loaded under seismic action.

NOTE 1 In the context of this Standard, the term "joint" means "connection" in present-day North-American English.

NOTE 2 It is recognized that, for some special types of joints, modification of the test method may be necessary provided the test objectives in this clause and the principles in Clause 6 are achieved. See Clause A.2 for details.

2 Normative references

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

ISO 554, *Standard atmospheres for conditioning and/or testing — Specifications*

ISO 3131, *Wood — Determination of density for physical and mechanical tests*

ISO 8970, *Timber structures — Testing of joints made with mechanical fasteners — Requirements for wood density*

ISO 6891, *Timber structures — Joints made with mechanical fasteners — General principles for the determination of strength and deformation characteristics*

3 Symbols and definitions

F Applied load, in newtons, or newton-millimetres in the case of joint rotation

F_{max} Maximum load, in newtons, or newton-millimetres in the case of joint rotation (as defined in Figure 1)

k Joint stiffness, in newtons per millimetre, or newton-millimetres per radian in the case of joint rotation

v Joint displacement, in millimetres, or radians in the case of joint rotation

v_u Ultimate joint displacement, in millimetres, or radians in the case of joint rotation (as defined in Figure 1)

NOTE "Load" and "displacement" are taken as generic terms. Load could be axial, shear, moment or torsion. Displacement could be any displacement (or slip) or rotation.

4 Test specimens

4.1 Conditioning

Attention shall be given to the conditioning of the timber before the manufacture of the joint and also to the conditioning of the joints after their fabrication.

The conditioning shall be conducted in such a way that the test conditions correspond in a realistic manner to the in-service conditions of joints in structures.

Where the purpose of testing is to compare joints under similar conditions, the standard atmosphere of 20 °C and 65 % relative humidity according to ISO 554 shall be used for conditioning. Density of the specimens shall comply with the requirements given in ISO 8970.

4.2 Form and dimension

Joint geometry, loading configuration and fabrication details (e.g. elapsed time between the fabrication and test, predrilling of holes, tolerances, conditioning details before and after fabrication) shall be representative of the intended end use.

4.3 Sampling

Sampling should provide for selection of representative test material on an objective and unbiased basis, covering an appropriate range in density and properties as circumstances suggest.

4.4 Number of replicates

The number of replicates depends on the specific objectives and desired reliability.

NOTE A minimum of 6 replicates is recommended for each of the static and cyclic tests to obtain a reliable estimate of mean mechanical properties.

5 Apparatus

The test apparatus, tolerances and restraints shall be of realistic forms that are representative of the intended end use.

The testing machine shall be able to apply and continuously record load and joint displacement with an accuracy of ± 1 % of the estimates of F_{max} and v_u or better.

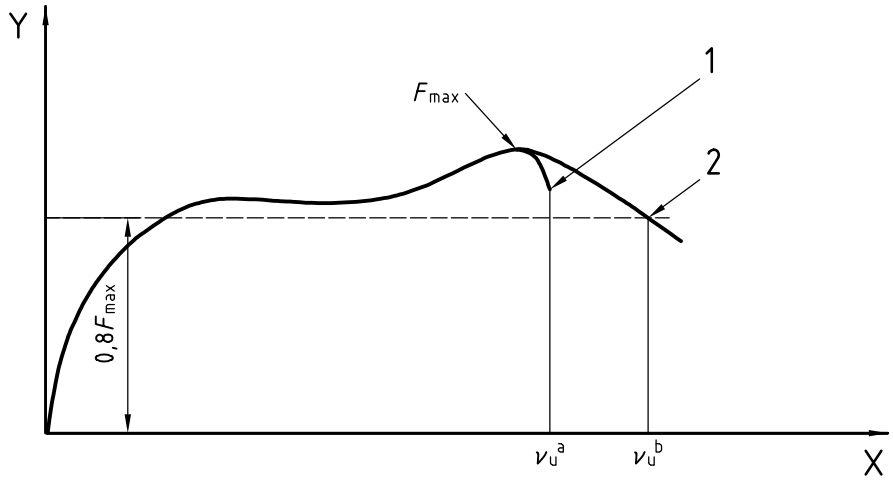
It is recommended that displacement measurements be made in such a way that the amount of member deformation included in displacement readings is minimized.

6 Test procedure

6.1 Properties from static (monotonic) tests

Static (monotonic) tests shall be conducted on a matched group (or specimen) according to ISO 6891 with the exception of preloading. The mean value (where applicable) of the ultimate displacement or rotation (v_u) of the static tests will be determined by following the definition of v_u in Figure 1.

NOTE Static (monotonic) test data previously obtained on a matched group (or specimen) may also be used.



Key

X Displacement, v
Y Load, F
1 case a
2 case b

a Displacement at failure (case a).

b Displacement at $0,8F_{max}$ in the descending portion of the load-displacement curve (case b).

Figure 1 — Definition of ultimate joint displacement: v_u corresponds to either v_u^a or v_u^b, whichever occurs first in the test

6.2 Cyclic displacement schedule

The cyclic displacement schedule shall produce

a) data that sufficiently describe the elastic and inelastic cyclic properties of the joint, and

b) representative demands imposed on the joints by earthquakes.

The cyclic displacement schedule given in Figure 2 shall be followed with a rate of slip between 0,1 mm/s and 10 mm/s. The amplitudes of the reversed cycles are a function of the mean value (where applicable) of the ultimate displacement (v_u) obtained in the monotonic test. Table 1 presents the amplitudes as a percentage of the ultimate joint displacement.

NOTE An alternative cyclic displacement schedule — either velocity or frequency based — that satisfies the principles given above may also be employed to achieve the test objectives.