CONSEIL INTERNATIONAL DU BÂTIMENT ★ INTERNATIONAL COUNCIL FOR BUILDING RESEARCH STUDIES AND DOCUMENTATION

WORKING GROUP W18
TIMBER STRUCTURES

CIB
STRUCTURAL TIMBER DESIGN CODE

ANNEX 01 AND 02, AUGUST 1980

ANNEX 01

CIB-W18 TECHNICAL PAPERS

Technical papers presented to CIB-W18 are identified by a code CIB-W19/a-b-c, where:

a denotes the meeting at which the paper was presented. Meetings are classified in chronological order:

1 Princes Risborough, England; March 1973
2 Copenhagen, Denmark; October 1973
3 Delft, Netherlands; June 1974
4 Paris, France; February 1975
5 Karlsruhe, Federal Republic of Germany; October 1975
6 Aalborg, Denmark; June 1976
7 Stockholm, Sweden, Feb/March 1977
8 Brussels, Belgium, October 1977
9 Perth, Scotland; June 1978
10 Vancouver, Canada; August 1978
11 Vienna, Austria; March 1979
12 Bordeaux, France; October 1979
13 Otaniemi, Finland; June 1980

b denotes the subject:

1 Limit State Design
2 Timber Columns
3 Symbols
4 Plywood
5 Stress Grading
6 Stresses for Solid Timber
7 Timber Joints and Fasteners
8 Load Sharing
9 Duration of Load
10 Timber Beams
11 Environmental Conditions
12 Laminated Members
13 Particle and Fibre Building Boards
14 Trussed Rafters
15 Structural Stability
16 Fire
17 Statistics and Data Analysis
100 CIB Timber Code
101 Loading Codes
102 Structural Design Codes
103 International Standards Organisation
104 Joint Committee on Structural Safety
105 CIB Programme, Policy and Meetings
106 International Union of Forestry Research Organisations

c is simply a number given to the papers in the order in which they appear:

Example: CIB-W18/4-102-5 refers to paper 5 on subject 102 presented at the fourth meeting of W18.

Listed below, by subjects, are all papers that have to date been presented to W18. When appropriate some papers are listed under more than one subject heading.

LIMIT STATE DESIGN

1-1-1 Paper 5 Limit State Design - H J Larsen

1-1-2 Paper 6 The use of partial safety factors in the new Norwegian design code for timber structures - O Brynildsen

1-1-3 Paper 7 Swedish code revision concerning timber structures - B Norén

1-1-4 Paper 8 Working stresses report to British Standards Institution Committee BLCP/17/2

6-1-1 On the application of the uncertainty theoretical methods for the definition of the fundamental concepts of structural safety - K Skov and O Ditlevsen

11-1-1 Safety Design of Timber Structures - H J Larsen

TIMBER COLUMNS

2-2-1 Paper 3 The Design of Solid Timber Columns - H J Larsen

3-2-1 Paper 6 Design of Built-up Timber Columns - H J Larsen

4-2-1 Paper 3 Tests with Centrally Loaded Timber Columns - H J Larsen and Svend Sondergaard Pedersen

4-2-2 Paper 4 Lateral-Torsional Buckling of Eccentrically Loaded Timber Columns - B Johansson

5-9-1 Strength of a Wood Column in Combined Compression and Bending with respect to Creep - B Källsner and B Norén

5-100-1 Design of Solid Timber Columns - H J Larsen

6-100-1 Comments on Document 5-100-1, Design of Timber Columns - H J Larsen

6-2-1 Lattice Columns - H J Larsen

6-2-2 A Mathematical Basis for Design Aids for Timber Columns - H J Burgess

6-2-3 Comparison of Larsen and Perry Formulas for Solid Timber Columns - H J Larsen

7-2-1 Lateral Bracing of Timber Struts - J A Simon

8-15-1 Laterally Loaded Timber Columns: Tests and Theory - H J Larsen

SYMBOLS

3-3-1 Paper 5 Symbols for Structural Timber Design - J Kuipers and B Norén

4-3-1 Paper 2 Symbols for Timber Structure Design - J Kuipers and B Norén

1 Symbols for Use in Structural Timber Design

PLYWOOD

2-4-1 Paper 1 The Presentation of Structural Design Data for Plywood - L G Booth

3-4-1 Paper 3 Standard Methods of Testing for the Determination of Mechanical Properties of Plywood - J Kuipers

3-4-2 Paper 4 Bending Strength and Stiffness of Multiple Species Plywood - C K A Stieda

4-4-4 Paper 5 Standard Methods of Testing for the Determination of Mechanical Properties of Plywood - Council of Forest Industries, BC

5-4-1 The Determination of Design Stresses for plywood in the revision of CP 112 - L G Booth

5-4-2 Veneer Plywood for Construction - Quality Specifications - ISO/TC 139 - Plywood, Working Group 6

6-4-1 The Determination of the Mechanical Properties of Plywood Containing Defects - L G Booth

6-4-2 In-grade versus Small Clear Testing of Plywood - C R Wilson

6-4-3 Buckling Strength of Plywood: Results of Tests and Recommendations for Calculations - J Kuipers and H Ploos van Amstel

7-4-1 Methods of Test for the Determination of the Mechanical Properties of Plywood - L G Booth, J Kuipers, B Norén, C R Wilson

7-4-2 Comments on Paper 7-4-1

7-4-3 The Effect of Rate of Testing Speed on the Ultimate Tensile Stress of Plywood - C R Wilson and A V Parasin

7-4-4 Comparison of the Effect of Specimen Size on the Flexural Properties of Plywood using the Pure Moment Test - C R Wilson and A V Parasin

8-4-1 Sampling Plywood and the Evaluation of Test Results - B Norén

9-4-1 Shear and Torsional Rigidity of Plywood - H J Larsen

9-4-2 The Evaluation of Test Data on the Strength Properties of Plywood - L G Booth

9-4-3 The sampling of Plywood and the Derivation of Strength Values (Second Draft) - B Noren

9-4-4 On the Use of the CIB/RILEM Plywood Plate Twisting Test: a progress report - L G Booth

10-4-1 Buckling Strength of Plywood - J Dekker, J Kuipers and H Ploos van Amstel

11-4-1 Analysis of Plywood Stressed Skin Panels with Rigid or Semi-Rigid Connections - I Smith

11-4-2 A Comparison of Plywood Modulus of Rigidity Determined by the ASTM and RILEM 3-TT/CIB Test Methods - C R Wilson

11-4-3 Sampling of Plywood for Testing Strength - B Norén

12-4-1 Procedures for Analysis of Plywood Test Data and Determination of Characteristic Values Suitable for Code Presentation - C R Wilson

STRESS GRADING

1-5-1 Paper 10 Quality specifications for sawn timber and precision timber - Norwegian Standard NS 3080

1-5-2 Paper 11 Specification for timber grades for structural use - British Standard BS 4978

4-5-1 Paper 10 Draft Proposal for an International Standard for Stress Grading Coniferous Sawn Softwood - ECE Timber Committee

STRESSES FOR SOLID TIMBER

4-6-1 Paper 11 Derivation of Grade Stresses for Timber in UK - W T Curry

5-6-1 Standard Methods of Test for Determining some Physical and Mechanical Properties of Timber in Structural Sizes - W T Curry

5-6-2 The Description of Timber Strength Data - J R Tory

5-6-3 Stresses for EC1 and EC2 Stress Grades - J R Tory

6-6-1 Standard Methods of Test for the Determination of some Physical and Mechanical Properties of Timber in Structural Sizes (third draft) - W T Curry

7-6-1 Strength and Long-term Behaviour of Lumber and Glued-laminated Timber under Torsion Loads - K Möhler

9-6-1 Classification of Structural Timber - H J Larsen

9-6-2 Code Rules for Tension Perpendicular to the Grain - H J Larsen

9-6-3 Tension at an Angle to the Grain - K Möhler

9-6-4 Consideration of Combined Stresses for Lumber and Glued Laminated Timber - K Möhler

11-6-1 Evaluation of Lumber Properties in the United States - W L Galligan and J H Haskell

11-6-2 Stresses Perpendicular to Grain - K Möhler

11-6-3 Consideration of Combined Stresses for Lumber and Glued-laminated Timber (addition to Paper CIB-W18/9-6-4)

12-6-1 Strength Classifictions for Timber Engineering Codes - R H Leicester and W G Keating

12-6-2 Strength Classes for British Standard BS 5268 - J R Tory

13-6-1 Strength Classes for the CIB Code - J R Tory

13-6-2 Consideration of Size Effects and Longitudinal Shear Strength for Uncracked Beams - R O Foschi and J D Barrett

13-6-3 Consideration of Shear Strength on End-Cracked Beams - J D Barrett and R O Foschi

TIMBER JOINTS AND FASTENERS

1-7-1 Paper 12 Mechanical Fasteners and Fastenings in Timber Structures - E J Stern

4-7-1 Paper 8 Proposal for a Basic Test Method for the Evlauation of Structural Timber Joints with Mechanical Fasteners and Connectors - RILEM, 3 TT Committee

4-7-2 Paper 9 Test Methods for Wood Fasteners - K Möhler

5-7-1 Influence of Loading Procedure on Strength and Slip Behaviour in Testing Timber Joints - K Möhler

5-7-2 Recommendations for Testing Methods for Joints with Mechanical Fasteners and Connectors in Load-Bearing Timber Structures - RILEM 3TT Committee

5-7-3 CIB Recommendations for the Evaluation of Results of Tests on Joints with Mechanical Fasteners and Connectors used in Load-Bearing Timber Structures - J Kuipers

6-7-1 Recommendations for Testing Methods for Joints with Mechanical Fasteners and Connectors in Load-Bearing Timber Structures (seventh draft) - RILEM, 3TT Committee

6-7-2 Proposals for Testing Joints with Integral Nail Plates - K Möhler

6-7-3 Rules for Evaluation of Values of Strength and Deformation from Test Results - Mechanical Timber Joints - M Johansen, J Kuipers, B Norén

6-7-4 Comments to Rules for Testing Timber Joints and Derivation of Characteristic Values for Rigidity and Strength - B Norén

7-7-1 Testing of Integral Nail Plates as Timber Joints - K Möhler

7-7-2 Long Duration of Tests on Timber Joints - J Kuipers

7-7-3 Tests with Mechanically Jointed Beams with a Varying Spacing of Fasteners - K Möhler

7-100-1 CIB Timber Code Chapter 5.3 Mechanical Fasteners; CIB Timber Standard 06 and 07 - H J Larsen

9-7-1 The Design of Truss-Plate Joints - F J Keenan

9-7-2 Staples - K Möhler

11-7-1 A draft Proposal for an International Standard: ISO Document ISO/TC 165N 38E

12-7-1 Load-carrying Capacity and Deformation Characteristics of Nailed Joints - J Ehlbeck

12-7-2 Design of Bolted Joints - H J Larsen

12-7-3 Design of Joints with Nail Plates - B Norén

13-7-1 Polish Standard BN-80/7.159-04:Parts 00-01-02-03-04-05. 'Structures from Wood and Wood-based Materials. Methods of Test and Strength Criteria for Joints with Mechanical Fasteners'.

13-7-2 Investigation of the Effect of Number of Nails in a Joint on its load-carrying Capacity - W Nożyński.

13-7-3 International Acceptance of Manufacture, Marking and Control of Finger-jointed Structural Timber - B Norén.

13-7-4 Design of Joints with Nail Plates - Calculation of Slip - B Norén.

13-7-5 Design of Joints with Nail Plates - The Heel Joint - B Källsner.

13-7-6 Nail Deflection Data for Design - H J Burgess.

13-7-7 Test on Bolted Joints - P Vermeyden.

13-7-8 Comments to paper CIB-W18/12-7-3 'Design of Joints with Nail-Plates' - B Noren.

13-7-9 Strength of Finger Joints - H J Larsen.

13-100-4 CIB Structrual Timber Design Code. Proposal for Section 6.1.5 Nail Plates - N I Bovim.

LOAD SHARING

3-8-1 Paper 8 Load Sharing - An Investigation on the State of Research and Development of Design Criteria - E Levin

4-8-1 Paper 12 A Review of Load Sharing in Theory and Practice - E Levin

4-8-1 Paper 13 Load Sharing - B Norén

DURATION OF LOAD

TIMBER BEAMS

TRUSSED RAFTERS

4-9-1 Paper 14 Long Term Loading of Trussed Rafters with Different Connection Systems - T Feldborg and M Johansen

6-9-3 Deflection of Trussed Rafters under Alternating Loading During a Year - T Feldborg and M Johansen

7-2-1 Lateral Bracing of Timber Struts - J A Simon

9-14-1 Timber Trusses - Code Related Problems - T F Williams

9-7-1 The Design of Truss-Plate Joints - F J Keenan

10-14-1 Design of Roof Bracing - The State of the Art in South Africa - P A V Bryant and J A Simon

11-14-1 Design of Metal Plate Connected Wood Trusses - A R Egerup

12-14-1 A Simple Design Method for Standard Trusses - A R Egerup

13-14-1 Truss Design Method for CIB Timber Code - A R Egerup

13-14-2 Trussed Rafters, Static Models - H Riberholt

13-14-3 Comparison of 3 Truss Models Designed by Different Assumptions for Slip and E-modulus - K Möhler

FIRE

12-16-1 British Standard BS 5268 The Structural Use of Timber: Part 4 Fire Resistance of Timber Structures

13-100-2 CIB Structural Timber Design Code. Chapter 9. Performance in Fire.

STATISTICS AND DATA ANALYSIS

13-17-1 On Testing Whether a Prescribed Exclusion Limit is Attained - W G Warren

CIB TIMBER CODE

2-100-1 Paper 2 A Framework for the Production of an International Code of Practice for the Structural Use of timber - W T Curry

5-100-1 Design of Solid Timber Columns - H J Larsen

5-100-2 A Draft Outline of a Code of Practice for Timber Structures - L G Booth

6-100-1 Comments on Document 5-100-1; Design of Timber Columns - H J Larsen

6-100-2 A CIB Timber Code - H J Larsen

7-100-1 CIB Timber Code Chapter 5.3 Mechanical Fasteners; CIB Timber Standard 06 and 07 - H J Larsen

8-100-1 CIB Timber Code: List of Contents (Second Draft) H J Larsen

9-100-1 The CIB Timber Code (Second Draft)

11-100-1 CIB Structural Timber Design Code (Third Draft)

11-100-1 Comments Received on the CIB Code

11-100-3 CIB Structural Timber Design Code: Chapter 3

12-100-1 Comment on the CIB Code - Sous Commission Glulam

12-100-2 Comment on the CIB Code - R H Leicester

12-100-3 GIB Structural Timber Design Code (Fourth Draft)

13-100-1 Agreed Changes to CIB Structural Timber Design Code

13-100-2 CIB Structural Timber Design Code. Chapter 9: Performance in Fire

13-100-3a Comments on CIB Structural Timber Design Code:

13-100-3b Comments on CIB Structural Timber Design Code - W R A Meyer

13-100-3c Comments on CIB Structural Timber Design Code - British Standards Institution

13-100-4 CIB Structural Timber Design Code. Proposal for Section 6.1.5 Nail Plates - N I Bovim

LOADING CODES

4-101-1 Paper 19 Loading Regulations - Nordic Committee for Building Regulations

4-101-2 Paper 20 Comments on the Loading Regulations - Nordic Committee for Building Regulations

STRUCTURAL DESIGN CODES

1-102-1 Paper 2 Survey of Status of Building Codes, Specifications etc, in USA - E G Stern

1-102-2 Paper 3 Australian Codes for Use of Timber in Structures - R H Leicester

1-102-3 Paper 4 Contemporary Concepts for Structural Timber Codes - R H Leicester

1-102-4 Paper 9 Revision of CP 112 - First Draft, July 1972 - British Standards Institution

4-102-1 Paper 15 Comparison of Codes and Safety Requirements for Timber Structures in EEC Countries - Timber Research and Development Association

4-102-2 Paper 16 Nordic Proposals for Safety Code for Structures and Loading Code for Design of Structures - O A Brynildsen

4-102-3 Paper 17 Proposals for Safety Codes for Load-Carrying Structures - Nordic Committee for Building Regulations

4-102-4 Paper 18 Comments to Proposal for Safety Codes for Load-Carrying Structures - Nordic Committee for Building Regulations

4-102-5 Paper 21 Extract from Norwegian Standard NS 3470 "Timber Structures"

4-102-6 Paper 22 Draft for Revision of CP 112 "The Structural Use of Timber" - W T Curry

8-102-1 Polish Standard PN-73/B-3150: Timber Structures; Statistical Calculations and Designing

8-102-2 The Russian Timber Code: Summary of Contents

9-102-1 Svensk Byggnorm 1975 (2nd Edition); Chapter 27: Timber Construction

11-102-1 Eurocodes - H J Larsen

13-102-1 Programme of Standardisation Work Involving Timber Structures and Wood-Based Products in Poland

INTERNATIONAL STANDARDS ORGANISATION

3-103-1 Paper 2 Method for Preparation of Standards Concerning the Safety of Structures - published by International Standards Organisation (ISO/DIS 3250)

4-103-1 Paper 1 A Proposal for Undertaking the Preparation of an International Standard on Timber Structures - International Standards Organisation

5-103-1 Comments on the Report of the Consultation with Member Bodies concerning ISO/TS/P129 - Timber Structures - Dansk Ingeniorforening

7-103-1 ISO Technical Committees and Membership of ISO/TC 165

8-103-1 Draft Resolutions of ISO/TC 165

12-103-1 ISO/TC 165 Ottawa; September 1979

13-103-1 Report from ISO TC/165

JOINT COMMITTEE ON STRUCTURAL SAFETY

3-104-1 Paper 1 International System on Unified Standard Codes of Practice for Structures - Published by Comité Européen du Béton (CEB)

7-104-1 Volume One: Common Unified Rules for Different Types of Construction Material - CEB

CIB PROGRAMME, POLICY AND MEETINGS

1-105-1 Paper 1 A Note on International Organisations active in the field of Utilisation of Timber - P Sonnemans

5-105-1 The Work and Objectives of CIB-W18 - Timber Structures - J G Sunley

10-105-1 The Work of CIB-W18 Timber Structures - J G Sunley

INTERNATIONAL UNION OF FORESTRY RESEARCH ORGANISATIONS

7-106-1 Time and Moisture Effects - CIB W18/IUFRO S5.02-03 Working Party

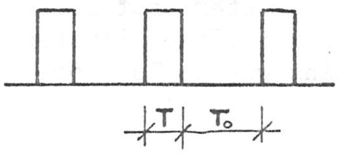
ANNEX 02
NOTES ON THE DERIVATION AND INTERPRETATION OF PARTICULAR CLAUSES

The full titles of the CIB technical papers referred to in this annex, may be found in Annex 01.

2.1.1 The test climate and the climates in section 2.2 are chosen with regard to International Standard ISO 554 'Standard Atmospheres for Conditioning and/or Testing - Specifications'.

2.2 The climate class grading is based on CIB-W18/5-11-1 with small changes motivated by 6-11-1. The climate classes should not be confused with meteorological climates.

2.3 The load-duration grading is based on CIB-W18/3-9-1 and especially on 7-9-1.



The load-duration class for a given load (specified by its time spectrum) depends on the properties of the material or the whole structure. For the intermittent load shown the effective loading time is equal to T if T_0 is long as compared to the recovery time for the material, and equal to the accumulated loading time if there either is no recovery or if T_0 is comparatively short.

4.0 The standard strength classes are introduced in CIB-W18/9-6-1.

4.3.1 The requirements apply to the glulam, not to the laminae. The additional tensile strength requirement for glulam made from more than one species is necessary to ensure a normal property-profile. The introduction of standard glulam strength classes does not prevent the introduction of other grades, eg grades with a higher $f_m/f_{t,0}$-ratio by using high-strength wood in the outermost laminae.

5.1.0 The modification factors correspond to the traditionally used reduction factors of 9/16 $\sim$0.6 for long-term load and 0.85 for exterior conditions. The true reductions are probably less for the low grades.

5.1.1.1 In cases where the influence of the size can be disregarded the conditions (5.1.1.1 a) and (5.1.1.1 b) can be generalised to an arbitrary angle, α, between stress and grain direction, viz:

$$\sigma_t \leq \frac{1}{\sqrt{\left(\frac{\cos^2\alpha}{f_{t,0}}\right)^2 + \left(\frac{\sin^2\alpha}{f_{t,90}}\right)^2 + \left(\frac{\sin\alpha\cos\alpha}{f_v}\right)^2}}$$

cf formula (5.1.1.6 a).

The introduction of size factor for the two directions of practical interest has been found more important than having a general formula.

The values for $k_{size,90}$ are based on papers by J D Barrett (Wood and Fiber, Vol 6, No 2, 1974 and Canadian Journal of Civil Engineering, Vol 2, 1975).

5.1.1.2 Together with the Hankinson formula this formula has been used for many years in many codes for designing traditional timber structures. No need has been felt for replacing it with a more sophisticated and more restrictive expression based on formula (5.1.1.6 a). The formula has been chosen in preference to the Hankinson formula because of its simplicity.

$k_{bearing}$ is based on a comparison of the rules in a number of codes, cf CIB-W18/5-10-1, and on the work of G Backsell (Swedish Institute for Building Research, Report 12/66 1966).

5.1.1.3 A depth effect can be counteracted by stricter knot limitations for larger sizes. This may be thereason for the different traditions concerning depth factor, and it explains why it is impossible to give a general expression in this code.

The limiting depth of 200 mm has been chosen on the basis of tradition in the countries where such a factor has been used.

At present the depth dependence for the ECE-grades is investigated. A provisional value of $\kappa = 1/9$ has been suggested.

Reference is also made to the survey in CIB-W18/5-10-1.

The rules concerning lateral instability are based on the work of Hooley and Madsen (ASCE Journal of the Structural Division, Vol 70 (1964) ST 3) as described in CIB-W18/5-10-1.

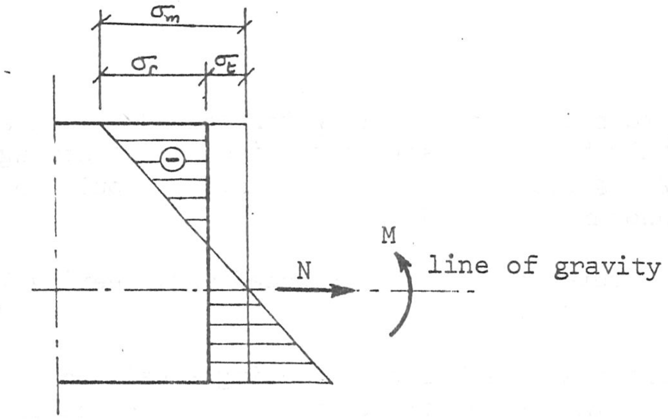
5.1.1.4 The reduction of the load near the supports is discussed in CIB-W18/9-10-1.

Further papers concerning size effect and the reduction for notched beams are under preparation and changes may be made.

5.1.1.6 The interaction formula is empirical and suggested by Norris, cf Forest Products Laboratory, Madison, Report 1816, 1962. A more complicated formula

$$\left(\frac{\sigma_0}{f_0}\right)^2 - \frac{\sigma_0\sigma_{90}}{f_0 f_{90}} + \left(\frac{\sigma_{90}}{f_{90}}\right)^2 + \left(\frac{\tau}{f_v}\right)^2 \leq 1$$

given in the report mentioned is not supported by the tests described in CIB-W18/9-6-4, and CIB-W18/11-6-3. Reference is also made to CIB-W18/11-10-1.



Formula (5.1.1.6 c) (and (5.1.1.6 e)) ensure that the resultant stress, σ_r, does not exceed f_m, which could be the case for unsymmetrical cross-sections if only (5.1.1.6 b) (or (5.1.1.6 d)) was used, since

$$\frac{\sigma_r}{f_m} = \frac{|\sigma_m|}{f_m} - \frac{\sigma_t}{f_m} = 1 + \frac{\sigma_t}{f_{t,0}} - \frac{\sigma_t}{f_m} \geq 1$$

for $f_{t,0} < f_m$

See also CIB-W18/4-10-2.

(5.1.1.6 f) is based on a paper by Möhler and Hemmer (Holz als Roh- und Werkstoff 35 (1977) 473-478).

5.1.1.7 The background for the column design is given in CIB-W18/2-2-1. The code format has emerged from discussion in CIB-W18 and the work in connection with a revision of the British Code of Practice for The Structural Use of Timber.

5.1.2 Refer to CIB-W18/11-10-1

5.2.1 The influence of notches has been found to be much more severe for glulam than for solid timber and in some countries the notching of glulam beams is not allowed. This expression has been proposed by K Möhler, see CIB-W18/9-6-4.

5.2.2 The rules are in principle thesame as those in Canadian Standard CSA-086/1977, but slightly simplified.

The background for the calculation of radial tensile stresses etc is given by Foschi & Fox (see for example ASCE, Journal of the Structural Division, Vol 76 (1970) ST10.

The formula and the diagrams are based on papers by H Blumer (among others Holzbau 6-8/1975) and Möhler & Blumer (Berichte aus der Bauforschung, Berlin 1974, Nr 92).

5.2.3 Formula 5.2.3a is a simplification of the Wilson and Hudson formulas; see CIB-W18/5-10-1.

The values in Fig 5.2.3b are suggested by K Möhler, see CIB-W18/5-10-1.

Formula 5.2.3e is a simplified version of the rules in Canadian Standard CSA-086/1977.

6.1 The use of the factors from Table 5.1.0b for load-duration and climate classes will normally be on the safe side since joint strength depends on S_c^{κ}, where $0.5 \leq \kappa \leq 1.0$. A more refined system would be so difficult to use that it cannot be justified.

6.1.1.1 Formula 6.1.1.1 a - refer to CIB-W18 Proceedings, Meeting 11 α_{nail} is in the range 1.5 to 2.0.

To take into account the possiblity of placing a nail in a knot or split most codes have a minimum requirement of at least 3-4 nails, even though 1 or 2 are in fact accepted in practice. Another rule has been discussed, namely the addition of one nail in joints where the calculation gives 1 or 2 nails, but the proposed test is more flexible.

6.1.1.2 Table 6.1.1.2 - refer to CIB-W18/9-7-2.

7.1.1 The inclusion of limitations on $\sigma_{m,wc}$ and $\sigma_{m,wt}$ is discussed. According to established practice in USA and Canada they are disregarded in designing plywood beams. If the stresses are calculcated according to the theory of elasticity they will for most plywood types be decisive.

Formulae 7.1.1g, 7.1.1h, 7.1.1i - the method is based on the theory of elasticity. See, for example, 'Halasz and Cziesielski (Berichte aus der Bauforschung, Heft 47' and CIB-W18/6-4-3.

7.1.2 The simple method has been shown by Booth to be satisfactory (IUFRO-Section 41, Madison, 1971). The effective width for uniform load for plywood corresponds approximately to $b_{f,e} = 0.15\ell$ (Möhler a.o in Holz als Roh- und Werkstoff Nr 21, 1963) but has been reduced to take into account the effect of uneven load distribution.

The limit b_{max} has been calculated according to the method given above.

7.1.3 The design of spaced columns and mechanically jointed components is discussed in CIB-W18/3-2-1.

7.3 The following guidelines were given in CIB-Timber Code, second draft:

> The axial forces are calculated assuming hinges in all nodal points, and the moments in continuous members, if any, are assumed to lie between 80 per cent and 100 per cent of the simple moments (corresponding to hinges in both ends) dependent upon the degree of end-fixing and the support conditions. For non-continuous members the moments are assumed equal to the simple moments. The free column length is assumed between 85 per cent and 100 per cent of the theoretical nodal point distance dependent upon continuity and degree of restraint.

A sub-group was formed at the CIB-W18 meeting in Perth with the task of discussing these rules especially with regard to the use of nail-plates.