# Perspectives on European Standards for wood-based panels*

## NACRTI BUDUĆIH EUROPSKIH NORMI ZA DRVNE PLOČE

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Sažetak

Ovaj rad predstavlja raspravu o potrebi stvaranja novih Europskih normi za glavne pločaste proizvode. U njemu su obuhvaćene metode testiranja, specifikacije materijala, načini izvršavanja normi i Eurokoda 5, kao i njihovi međusobni odnosi. Napredak u donošenju novih normi je poželjan i iz razloga značaja novih načina testiranja kao i zahtjevnih istraživanja od kojih su neka i navedena u radu. Upravo sada, primjenjivost novih normi širom Europe ima intenciju za njihovom zajedničkom provedbom.

Summari

This paper sets out the reasoning behind the set of new European Standards being drafted to govern panel products. These cover test methodology, material specifications, performance standards and Eurocode 5, and the interactions among these are described. Progress in drafting has been good even though a considerable amount of new testing and research has been required, some of which is described here. Implementation of the new standards throughout Europe is now intended to be achieved as a single package at a common date.

### THE CONSTRUCTION PRODUCTS DIRECTIVE

Probably the single most important piece of European technical legislation for the wood-using and wood-products industries in the last few years has been the Construction Products Directive (CPD) with its set of six Essential Requirements on the performance of construction works. These are:

1 Mechanical resistance and stability
2 Safety in case of fire
3 Hygiene, health and environment
4 Safety in use
5 Protection against noise
6 Energy economy and heat retention

Now, depending on the intended use of the panel product, and the particular regulatory requirements, all, some, one, or even none, of these requirements may apply. The connection between these requirements, which relate to buildings, and the CPD, which relates to building products, is set out in a series of Interpretative Documents which are currently being finalised. Thus it must be demonstrated that wood-based panel products, like any other construction materials under European mandates, can enable the building works to comply with the essential requirements, and are therefore materials which are fit for their intended purpose. Once agreed by the European Commission, harmonised European Standards will provide the mechanism by which specific products such as plywood, particleboard, orientated strand board (OSB) or fibreboard will demonstrate this compliance.

In complying with the requirements of the harmonised European Standards, whether these are material specifications or performance requirements, manufacturers must demonstrate conformity of the product with the technical specification. This will include some degree of testing and/or certification, possibly by a third party. If conformity is achieved, then the manufacturer may use the CE mark.

Much confusion has arisen over the significance of this mark. Basically it is only a symbol of conformity with the essential requirements, or with those particular requirements for an intended end use. Therefore it is not a mark of quality, and it is not intended that it be interpreted as a quality mark. One very important point which must be appreciated is that member states of the European Community (EC) have the freedom, where different levels of performance are included in a harmonised standard, to opt for whichever level they wish for the purposes of legislation. This means that if the higher of two levels is adopted, boards complying with the lower level will not satisfy the legislation in that country despite bearing the CE mark.

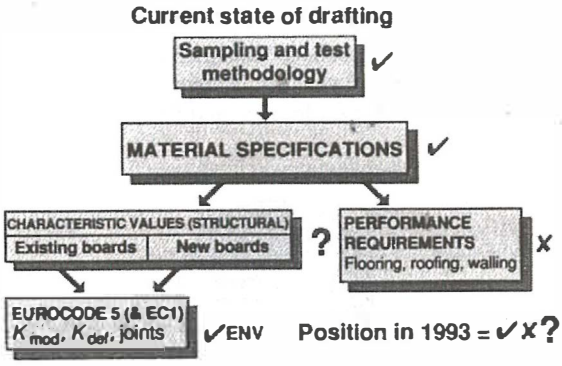


**Figure 1 The various components necessary to meet the essential requirements and their current state of drafting**

While the manufacturer is therefore primarily concerned with meeting the material specifications and, where appropriate, the performance requirements, the user of the product wishes to know either how the board performed in the performance tests (prototype testing), or whether stress values, time-modification factors, and rules for the structural use of board materials are available. The derivation of characteristic values for new board types used in structural design is set out in draft European Standard prEN(124.206) while the values for existing boards (particleboard, plywood and hardboard) are included in prEN(112.406). The regulations governing the design of timber structures, together with values of the two sets of time- modification factors, are set out in Eurocode 5.

The task of formulating these new Standards has been given to the European committee for Standardisation (CEN), who in turn have formed a number of Technical Committees to cover specific materials or products. Thus Technical Committee TC112 is responsible for the production of standards relating to wood-based panel products. TC112 has been subdivided into six working groups to cover, respectively, each of the following: particleboard (including OSB), plywood, fibreboard, test methodology, formaldehyde, and cement-bonded particleboard. Most working groups are further divided into smaller ad-hoc groups to examine specific aspects such as moisture resistance, specific test methods, and derivation of structural characteristic values. Membership of the national delegations for these working and ad- hoc groups is drawn from industry, associations and institutions (including BRE) according to the technical specialism needed. Experts are nominated by the respective national committees responsible for the work programmes.

## PREPARATION OF STANDARDS

There are four groups of standards being evolved for panel products:

. Those defining test methodology

. Those defining quality specification

. Those defining the performance requirements of the panel in particular applications

. A single regulatory standard (Eurocode) for the general structural use of timber and panel products

With a few exceptions, the test methodology and sampling standards are now well advanced (Figure 1). The initial committee work and drafting has been completed and many of the draft European Standards (prENs) are either out for preliminary CEN enquiry or for final voting. Two European Standards (ENs) have actually been published on new test methodology.

The materials specifications are almost as well advanced, with agreement reached in committee on at least 95% of the values proposed; indeed the prENs for some grades of panels are already out for CEN enquiry, while two of the classification documents have been published.

The first and perhaps somewhat limited approach to the structural design of particular components (eg floors) is through prototype testing as set out in the relevant performance specification. Although the essential requirements and their draft Interpretative Documents are couched in terms of performance, TC112 has been slow to embrace the question of performance testing; many member states have been less than enthusiastic about the concept. However, the issue of new mandates by CEN for performance testing has stimulated interest in this important area and a new ad-hoc group has been set up to produce a series of performance standards for board materials. Unfortunately, it will be some tome before these are published.

For general structural design, recourse to the use of characteristic values and time-modification factors is necessary. A method for the derivation of the characteristic values for new board types when used in structural design work has been completed /prEN(124.206) and prEN789/, and the corresponding specification setting out the values for existing board types is currently being drafted /prEN(112.406)/, though it is doubtful if this will be completed before the middle of 1993.

These characteristic values will be used in conjunction with Eurocode 5 which, in addition to setting out design procedures for both members and joints in various structures, includes values for the two time-modification factors, which will be discussed later in more detail. The drafting of Eurocode 5 has now been completed and it is hoped that this will be issued as an ENV (Voluntary European Standard) in the first half of this year. As a trial standard the ENV is non-mandatory and open for further discussion and development. Designers will be encouraged to use it alongside national codes of design in order to derive experience in its application: it is hoped that it will become a mandated standard in from five to seven years. This transition period will not be without considerable problems where old national standards have to be retained to sustain the national design code. Many of the national standards are in conflict with their new EN counterparts and much flexibility and tolerance will be required over this transition period in order to avoid major international disagreements.

## MATERIAL SPECIFICATIONS

**Particleboard** (Figure 2)

Six grades of particleboard are specified in prEN312, in Parts 2 to 7. Four of these grades may be used structurally in accordance with either Eurocode 5 or a relevant performance standard. Parts 4 and 6 specify two grades of loadbearing boards for use under Service Class SC1 conditions, while Parts 5 and 7 specify the corresponding grades for use under Service Class SC2 conditions. Part 2 relates to boards for general-purpose use, while Part 3 specifies boards to be used in fitments and furniture. Part 1 of the standard sets out common general requirements such as levels of tolerance and formaldehyde.

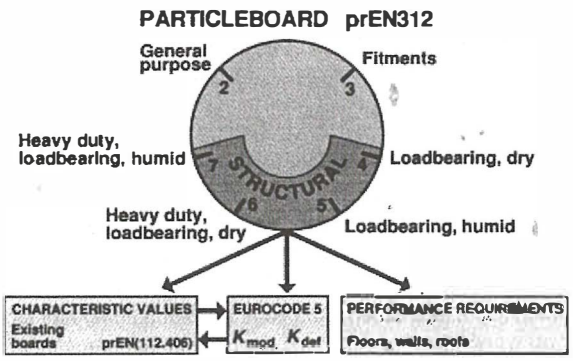


**Figure 2 The six material specifications for particleboard and the interaction between the four structural grades and Eurocode 5**

**OSB** (Figure 3)

Four grades are specified in prEN300. Part 1 is for a generalpurpose board while Parts 2, 3 and 4 specify structural boards to be used in either Service Class SC1 (Part 2) or SC2 (parts 3 and 4) conditions.

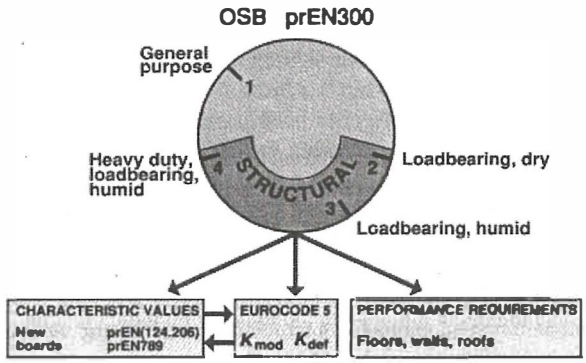


**Figure 3 The four material specifications for OSB and the interaction between the three structural grades and Eurocode 5**

**Fibreboard** (Figure 4)

At present four grades of fibreboard are specified in Parts 2 to 5 of prEN622, Boards for general use in Service Class SC1 are specified in Part 2, and for use in SC2 conditions in Part 4. Loadbearing boards for use in Sc1 are specified in Part 3, and for use in SC2 in Part 5. Within each Part, separate requirements are set out for each type of fibreboard (eg soft, medium, hardboard and MDF). Part 1 of the standard sets out common general requirements such as levels of tolerance and formaldehyde.

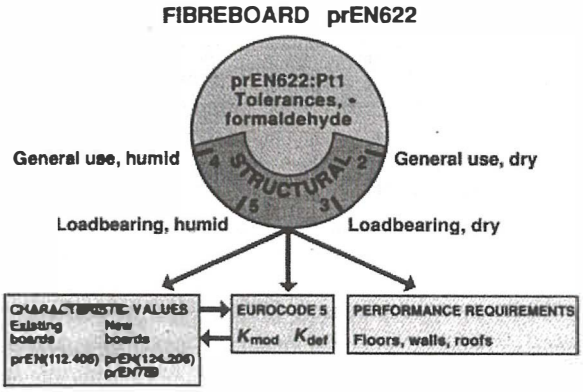


**Figure 4 The four material specifications for fibreboard and the interaction between the two structural grades and Eurocode 5. Within each specification, separate requirements are set for each type of fibreboard**

**Plywood** (Figure 5)

Unlike the specifications for the other materials, that for plywood (prEN636) sets out three grades which may be used structurally or non-structurally. Part 1 is for use in SC3 (full exterior), Part 2 is for use in SC2 (covered exterior), and Part 3 is for use in SC1 (dry interior) conditions.

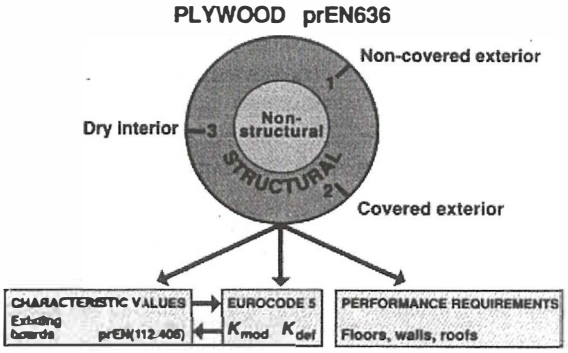


**Figure 5 The three material specifications for plywood, all of which can be used structurally as well as non-structurally**

**Cement-bonded particleboard**

A single grade of CBPB is specified in Part 2 of prEN 634 and relates to a board bonded with ordinary Portland cement. This board can be used either internally or externally in nonloadbearing situations. Insufficient evidence of its structural performance is available to permit its use in structural design at present. Part 1 of the standard sets out dimensional tolerances.

## RESEARCH REQUIRED FOR SPECIFICATION DEVELOPMENT

The development of new test methodology, as well as the revision of existing methodology, has necessitated

the use of much existing research data and the execution of new work. The scale of test evaluation work, as well as more basic research, has been tremendous, carried out by research institutes and universities, as well as in industry. Selected topics in which BRE has taken an active part are as follows.

*Sample size and thickness swell*

The compromise solution of a 50 x 50 mm sample has meant that all 16 member states must seek correlations between the values obtained using the new size and their previous test methods. The very recently published report of the Nordtest co-operation project in this area is a very good example of the volume of test work that must be carried out in order to measure the significance of changing the method of evaluation.

*Planar shear test*

The weight of the composite test piece was so great as to pose a question of safety. Research at BRE showed that the sample could be reduced to one-third of its area without mitigating against the efficacy of the test.

*Structural bending test*

Much discussion arose on the question of various parameters in the derivation of bending strength in structural-size (300 mm wide) test pieces. Questions of roller spacings for different thicknesses of board could only be resolved by actual investigation at many laboratories, including BRE.

*Percentiles*

The decision to express the results in the material specifications as a five percentile for strength and a ninety- five percentile for swell, generated much work in some countries including the UK, as manufacturers and users alike either attempted to rework existing data to produce percentile values, or carried out new evaluations of the product in terms of percentiles.

*Moisture resistance*

One of the main problems that has arisen in seeking harmonisation in the material specifications is the question of moisture resistance. With great difficulty a short-term solution has been negotiated which enables mutual recognition of the V313 and V100 procedures. However, the long-term solution lies in research to develop a glueindependent measurement of resistance. An application to the EC for research funds has been successful and test work has started on this co-operative research programme in which BRE is a participating member.

*Time-modification factors*

The need for values for the two time-modification factors, Kmod and Kdef, in Eurocode 5 has necessitated extensive programmes of work to derive these factors for a large range of boards under conditions commensurate with Service Classes 1 and 2. This topic is discussed in more detail next.

## TIME-MODIFICATION FACTORS IN EUROCODE 5

The two factors Kmod and Kdef are derived from experimental data. A number of laboratories have been involved in these determinations and BRE has been among the most prominent with a substantial programme of work initiated twenty years ago. This has generated a wealth of information on the long-term behaviour under load for a wide spectrum of board materials under a range of environmental conditions.Experiments have fallen into two distinct categories corresponding to the two different modification factors.

The first set of experiments was designed to measure the loss in strength with time, and therefore provide information on the duration of load. Sets of matching samples were subjected to a range of different loads representing different percentages of the sort-term ultimate strength. Failure times varied from a few days at 80% stress level to 9 months at 50% stress level. The logarithm of the time to failure for each sample was plotted against stress level, and the regression line then projected to the desired time periods (6 months, 10 years, 50 hears). The corresponding stress levels can now be read off to give values known as Kmod in Eurocode 5. The tests have been carried out at each of two environmental conditions (20pC and 65% relative humidity, and 20oC and 90% relative humidity) corresponding to Service Classes 1 and 2.

The second set of experiments relates to the assessment of the increase in deflection with time under load. The ratio of the increase in deflection over the original elastic deflection is known as 'relative creep' or the 'creep factor' and is designated Kdef in Eurocode 5. The duration of the BRE experiments was usually 6 months, though a few were extended to as much as 10 years. To obtain values of Kdef at 50 years for all materials, and 10 years for most, it was necessary to fit a rheological model to each set of data (one sample at one stress level and one environment) and then to calculate from the model the value of relative creep (Kdef) at the desired time periods (10 years, 50 years). This is a very laborious task and has to be repeated for each of the two environmental conditions.

The BRE values, together with values submitted by a number of other laboratories including VTT in Finland, have been considered by the Eurocode 5 committee for inclusion in the ENV.

## IMPLEMENTATION OF THE NEW STANDARDS

It will be appreciated that because of the large number of standards, it is not feasible for them all to be published at the same time; nor is it feasible to implement individual standards immediately on publication since many of them are interrelated, as for example a test method and associated grade specification providing values for the property determined by that method.

Thus, while the original requirement by CEN was that national standards should be withdrawn as soon as a new European standard was published, different timescales and interrelationships make this totally impracticable. This is especially so where several test methods are ready for publication, but the associated grade specifications have not been agreed. In such cases, if the national test method were withdrawn, the national grade specification would not relate to the new test method.

Consequently, it has now been agreed that although the CEN standards will be published when ready, they will not necessarily be implemented (by withdrawal of national standards) until an interrelated package of standards is ready. To reduce the uncertainty that could occur among different commercial trading countries in Europe needing different packages of standards, it is currently boeing proposed that the whole of Europe should make the change on an agreed date and the provisional date for this adoption process is 1 January 1995.

## CONCLUSIONS

1 The Construction Products Directive has now been implemented and product manufacturers, whilst enjoying the potential of a wider market, must familiarise themselves with and then implement the necessary material specifications, performance standards and attestation of conformity to allow them to gain the CE mark as an indication of compliance with the essential requirements of that Directive.

2 The drafting of the harmonised test methodology and material specifications is expected to be completed early in 1993. Publication of the Interpretative Documents, which are an essential link between the Directive, the essential requirements and the technical specifications, is subject to delays still.

3 The earlier lack of enthusiasm among some EC member states to address the drafting of performance tests, is giving way to a new awareness of their value and importance, and work on drafting these standards has now started.

4 Eurocode 5 regulates the structural design requirements for the application of the structural grades of particleboard, fibreboard, plywood and OSB, and provides the data on the two long-term modification factors. The drafting of Eurocode 5 is now complete and it should appear as an ENV early in 1993.

5 It is hoped to implement the entire package of standards on 1 January 1995.