

**Client Report :**

Review of regulatory framework  
(codes and standards) in  
relation to the use of green  
glued structural timber.

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## Executive Summary

This client report presents a review of how structural timber produced using 'green (wet) gluing' technology (GREENWELD and Collano polyurethane systems) can be successfully marketed. The effect of the current and planned regulatory framework (codes and standards) is assessed and the option for using third party certification is discussed. The work was jointly funded by the Forestry Commission's Policy and Practice Division and the United Kingdom Forest Products Association.

The review of current and future codes and standards has shown that the development of European standards is a long way behind the current developments in technology for green gluing. As a consequence, in the short-term it is believed that the only effective route to bringing green glued products, particularly those using polyurethane, to the market place is by third party accreditation. The long-term approach will be to ensure that relevant European standards currently under development allow the use of green gluing. BRE is actively working towards this through its participation in the relevant BSI and CEN committees and working groups.

The main difficulty concerning the UK and European standards route to the commercialisation of green gluing technology for structural products is that neither of the adhesives currently used have been formally evaluated for compliance to EN301. GREENWELD is a resorcinol based adhesive and thus comes under the remit of the standard when bonding dry timber. However, currently EN301 does not include provisions for testing polyurethane adhesives.

In the future, the compliance of polyurethanes as structural adhesives by the European standards route is likely to be possible by the development of a new standard by TC 193/SC1/WG4 (the CEN wood adhesives committee's Working Group for 'Novel Adhesives').

The current EN386 and draft prEN386 have a clause for strict limits on moisture content of the timber used for laminations and this is considerably below the moisture content desirable and cost effective for green gluing. The UK representatives on the CEN committee dealing with these documents need to ensure that the standards cover all the necessary performance criteria but are flexible and do not hinder new technologies, including the use of green gluing for structural products.

The **recommended short-term route** for the commercialisation of the technology concerned with the wet gluing of timber is by third party certification and there are two stages to achieving this:

- (a) Certification of the adhesive, using the testing regime of EN 301. This is expected to be organised by the adhesive manufacturer.

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- (b) Certification of the specific products to show that their performance is adequate for their intended use (fit for purpose). This will be the responsibility of the users of the adhesive.

BRE has already carried out some components of the required testing but further work will be necessary. For some uses the additional testing will be considerable. However, for the certification of polyurethane as an adhesive suitable for structural use, it is anticipated that the results of third party certification testing from Germany, Sweden and France can be used as an example.

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## Introduction

Over recent years adhesive systems have been developed that enable wood to be successfully jointed whilst 'green' (wet). The first true green gluing system GREENWELD™ was developed by the New Zealand Forest Research Institute (NZFRI). BRE signed an 'agreement of use' with NZFRI to test the performance of the adhesive on UK grown Sitka spruce for structural use having considered the system's potential for UK timber.

Initial assessments were very encouraging, with the adhesive system demonstrating very good bond strength. The test regime concentrated on testing finger-jointed material according to BS 5291: 1984 the manufacture of finger-joints for structural softwoods and ASTM 4688-90 evaluating structural adhesives for finger-jointing lumber, specific test methods used by NZFRI. These initial tests enabled comparisons to be made with those assessments carried out by NZFRI. The ASTM 4688-90 test is a severe accelerated weathering test to simulate the performance of the GREENWELD adhesive in hazardous humid conditions. An initial assessment was also successfully carried out in accordance with EN 301: 1992 part 1, determination of bond strength in longitudinal shear.

At the time of completion of the initial assessments, the view of the UK softwood sawmilling sector was that the application of the wet gluing system to structural timber was not economically viable. Therefore, in subsequent work, BRE developed and assessed wet gluing systems for the joinery and flooring markets. Towards this end, BRE forged links with Collano Ebnother AG, a manufacturer of clear polyurethane adhesives. The use of this adhesive was initially for non-structural application to produce re-engineered joinery quality timber from both hardwoods and softwoods.

The ability to "green glue" greatly increased the processing potential for low quality timber supplies. The removal of knots and other poor growth characteristics, which often cause distortion during drying, or by using short timber lengths greatly increased the potential of using this type of bonding system. The resultant lengths of green finger-jointed material could then be kiln dried, saving processing costs on drying timber of little value or where drying distortion could result in significant commercial loss.

The potential of using Collano polyurethane adhesive for improving wood quality and efficient processing has been successfully demonstrated. It was then realised that a potential existed to develop the process beyond joinery quality timber, to enable low grade timber of little commercial value and short length timbers to be upgraded to produce higher quality structural material.

Green gluing has the potential to greatly enhance the competitiveness of UK-grown timber. The current obstacle to the commercialisation of the green gluing process is the regulatory framework with regard to UK and EU codes and standards relating to structural timber.

It is clear from the work carried out in developing this technology, and the aspirations of the timber industry to apply the technology, that the process has outpaced the structural

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codes and standards. Even the most recently drafted standard revisions do not fully realise the potential.

The aims of this report are to examine the standards (current and draft) for structural timber to determine what is permissible, what is not permissible, and what codes and standards need clarification or amendment. This report indicates possible routes that are available to take the processing technology forward. It also highlights areas of research that are required to resolve identified problems or issues.

One of the major difficulties at present is that most of the structural timber codes and standards are currently under revision. In addition, their final form and their variation from the current standards may not be known for some time. In fact, some of the promising signs for the current standard revisions are unlikely to make it to the final versions. Therefore, the review in this report may be superseded due to the events and actions resulting from the TC124 working groups on structural timber. (However, it could be said that this is the ideal time to carry out this review because there are many changes taking place in the standards. Gaining an understanding of what is happening and its future impact for the UK industry, means we can be in a position to positively influence the longer term future). But, the development of standards, particularly at a European level is a notoriously slow process so, therefore, it will be essential to take supplementary actions in the short- and medium-term in order to take advantage of new technology.

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## Description of the project

This project is a review of the current state of normative and draft revised codes and standards relating to structural timber that may have a bearing on the use or production of green glued structural timber and includes:

- Interpretation of the current standards to seek to clarify the position for the use of green glued timber in structural applications.
- To determine what is permitted and, as importantly, what is expressly excluded when wishing to use green glued timber structurally.
- To highlight areas where codes and standards are at variance and bring this to the attention of the appropriate codes and standards committees and suggest appropriate measures to bring about a resolution.
- Indicate appropriate routes for the further development of this technology in both the short- and long-term.
- Highlight areas of research that will be needed to increase knowledge of wet gluing.
- Disseminate the findings to all those who have an interest in developing the potential for this technology in both the timber processing industry and the regulatory bodies.
- To identify the approach needed to enable the commercialisation of this technology for appropriate products.

The report includes the major areas of general concern to the end-user such as:

Part 1: What can be done in practice – Generic principles: a review of the types of applications with possible routes to success and specific needs to be addressed is presented for both finger jointing and glue-lamination by the general principles involved. However, due to client confidentiality, specific types of lay-ups (particularly with regard to glue lamination) will be avoided. The aim will be to give a guide as to what can be achieved and how this may be done. This part should be read in association with Annex 1, which contains extracts from the relevant standards.

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Part 2: Certificated product/ product validation: discusses options outside of the regulatory framework such as the potential for product certification by organisations such as Certification Bodies. This route offers significant potential and benefits in getting green glued products into the market place sooner than the route through codes and standards. The greatest advantage is that it is a performance based assessment of the products so nothing is ruled out before commencement.

Annexe 1: What the codes and standards say: covers what the codes and standards actually say regarding what is permitted and what is excluded as to the application of wet gluing as well as other issues that have a direct bearing on the topic that need to be discussed. Annexe 1 is the foundation on which Part 1 is built. It is included as a verification of Part 1, but also to allow the reader to be fully familiar with the wording of the codes and standards and to help them develop their own understanding and ideas as they relate to the issues at hand. It should also be pointed out that codes and standards dealing with structural timber, as opposed to joinery timber, are primarily related to health and safety matters and not simply product quality, therefore, it is advantageous to be aware of what is actually stated. Relevant points covered are:

- Moisture content
- Adhesives
- Strength grading
- Creep and duration of load requirements
- Finger jointing
- Glue-lamination

### **Part 1: What can be done in practice - Generic Principles**

The aim is to lay out some basic generic principles and highlight what is possible and where the regulatory framework will need addressing. This section should be read with Annexe 1 to gain a full understanding of the current situation.

It should be pointed out at the outset that currently no adhesive for wet gluing is covered by EN301, the structural adhesive standard. GREENWELD shows potential as a resorcinol adhesive but has to be fully tested to ensure compliance with the performance requirements. It is a brown and highly visible adhesive. Collano is a polyurethane and so is not covered by EN301, though it is probably the industry's preferred adhesive for wet gluing as it is almost invisible to the eye.

## **1. Strength grading of timber**

### **a) What is permitted under current standards; EN 519 and BS4978.**

- Machine grading of timber in the thickness range of 20 to 70mm in the dry or green moisture condition depending on the services class of end-use.
- Visual grading of timber of unlimited maximum thickness to a lower limit of 20mm in the dry or green moisture condition depending on the services class of end-use. (For visual grading this lower limit can be dropped below 20mm thickness in EN386).
- Machine grading with finger joints is permitted (joints made either dry or wet) so long as not more than 1 finger joint appears in the span (900 mm) of the grading machine at any time.
- Grading of laminated timber as a new species.

### **b) What will be required or needed to make the above possible.**

- New machine settings to be derived for timber of thickness less than 35mm. Though 20mm is around the minimum lower limit for machine grading. No settings have ever been derived.
- Evaluation of laminated timber as a new species with new setting derived specifically for the purpose.
- Each permutation of lay-up for glued-laminated products needing to be treated as a new species, unless it can be demonstrated that the new lay-up does not affect the accuracy of the grading process used for a previous lay-up arrangement.

### **c) Revised standards prEN14081-Part 1(replacing EN519)**

- The significant change to EN519 is that in the “Scope” of this document it states that finger jointed timber is not covered by this standard. This needs to be addressed and action taken to ensure this does not remain in the standard, as it will prevent machine grading of finger joints. This has already been raised by BRE and noted in public comment.

**See Annexe 1 “Strength grading” for what the standards specifically say and regulate in this area.**

## **2. Finger jointed material**

### **2.1 Dry timber of commercial size joined by a single finger joint.**

#### **a) What is permitted under current EN385.**

Finger jointing of commercial sized stock in the dry state with an adhesive that complies with EN301 is permitted under current structural codes, BS5268: Part2 and Eurocode 5. An EN301 compliant adhesive is defined as a phenolic or aminoplastic polycondensation adhesive. GREENWELD could be evaluated for EN301 compliance as it is a phenolic adhesive, but Collano could not as it is a polyurethane-based adhesive.

- It has been demonstrated by BRE that a single finger joint in commercially sized stock does not adversely affect the performance of the strength-grading machine.

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- Currently accepted adhesives can be used, as the timber will be in the dry state.
- The timber components can be constructed from short lengths of dry timber then finger jointed and machine graded.
- Wet glued finger joints where an EN301 compliant adhesive is used as specified by the manufacturer. This could be achieved by using GREENWELD tested in accordance with EN 301.

b) What is not permitted under EN385.

- The use of any adhesive that is not covered, or does not comply with EN301.

c) What needs to be addressed.

- GREENWELD needs to be fully evaluated for compliance with the performance requirements of EN301.
- The adhesives range covered by EN301 needs to be addressed to widen the scope to allow other adhesives (new standards are in production with the initial focus being on a standard for polyurethanes).
- Development of a certificated product route for finger joints made outside the scope of EN385 and with a non-EN301 adhesive.

**2.2 Dry timber of commercial size joined by multiple finger joints.**

a) What is permitted under EN385

- If the above criteria under 2.1 for single finger joints are followed then the only restriction currently on multiple finger joints is the frequency of their use in the final product.

b) What is not permitted under EN385.

- There should be no more than 1 finger joint per span of the grading machine, otherwise this will adversely affect the performance of the grading machine.
- Adhesives must conform to EN301 (phenolic or aminoplastic polycondensation adhesives); GREENWELD may conform to this standard when fully evaluated against the performance requirements, but the standard does not cover polyurethane adhesives.

c) What needs to be addressed.

- The range of adhesive types covered by EN301 needs to be wider, or a new standard drafted for polyurethane adhesives.
- Certification route for products with finger joints made outside the constraints of EN385 and with a non-EN301 adhesive.

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### **2.3. Wet timber of commercial size joined by single or multiple finger joints.**

#### **a). What is permitted under EN385.**

- If the above criteria under 2.1 and 2.2 for single or multiple finger joints are followed and the adhesive conforms to EN301 (phenolic and aminoplastic polycondensation adhesives) and follows the manufacturers' instructions for wet application then it is permitted. Currently GREENWELD is the only adhesive that would be applicable, but it needs full compliance testing against the requirements of EN301.
- Timber containing finger joints may be machine graded.

#### **b). What is not permitted under EN385**

- The use of a non-EN301 adhesive.
- More than 1 finger joint per span of the strength-grading machine be used.

#### **c). What needs addressing**

- Evaluation of GREENWELD for full compliance to the performance requirements of EN301.
- Certificated product route for finger joints made outside the constraints of EN385 and with a non-EN301 adhesive.

### **2.4. General points applicable to all finger jointed products**

- There is a relaxation of the wording in the revised finger jointing standard prEN385 indicating that other adhesives might be allowed, but still refers to EN301 adhesives. There has also been an attempt to get polyurethanes accepted for structural use by inclusion of an annexe relating their performance requirements in the glue lamination and finger jointing draft head standard prEN14080. However, this annexe had not been produced at the voting deadline and so the UK has voted against the inclusion of the relaxed wording for adhesive specification. This decision was taken to avoid confusion (the wording of the draft standard could have led to an adhesive being allowed in one country but not another) and prevent future problems, eg structural collapse where an adhesive with inadequate performance had been used.
- If the draft prEN14081–1 is approved without amendment or clarification then it is highly likely that machine grading of finger joints will not be permitted. It will need the efforts of the UK representatives on these committees to ensure that the statement on finger jointing is removed from the scope of the document and a more acceptable clause inserted in the proposed Part 2 or new Part 4 of the head standard for structural timber.

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- It is not considered necessary to evaluate these products for creep and duration of load performance, as they will conform to current finger jointing practice.
- Where the product may constitute a principal member, the finger joint or joints should be manufactured under a third party certification scheme.

**See Annexe 1 “Finger Joints” for what the standards specifically say.**

### **3. Glued-laminated Timber.**

It would be a demanding and challenging task to produce wet glue-laminated timber using existing codes and standards. Most notably, the moisture content requirements for laminates in both the current EN386 and draft prEN386, excludes timber over 18% moisture content. It does not seem likely that this will be changed in the immediate future. A new glued-laminated timber standard for wet gluing may be the most appropriate standard approach to longer-term progress for this work.

#### **3.1. Side-laminated components in the dry state (not exceeding 15% (untreated) to 18% (treated) moisture content).**

The simplest form of laminated product would be two side-laminated boards in the vertical plane. There are two methods by which this can be achieved set out in 3.1.1 and 3.1.2:

##### **3.1.1. Machine-grade the laminates.**

###### **a). What is permitted under EN386.**

- To machine grade the laminates prior to assembly.
- To assemble the boards using an adhesive compliant with EN301 (phenolic and aminoplastic polycondensation adhesives).

###### **b). What is not permitted under EN386.**

- Nothing is prohibited as the process follows current glue laminating policy, and is permissible while the process remains within this practice.

###### **c). What needs to be addressed.**

- For laminates less than 35mm new machine settings will need to be derived.
- Certificated product route for finger joints made outside the constraints of EN386 and with a non-EN301 adhesive.

###### **d). Benefits**

- As this conforms to current glue-lamination practice there is an increase in strength to be gained over the characteristic strength of the laminates. The factors are given in BS5268: Part 2.

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**3.1.2. Machine grading the laminated component in the dry state (not exceeding 15% (untreated) to 18% (treated) moisture content).**

a). What is permitted under EN386.

- Assembly of the boards before machine grading using an adhesive compliant with the performance requirements of EN301 (phenolic and aminoplastic polycondensation adhesives).
- Machine grade the whole laminated assembly.

b). What is not permitted under EN386.

- Nothing is prohibited as the process follows current glue laminating policy, and is permissible while the process remains within this practice.
- To machine grade laminated products in excess of 75mm by 300mm (maximum size limit of timber for bending type machines).

c). What needs to be addressed.

- To machine grade the whole assembly the finished product would need to be treated as a “new species” and a machine setting derived pertinent to that “new species”.
- Certificated product route for finger joints made outside the constraints of EN386 and with a non-EN301 adhesive.

d). Drawbacks.

- The “new species” setting would only be relevant to the particular lay-up used to derive the setting. The population would need to be carefully described and any variance from the tested lay-up would have to be tested to demonstrate that it does not affect the accuracy of the grading process.

**3.2. Side laminated components in the dry state with dry or green glued finger joints.**

For the side lamination in the dry state, the process described in 3.1.1 and 3.1.2 would hold true, but the addition of finger joints adds a new dimension.

a). What is permitted under the current EN386.

Finger joints manufactured in the dry state as above under 2.1 and 2.2 with an adhesive that complies with EN301 (phenolic and aminoplastic polycondensation adhesives) present no problems and the lamination process can be either of the above methods described under 3.1.1 or 3.1.2.

b). What is not permitted under EN386.

- The use of wet glued finger joints in glued-laminated timber. The relaxed rules on moisture content in EN385 for finger joints are expressly excluded from the current EN386 for glue-laminated products. The finger joints are constrained by the same moisture content requirements as the laminates; i.e. a moisture content not exceeding 15% for untreated timber and 18% for treated timber.

c). Revised draft of prEN386.

- In the latest revision of the glue-laminated timber standard (prEN386) the clause relating to moisture content restrictions for finger jointing in glued-laminated products is removed. This standard now indicates that wet finger joints may be used in glued-laminated products. However, the adhesive must conform to EN301 and must be used in accordance with the manufacturers' instructions with regard to moisture content. This relaxation of the moisture content rules under prEN386 is likely to be lost in the final version.

c). What needs to be addressed.

- The clause in EN386, which prohibits the relaxed moisture content conditions for finger joints in glued-laminated products, should be amended. However, the prEN386 has this obstruction removed. This means although the laminates must have a maximum moisture content of 15 or 18% before laminating, the finger joints could be made green and then dried before laminating. UK members on the CEN committee dealing with this standard should support this clause.
- While it is known how single finger joints in commercial sized stock behave in the grading machine, it is not known how thin section material would perform with settings that have not been derived yet. There is every likelihood that the thinner the timber section the greater the influence of the finger joint. Similarly, it is not known how finger joints in laminated material will perform in the grading machine, particularly the effect of finger joints passing only half way through the finished product, or their frequency along the length of the product.
- The UK should support the draft prEN386 in regard to finger joints.
- Certificated product route for this type of product that falls outside EN386.

d). Finger joint arrangement.

- Where finger joints appear in glue-laminated products irrespective of their orientation (i.e. horizontal or vertical, face or edge laminations), they should be used in accordance with EN386 and will be required to be staggered in certain conditions.

**3.3. Side laminated components assembled from wet timber with or without finger joints.**

a). What is permitted under the current EN386.

- The wording of the standard has prohibited this type of product by the requirement that the laminates must be within a specific moisture content range, see below.

b). What is not permitted under the current EN386.

- The laminates used to assemble a glue-laminated product must have a moisture content that does not exceed 15% for untreated timber or 18% for treated timber. This moisture content is well below what would be used in order to maximise the potential of wet gluing technology.
- The revised EN386 (prEN386) maintains this position and there is no immediate prospect of change, though it does relax the rules for allowing wet finger joints to be used, but as stated previously, this may be lost in the final version.

c). What needs to be addressed.

- The recurrent difficulties with the adhesive needing to fully comply with requirements of EN301 (phenolic and aminoplastic polycondensation adhesives).
- The wording of the standard relating to the limits on the moisture content of boards, though this seems a difficult situation to circumvent.
- Draft a standard for the glue lamination of wet timber rather than attempting to circumvent EN 386.
- Certificated product route for finger joints made outside the constraints of EN386 and with a non-EN301 adhesive.
- Research to investigate the effects on machine grading glued-laminated products with finger joints formed under EN385 and prEN387.

**3.4. Draft standard prEN387**

The draft standard prEN387 on large finger joints for glued-laminated timber offers possible advantages.

a). What is permitted under prEN387.

- Where characteristics such as knots are to be removed from the product to increase dimensional stability, the boards may first be laminated and then the knots removed and the sections of glued-laminated timber joined by large finger joints
- To form short lengths of glue-laminated timber and join them with large finger joints.
- To machine grade the final laminated product with large finger joints.

b). What is not permitted under prEN387.

- The boards must not exceed 15% or 18 % moisture content depending on the preservative treated condition.
- To use any adhesive other than one that complies with EN301.

c). What needs to be addressed.

- Research needs to be carried out to determine how large finger joints will affect machine grading. This is a new standard and there is little experience on the use of large finger joints.
- New machine setting derived to allow the grading of glue-laminated products.
- The determination of creep and duration of load characteristics, though only where the manufacture is not fully compliant with the standard.

**3.5. Horizontal laminated products**

In essence there is little difference between vertical and horizontal lamination as the same constraints apply. Vertical laminations seem to offer the greatest lay-up potential for the immediate future, be that as vertical face or edge laminations.

**3.6. General points that should be considered when contemplating laminated products.**

- For machine grading of laminated products, the frequency and position of the glue lines may require machine trials before derivation of setting to determine if the manner and pattern of lay-up has a bearing on the machine's performance, in a similar manner to finger joints. This will need to be done regardless of the route taken, either through codes and standards or as a performance-certificated product.
- The creep and load duration characteristics will need to be investigated where the lay-ups are at variance from current glued-laminated timber (glulam) practice or where adhesives have been used that are not covered by EN301. Products that are covered by EN386 do not need to be investigated for creep or duration of load.
- If draft prEN14081–1 is ratified without amendment or clarification then it is highly likely that machine grading of finger joints will not be permitted. It will need the efforts of the UK representatives on these committees to ensure the statement on finger jointing is removed from the scope of the document and a more acceptable clause inserted in the proposed Part 2 or new Part 4 of the head standard for structural timber.

**See Annexe 1 “Glued-laminated products” for the specific points raised by the standards.**

**Part 2: Certificated Product / Product Validation.**

From the above, it can be seen that all but the simplest of products will encounter difficulties in meeting the current and future codes and standards and a great deal of work will need to be done by UK representatives to overcome this. The alternative route, which may offer time savings over trying to change codes and standards, is the Certificated Product route.

Certification bodies, such as BRE Certification and others, all offer services that will assess products for approval against predetermined performance criteria. This will rely on the company producing the product to demonstrate that their product meets or exceeds the performance requirements.

Discussions have been held with a representative of BRE Certification, as a typical certification body, to establish the criteria by which a Certification Body would evaluate the product. This discussion indicated that they are more interested in actual performance by determination than by code or standard and this would have the following advantages and drawbacks.

**Advantages:**

- Evaluation for a Certificated product is against measured performance-based criteria, which allows all approaches to be accepted provided that they are validated by test.
- Certification would negate the limitation of the current and future regulatory framework and should make wet gluing a reality in a much shorter time period than attempting to amend the codes and standards.
- Certification allows for commercial confidentiality for the company that holds the certificate. Competitors would have to carry out their own product development by a similar certification route. However, there is a question mark against grading machine settings, see note below relating to this.
- Certification would allow the use of adhesives not strictly covered by EN301 such as polyurethanes, as long as they meet the performance requirements.
- Results produced as part of the certification process could be used to support changes in the regulatory framework.

**Disadvantages:**

- The major draw back to certificated products is that only the product as described by the certificate is covered, any variation from the certificated product would require amendment to, or an additional certificate.
- There would be a cost of the certification process as well as the cost of the work needed to validate the product.

Note: Currently all machine settings are issued by the UKTGC and once released are in the public domain regardless of how they were financed.

## What A Certification Body Would Expect

The Certification Body would expect an applicant for a Certificated Product to demonstrate by test that the performance of the product meets or exceeds the performance requirements of products covered by the regulatory framework and are fit for the purposes for which they are intended.

The following sections present the aspects that would need to be covered.

### a). Adhesive for all types of wet gluing

- Demonstration that the chosen adhesive meets or exceeds the performance requirements as set by the Certification Body. The performance requirements will more than likely be those in EN301 when tested in accordance with EN302, though the adhesive will not be restricted to the types specified in EN301. This should make polyurethane adhesives acceptable for use, as long as all polyurethane specific technical properties are assessed (eg creep, ultra violet resistance, high temperature performance and gap filling).

### b). Finger jointing

- Demonstrate that the adhesive conforms to “Adhesives for all types of wet gluing” (above) and when applied in a wet gluing application, produces finger joints that have a characteristic strength equal to, or greater than the characteristic strength for the strength class of the timber. Show that there is no degrade of the joint strength resulting from the subsequent drying process.
- Show that the adhesive does not adversely affect creep or duration of load characteristics.
- Prove that the frequency of finger joints within the product does not affect the performance of the grading machine.
- Finger joints in principal members are made under third party certification.

### c). Glued-laminated products

- That the adhesive conforms to “Adhesives for all types of wet gluing” as set out above.
- That any finger joints present in the laminations conform to “Finger joints” as above.
- Where machine grading is to be carried out on the laminations before assembly, that accurate and reliable machine settings are derived for the thickness of laminations to be graded. This will need research to acquire additional data for machine grading thin timber so that accurate settings can be derived.

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- Where the laminated product is to be machine graded after assembly, machine settings will need to be derived to achieve this. This would be best achieved by treating the material as a new species. However, the lay-up arrangements must be precisely described and the setting will only be applicable to the lay-up arrangements used to derive the setting.
- The machine settings are accurate for the material being graded.
- Testing to demonstrate that the final strength of the product is acceptable.
- Demonstration that the lay-up or the adhesive do not adversely affect the creep or duration of load characteristics.
- The final moisture content for all laminations can be demonstrated to meet the service class for which the product is intended, where multiple laminations and finger joints are used. This is because glue lines act to slow or restrict moisture movement through the timber. Timber embedded in a deep lamination may not be able to easily lose the excess moisture and so in part remains at a higher moisture content than is acceptable.

## Conclusion and recommendations

### Conclusions

There are two conclusions to be drawn:

#### **Short-term:**

- The only way forward in the short-term for the commercialisation of green gluing for structural uses will be through third party certification.

#### **Long-term:**

In the longer-term, the only way to ensure that future European codes and standards allow for the use of green glued products will be to ensure that the green gluing / UK sawmilling sector is forcefully represented at CEN level for all relevant standards to achieve the following:

- The adhesives currently employed for wet gluing do not comply with or have not been fully performance tested to EN 302 to meet the requirements of EN 301. GREENWELD may well comply with the performance requirements of EN301 but needs to be fully tested. Collano is a polyurethane adhesive and not covered by EN301. The best hope of getting polyurethane adhesives accepted for structural use is the development of a separate standard for polyurethane adhesives. To cover green gluing, this will need to allow bonding to be done at the moisture content recommended by the manufacturer (with bond performance being assessed after the bonded members have reached the currently specified moisture content). BRE is actively participating in the CEN working group that is developing such a standard.
- The most appropriate standard for built up laminated structural timber (BS EN 386 current or draft revision) clearly states moisture content requirements for the boards used for laminations. These requirements are greatly at variance with the moisture content desired to achieve the best production efficiencies that are possible by green (wet) gluing. It seems unlikely that these limits on moisture content will be relaxed in the immediate future within this standard.
- No data (as yet) is available on the creep or duration of load performance characteristic of green (wet) bonded products where the lay-up or adhesives falls outside the regulatory framework. Current structural codes assume glulam has a similar creep and duration of load performance to that of solid timber. This cannot be assumed to be the case for wet glued products with non-EN301 adhesives. The moisture content of the timber at time of manufacture adds a degree of uncertainty to the long-term load carrying capacity of such material.

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- Many of the applications of this technology will rely on machine strength grading and there are areas where new settings will need to be derived. This will require additional research to obtain the necessary data to derive these settings. However, this is one of the simpler tasks and can readily be achieved. Visual grading can be used to grade the thinner timber sections, but this tends to underestimate the strength and stiffness compared to machine graded timber. However, visual grading can be carried out until such time that machine settings are derived.

## Recommendations.

### **Short-term:**

For effective commercialisation of green (wet) glued products the following steps are recommended:

- Seek third party certification of green glued products, especially if using polyurethane adhesive.
- Undertake research into duration of load and creep characteristics of green glued material.
- All adhesives for wet gluing of structural timber should be evaluated according to the performance criteria of BS EN301 types I and II.

### **Long-term:**

- Efforts should be made to address the deficiencies in EN301 as to the types of adhesives acceptable under the standard. BRE's participation in the relevant BSI committee has ensured that the UK will be asking for the revisions of EN 301 and ENs 302 (parts 1 to 7) to allow the moisture content of the timber at bonding to be that recommended by the adhesive manufacturer. It is also vital that the work needed to allow the safe use of non-EN 301 adhesives continues, with particular emphasis on the development of a standard specifically for polyurethane adhesives.
- Efforts should be made to address the moisture content criteria in EN386 which prevents glued (wet) structural timber conforming to this standard and limits the potential for wet glued products. An alternative approach to amending EN386 would be to draft a new standard for wet glued-laminated structural timber.

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## References

See Annexe 1 for the comprehensive references relating to the regulatory review.

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## **Annexes**

This section contains:

Annexe 1: What the codes and standards say, with references.

Annexe 2: Additional information relating to Collano.

## **ANNEXE 1: What the codes and standards say**

Codes and standards relating to structural timber are in the main concerned with safety and health and knowledge of their contents is essential when reviewing possible future products.

The use of adhesives in creating structural timber elements and components is a well-established process and is well covered by codes and standards. However, there are a few discrepancies between the codes and standards and what is to be achieved with green gluing, in the particular instance that the timber is specified as “Dry” and there are only a limited number of permutations used.

Such is the potential of adhesive technology, as to what can be achieved in terms of a modified timber element for structural use, that there is no one simple answer as to what is possible. A simple case scenario of removing knots from a commercial size of green structural timber, finger jointing the ends by green gluing, drying and grading for structural use seem to be within reach, and would be possible, though certain third party controls may need to be added. While at the opposing end of the scenario scale where a structural timber element has been constructed from a number of laminations either vertically or horizontally arranged each with a number of finger joints all green glued before drying will raise difficulties in relation to codes and standards. Therefore, there is a need for specific answers before it can be achieved in practice. Of course there are innumerable permutations between these two cases each with their own possibilities and problems. Therefore, the most productive approach may be to address each process in general terms with the aid of generic examples such that an overall impression of what might be gained without breaching commercial confidentialities, leaving manufacturers to clarify specific points as they think necessary. In all cases where codes and standards prevent the use of green gluing, the only rapid access to the market will be through third party certification.

### **1. Moisture content.**

For the purposes of this review, the moisture content will be taken as falling outside the currently accepted range for structural timber. It will be assumed that as the desire to carry out this work will form part of the primary processing activities involving the timber and that the moisture content to all intent and purposes will be at, or about fibre saturation point, commonly accept to be around 28% for softwoods. This high moisture content will only apply while the product is being processed, at completion it must have a moisture content appropriate to the service class intended for the end-use.

## 2. The Adhesive.

Adhesives for structural timber, used in whatever application must conform to EN301<sup>1</sup>. The two adhesives used for wet gluing of timber have not yet been fully evaluated against this standard.

- Collano is a polyurethane-based adhesive and falls outside the stated scope of EN 301. However, it has been certified for use in other European countries with specific additional requirements because it is not a gap filling adhesive.
- GREENWELD is a resorcinol adhesive, and so is covered by EN 301, but needs to be fully validated against the performance requirements of EN301.

Under clause 3 Definitions, the standard describes the adhesive types that are covered by the standard and reads:

### 3.1 *Polycondensation adhesive*

*An adhesive, made from a resin formed by a polymerisation reaction involving the elimination of water, with a hardener. Such adhesives usually contain extenders and /or fillers.*

### 3.2 *Phenolic resin*

*A synthetic resin derived from a condensation reaction between a phenolic compound (e.g. phenol, cresol, xylene, resorcinol) or a mixture of phenolic compounds with an aldehyde (e.g. formaldehyde, furfuraldehyde) or a mixture of aldehydes.*

### 3.3 *Aminoplastic resin*

*A synthetic resin derived from a condensation reaction between a synthetic compound containing amino groups (e.g. urea, thiourea, melamine) or allied compounds alone or in combination, with formaldehyde.”*

There is some evidence that GREENWELD may conform to EN301 when tested against EN302<sup>2</sup> for compliance. BRE Client Report CR54/96 “ Added value for British grown timber by end jointing, by Mr K Maun<sup>3</sup> has reported tests to part 1 of EN302 and these show promise. However, for full compliance to EN301 clause 5 Requirements, states:

### *“ 5. Requirements.*

*5.1 General Adhesives complying with this European Standard shall meet the performance requirements specified in clause 5 when tested in accordance with EN302-1 to EN302-4 using the following test methods.*

- a) The tensile shear test (subclause 5.3 and EN302-1) using bonded test pieces made from beech (Fagus sylvatica L.).*

- b) The delamination test ( subclause 5.3 and EN302-2) on adhesively bonded test pieces made out of spruce (Picea abies L.). If the adhesive is specifically claimed to be suitable for use with wood from broad-leaved species and /or specially treated wood, then the adhesive shall also be tested on bonded test pieces made from that species or wood treated in that way.*
- c) The fibre damage test (subclause 5.4 and EN302-3) on adhesively bonded test pieces made out of spruce (Picea abies L.).*
- d) The shrinkage stress test (subclause 5.5 and EN302-4) on adhesively bonded test pieces made out of spruce (Picea abies L.).*

Sub-clause 5.3 to 5.5 of EN301 gives the requirements that must be met by the respective EN302 tests 1 to 4.

GREENWELD has only been tested against EN302-1 and so the remaining tests need to be carried out to ensure compliance.

Discussions with the BRE representative on the UK timber adhesives' committee indicated that although attempts are being made to be more inclusive with the types of adhesives used, it seems unlikely that EN301 will change to any great extent soon. Though there is currently an attempt to draft a polyurethane adhesive standard: the proposed polyurethane performance requirement annexe to EN14090<sup>4</sup> could not be produced before the voting deadline on the main document.

### 3. Strength Grading

Strength grading can be performed by either visual or machine methods: machine grading gives by far the better yields, as visual grading tends to give conservative results.

Machine grading to the current BS EN 519<sup>5</sup> or any of the subsequent re-drafts under that number make no mention of machine grading of timber that contains finger joints. However, it has been assumed to be acceptable, as the standard does not specifically exclude the possibility. Tests at BRE have shown that timber with finger joints can be machine graded satisfactorily, though the frequency of finger joints has to be controlled as there is a tendency to increase the measured stiffness in the "plank" direction when more than one finger joint is present in the span of the grading machine. The stiffness in the "plank" direction is the indicating parameter by which all bending type machines attribute the timber to a strength class. Such increased stiffness would result in a false measure of strength. This has been recognised and the UKTGC's document –

Guidelines for Approved Certification Bodies<sup>6</sup> and under clause 8 - UK requirements for certification bodies operating schemes for machine strength graded timber, sub-clause 8.15 states that:

*"Finger-jointed timber may be passed through a grading machine with no significant effect on the grading accuracy, provided not more than one finger-joint is within the grading machine's stiffness measuring span at the same time. This is because a finger-joint may affect the stiffness of the timber, and means that for current bending type machines there should be no more than one finger-joint in any 900mm length of timber. Current grading machines do not give an indication of whether a finger-joint has sufficient strength. "*

Therefore under the current standards, as it is not specifically ruled out and as long as there is compliance that the finger joints do not adversely affect the accuracy of the grading process, it is acceptable to machine grade finger jointed timber.

Current machine settings do not allow for thickness of less than 35mm PAR to be graded. This is because settings have not been derived for thickness less than 35mm and not because they are not allowed. If the thickness to be machine graded is less than 35mm then settings will need to be derived. This will need to be a compromise between having a deflection of sufficient severity for the load recording system to accurately record it, while not being so severe as to damage the timber. This increases in difficulty as the thickness reduces.

The thickness for machine grading is covered in EN 336<sup>7</sup> and the indication from this standard is that 22mm is the minimum thickness for sawn material, but this can be reduced to 19mm for timber planed on all four faces.

The minimum thickness for visually graded timber is given in sub-clause 4.2 of BS4978<sup>8</sup> and this states:

*"Unless otherwise specified, softwood graded to this standard shall conform to BS EN 336 with respect to permissible deviations and processing reductions applicable to constructional timber. It shall have a minimum cross-sectional area of 2000mm<sup>2</sup> and a minimum thickness of 20mm".*

This has been taken as the minimum cross sectional size as a rule of thumb for machine grading as well.

Therefore, if there is a need to machine grade thin laminates, settings must be derived to make this possible. This will require additional testing work to derive data for these thinner laminates.

Whilst there is a tacit assumption that finger joints can be graded to EN519, the February 2000 draft of EN TC 124 - 1.1<sup>9</sup>, under Scope states:

*“ Finger jointed timber is not covered in this standard”*

This statement is repeated in the later version of the document (December 2000), now entitled Draft prEN14081-1<sup>10</sup>.

The implications of this statement are unclear at this point in time. There are three possible interpretations that can be placed on it.

- Machine grading of timber with finger joints is not allowed under any circumstances.
- A strength grading machine should not be used to determine the strength of the finger joint as this should be done in accordance with EN385<sup>11</sup> and EN408<sup>12</sup> and would require demonstration that the joint meets the required strength. The machine could be used to attribute a strength class to the timber.
- Machine grading of finger jointed timber will be covered by another standard. The most likely standard would be prEN14080 the head standard for finger jointing and glued-laminated timber, though this draft standard makes no mention of it.

The second case seems most likely to be the situation. However, this has been raised as a matter of urgency with the convenor of TC124 WG 2 and his response, paraphrased was:

*He was not aware of its presence. The intention was not to exclude the use of finger joints and the most likely explanation was that the range of strength grading machine is increasing and what may affect one type of grading machine would not affect an other. The current assumed situation with bending types would not apply to non-contact type machines and so more general terminology needs to apply.*

A request for the clause to be taken out has been made and was noted and added to the public comments and a separate clause asked to be added, probably in the proposed New Part 4 of the head standard. The wording of the proposed new clause may be something like:

” Features such as finger joints may be machine graded where their presence does not adversely affect the setting of the grading machine.”

However, this cannot be guaranteed and will require support of the UK representatives on these committees. It is imperative that this is achieved.

Moisture content for machine grading is covered by the national annex in EN519, clause NA.3 Moisture content, and states:

*“ The assessment of fissures and distortion of the timber being strength graded should be made when the batch has an average moisture content of 20% or less, with no reading to exceed 24% moisture content. Such timber is to be called ‘dry graded timber’.*

*Because thick timber is difficult to dry, this requirement does not apply to timber that has a target thickness of 100mm or more. Neither does it apply to timber that is specified for use in contact with water or in climatic conditions leading to a timber moisture content higher than 20% (corresponding to service class 3, as defined in 3.1.5 of DD ENV 1995 –1-1 Eurocode 5: Design of timber structures Part 1.1 General rules for buildings (together with United Kingdom Application Document). Such timber is to be called ‘wet graded timber’.*

This indicates that laminates can be graded green as part production process as the remaining process activities such as wet side lamination will be in the wet state or taken as being service class three conditions. The laminates being dried to the moisture content range specified in EN386<sup>13</sup> before final lamination.

#### 4. Creep and duration of load

With re-engineered timber products for structural use thought will need to be given to the potential for creep and the effects that duration of load has upon the products. At this stage the requirements cannot be defined as this will to a great extent depend on the lay-up arrangement and the characteristics of the adhesive used. However, this should be borne in mind when consideration is given to the composition and related construction arrangement of the product.

In general, testing will be required to demonstrate that the product has similar creep and duration of load characteristics to those of solid timber where the re-engineered product varies from the current regulatory framework. Products made in accordance with EN385 and EN386 will not need these properties evaluated. Where the re-engineered product has a lay-up that is unusual compare to common glue laminating practice or the adhesives used do not comply with EN301 types I and II, the creep and duration of load characteristics should be investigated. The more complex the arrangement of the re-engineered product the greater the potential to vary from the characteristics of solid timber.

The current view of BRE's Timber Engineering Capability is that some re-engineered products may have an enhanced potential for creep over that of solid timber though no definitive testing had been carried out to demonstrate this.

#### 5. Finger jointing

BS EN385 and prEN387 cover finger jointing for structural use.

For the majority of the applications EN385 will apply and covers the following:

Adhesive (sub-clause 5.3); the standard states:

*“ The adhesive shall enable joints of such strength and durability to be produced in order that the integrity of the bond is maintained throughout the intended lifetime of the structure.*

*The adhesive used shall be type I and shall meet the requirements for this type given in EN301. Or, for structures in service class 1 and 2 an adhesive of type II according to EN301 can be used, provided the temperature of the member in the structure will always be below 50°C.”*

Manufacturing requirements (sub-clause 6.2) second paragraph:

*“ Unjointed timber shall have a moisture content within the range specified by the adhesive manufacture according to the formulation and method of application”.*

A footnote says:

*“ Note. Timber should have a moisture content between 8% and 18%. Some adhesives make it possible to extend the upper limit to 23%.”*

As this is a note it does not override the manufacturers' guidance.

Quality control (sub-clause 7.1 and on) states that a number of finger joints must be tested or proof loaded per shift.

Draft prEN385<sup>14</sup> (revision to current standard) makes no significant changes to the above except under adhesives the additional paragraph is added:

*“ For adhesives of other types than covered by EN301 a bond with equivalent durability and strength shall be achieved. Special consideration shall be given to creep failure, the ability to maintain structural integrity*

*during fire and elevated temperatures and moisture content in ordinary service.”*

This seems to open up the possibility for glues other than those types covered by EN301, though they will need the support of additional performance information to demonstrate they meet the range of performance criteria required. Discussions with the BRE representative on the BSI adhesive committees suggested this is an attempt to get Polyurethane adhesive accepted for use. However, it seems unlikely that this will be in the final version of the standard if the polyurethane performance Annex is not produced or does not cover enough aspects to allow safe use of this type of adhesive. UK representatives are actively supporting all work aimed at widening both the types of adhesives allowed in structural joints and the moisture content of the timber when the joint is made.

BS5268: 1996 Part 2<sup>15</sup> has the following contributions to make as to the use of finger joints:

Glued Joints – sub-clause 6.10.1.2 Adhesives:

*“The adhesive used should be appropriate to the environment in which the joint will be used Table 94 details the four exposure categories, the permitted adhesives and the British Standard classification and reference”.*

Finger joints – sub-clause 6.10.2 states:

*“Finger joints should be manufactured in accordance with BS EN385”.*

*“Finger joints should not be used in principal members, or other members acting alone, where failure of a single joint could lead to collapse, except where the joints have been manufactured under a third party quality control scheme.*

*Finger joints should have the characteristic bending strength of not less than the characteristic bending strength of the strength class for the timber being joined (see table 95) when tested in accordance with BS EN385. Alternatively, finger joints should have bending efficiency ratings (regardless of the type of loading) equal to or greater than the values in table 96.”*

The final paragraph of the clause states:

*“ It may be assumed that the presence of finger joints in the cross-section does not affect its modulus of elasticity, and the full cross-section may be used in calculations.”*

It should be pointed out that the characteristic bending strength for the timber and the characteristic bending strength for the finger joint are not derived in the same way. For the solid timber the characteristic value is derived from a ranked 5<sup>th</sup> percentile value, while for the finger joint the characteristic value is derived from the 5<sup>th</sup> percentile of a Log-Normal probability distribution function.

The assumption that a finger joint in the cross-section does not affect the stiffness may be true for single or isolated finger joints in the “joist” direction. Work at BRE on machine grading timber with finger joints indicates that more than 1 finger joint in the span of the grading machine (900mm) artificially increases the stiffness in the “plank” direction, the direction used by the grading machine to attribute grades to the timber, thereby making the timber appear to have greater strength than is the case. Multiple finger joints may therefore affect stiffness and this should be investigated.

## 6. Glued-laminated products.

There is a proposed new standard that heads the finger jointing and glue-laminating standards for structural timber currently under review – Draft prEN14080. The current draft has been criticised, particularly by the German representatives for still excluding polyurethane-based adhesives, although the wording of allowable adhesives has been relaxed. There is an attempt by Sweden and Germany to draft an annexe to this draft standard covering performance requirements for polyurethane adhesives before the end of the public comment process. Unfortunately, this annexe could not be produced in time for assessment before the voting deadline. This was one of the reasons why the UK voted against this draft standard.

The supporting glue lamination standards are also under revision, which may add to the confusion. The approach set out below is to note the situation relating to current standards and additionally note changes to this in the new draft revised standard.

It is assumed that for the purpose of this review into the regulatory framework and the potential for wet gluing that the thickness of the laminations will be 45mm or less and hence covered by EN386.

Two critical points arise from this particular standard and these are:

- Adhesive requirements.
- Moisture content.

### Adhesive requirements.

The standard under sub-clause 5.3 (Adhesives) states:

*“The adhesive shall be capable of producing strong and durable joints so that the integrity of the bond is maintained throughout the intended lifetime of the structure.*

*Acceptable strength and durability can be achieved by use of polycondensation adhesive of the phenolic or aminoplastic types as defined in EN 301. The adhesive shall meet the requirements for adhesive types I or II as appropriate in EN 301.*

This gives a strong steer to the use of adhesives compliant with EN 301 types I and II, but the first paragraph does not seem to exclude other types. However, it should be assumed that the same performance and durability would require to be demonstrated. This can be done for GREENWELD and there is every possibility that it would fully comply with EN301, as it is a resorcinol adhesive. However, Collano could not at present be covered by EN 301 as it is a polyurethane. The most appropriate option may be to demonstrate the GREENWELD adhesive's potential against EN 301 performance criteria and Collano's against any new polyurethane performance requirements, and if both can be demonstrated to meet or exceed the requirements, it will go a long way to easing the adoption of green gluing.

The draft prEN386<sup>17</sup>, like the draft prEN385 has the additional lines:

*“For adhesives of types other than covered by EN301 a bond with equivalent durability and strength shall be achieved. Special consideration shall be given to creep failure, the ability to maintain structural integrity during fire and elevated temperature and moisture conditions in ordinary service”.*

Again this wording is likely to be lost in the final version, as 'equivalent durability' is too ambiguous and potentially detrimental to the future uptake of non-EN 301 type adhesives.

### Moisture Content.

Under Manufacturing Requirements sub-clause 6.2.2 Moisture content states:

*“The required moisture content of the laminations depends on whether or not the timber used has been preservative treated.*

*Non treated timber. At assembly, the moisture content in every lamination shall be in the range of 8% to 15%. The range of moisture content of the laminations in a glulam member shall be not greater than 4%.*

*Treated timber. At assembly the moisture content in every lamination shall be in the range of 11% to 18%. The range of moisture content of the laminations in a glulam member shall be not greater than 4%.*

The standard goes on to say under sub-clause 6.4.1.3:

*“When laminations are jointed by finger joints these shall be produced in conformity with EN385.*

*The moisture content of the individual boards shall comply with 6.2.2 of this standard (BS EN386)”.*

*“Note. The more relaxed requirements in 6.2 in EN385: 1995 are not valid for finger joints in glulam”.*

This clearly rules out the use of green gluing as definitive moisture contents are quoted and reinforced with regard to finger jointing and the more lenient “manufacturer’s guidance“ given in EN385.

The clause relating to the “relaxed” moisture content conditions not being applicable has been removed from the draft prEN386: 2001. This opens the possibility to green glue the finger joints before drying prior to the final lamination process.

The standard in sub-clause 5.2 Timber says:

*“The timber shall be strength graded in conformity with either EN518<sup>18</sup> or EN519”.*

As stated earlier, the current minimum practical thickness for machine grading is 35mm. To machine grade below this current value, work would be needed to derive new settings and acceptable deflection. One of the major difficulties is determining the deflection for thinner thickness timbers. The deflection has to be great enough to produce a meaningful reaction load whilst not so great as to damage the timber being graded. It can, however, be visually graded:

The National annexe to EN386 says in clause NA5 stress grading:

*“ Individual laminations will be visually graded in accordance with BS EN518 or machine graded in accordance with BS EN519. In the case of laminations less than 20mm thick, the grading rules in BS 4978 shall continue to apply.”*

The visual grading rules under BS4978 would normally apply to a thickness of 20mm, but here there appears dispensation to grade below this value.

### Large finger joints for glued-laminated products.

Where glue-laminated products contain finger joints that have been used to eliminate features such as knots, an alternative route may soon exist to finger jointing the laminates. The draft standard prEN387 relates to the possibilities of finger jointing glue-laminated products after assembly by the use of "large" finger joints.

## **Annexe 2: Additional information relating to Collano adhesive.**

The Collano adhesive is a polyurethane and in consequence does not comply with the requirements of EN301 for structural adhesives. While in essence this remains so and will remain so while the terms of reference in EN301 are unaltered, the adhesive manufacturers have faced this problem within the European Union. They have taken steps over the last 10 years to gain permission for the adhesive to be used under a Certificated Product route.

Within Germany they have carried out testing under DIN 68141, which defines standards for wood joints, adhesives and glued joint tests used in load bearing timber construction, and follows the requirements of EN301 and other essential criteria.

This means that the adhesive has a performance that is in accordance with the performance requirements of EN301 but does not conform to EN301 because it is a polyurethane-based adhesive.

In Sweden the adhesive has been performance evaluated against the requirements of EN301 and as a result, has been certificated to perform in accordance with the requirements of EN301.

Currently a similar process is being carried out within France to certificate the adhesive for performance in accordance with the requirements of EN301.

These are very positive steps and indicate the importance of the polyurethane adhesive. However, the evaluation for performance in accordance with EN301 within the above countries is for use with current glue-lamination type applications – “Dry Use”. Therefore, there is further testing required before the adhesive can be used for green glued applications.

Recent discussions with the manufacturers indicate they are contemplating having the adhesive tested as a certificated product within the UK. Significant influence has been brought to bear to suggest that potential usage of the adhesive would be far greater if wet glued applications were covered as part of the certification process.

If the manufacturers do pursue this route of having the adhesive tested for certificated product status and this includes green applications, then the UK manufacturers of re-engineered timber products will save both time and effort in achieving their aims. When evaluating the re-engineered product, the manufacturer will not need to prove by test the performance of the adhesive, as this will be a certificated product supplied by the adhesive manufacturer. This will be a significant advance on any potential offered by changes to current codes and standards, but may in its way start the process of change much needed in EN301 for the furtherance of applied green gluing technology.

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