



BEST UTILISATION

NEWS OF BRE-CTTC'S WORK ON UK TIMBER

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Introduction

This is Issue 5 of BRE's Centre for Timber Technology and Construction newsletter. It summarises our UK timber related activities in the Centre for Timber Technology and Construction at BRE. The information provided follows on from Issue 4, by presenting new projects and updating the progress of others in forestry technology. If you would like to learn more about any project, or would like to become more involved, please do not hesitate to contact us (see below for contact details).

PII Timber Scanning Technology (DTI & Ind.)

BRE are pleased to have the support of the following industrial partners for the recently won, DTI sponsored, Partners in Innovation Project, 'Providing high quality UK grown timber for the construction industry by using low cost scanning technology':

- A. J. Charlton and Sons Ltd
- Adam Wilson and Sons Ltd
- Balcas Timber Ltd
- Howie Forest Products plc
- James Jones and Sons Ltd
- James Callander and Sons Ltd
- John Gordon and Son Ltd

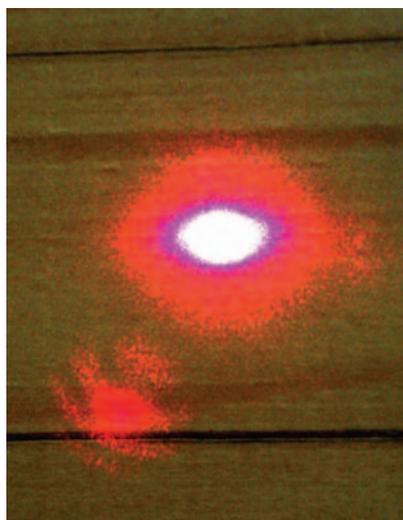
The project objective is to improve the competitiveness and quality of UK timber through the application of scanning technology. The aim is to explore the potential of using low cost log shape, growth characteristic and dimensional size scanning technology for 'in line' assessment of saw-logs and newly sawn timber.

CTTC have developed the capability to measure logs using an in-house 3D laser scanner, and in addition, to decode and process data from

commercially available scanners operating in sawmills. This gives the Centre the ability to relate log shape characteristics, such as taper, bow and ovality, with wood quality, such as compression wood and machine grader output, and has allowed the development of a substantial log shape/batten performance database.



▲ 3D log image processed at BRE using data from a commercial scanner



▲ Laser halo effect used to measure compression wood and grain angle

Wood Eye Scanner

The Centre for Timber Technology and Construction have taken delivery of an advanced board scanner. This is part of collaborative work with the manufacturers, Innovative Vision (IV) from Sweden. The Wood Eye scanner has an array of lasers and cameras linked to a bank of 3 computers. It is capable of detecting, at very high speed, surface features such as knots, disturbed grain, compression wood, resin pockets and dimensional defects. Collaborative work planned with Innovative Vision includes work on

- strength grading of timber
- intelligent knot avoidance cross-cutting
- re-engineering low quality and reject timber into structural material.



▲ Wood Eye Scanner

Abbreviations:

CTTC	Centre for Timber Technology and Construction
DTI	Department of Trade and Industry
EU	European Union
FC	Forestry Commission
GW	Grampian Woodlands Company
HIE	Highlands and Islands Enterprise
Ind	Industry
SE	Scottish Enterprise
SFT	Scottish Forestry Trust
THC	The Highlands Council
UKFPA	UK Forest Products Association



Drying Research (EU, DTI & FC)

The DTI funded drying programme, which has been assessing a number of novel drying and conditioning methods on UK spruce, has now officially finished. Results from the programme have shown that UK spruce can be successfully dried using high temperature (120°C) with shorter schedule times and similar distortion parameters to that obtained using conventional methods. Pneumatic top-loading, the process of applying top-loads using pneumatic rams, is recommended. This process allows top-loading to be varied throughout the drying process and overcomes a number of health and safety issues which arise when using concrete or other materials as top-loads. Top-loading has been shown to significantly reduce all distortion parameters, especially twist. The final report, distributed to all the partners provides more details of the methods assessed in this project.

The EU funded drying programme (which was co-funded by the DTI project) is still on-going and results from this project will be presented at a dissemination meeting proposed for May 2004.

The Forestry Commission supported project on improving and accelerating the conventional drying of UK spruce is progressing well. The initial experiments on assessing incremental increase in temperature have been completed. Analysis of this data will provide information on possible improvements to drying schedules. Once this analysis is complete, further experimental trials will be undertaken before moving on to industrial trials.

Oak beams from small diameter logs (DTI)

The aim of this project is to improve the utilisation of a natural UK resource by utilising small diameter low value UK grown oak stems to produce re-engineered components of standard dimensions using a novel cutting and jointing technique.

By using 'green' gluing technology (bonding wood whilst the timber is 'wet') small diameter oak stems can be converted using a 'star' cutting pattern (cut into four equal quarters), machined, inverted and bonded together to form a square. The project is progressing well and a number of beams have been re-engineered and tested for strength, stability and distortion.



▲ Surface finish of solid and re-engineered oak beam after drying

Hardwood beams from small diameter logs (FC)

This project follows the same remit as the above DTI funded project, but also includes the utilisation of other hardwood species using the same process. One aspect of the re-engineering process which was unexpected, but very encouraging, was the stability of the beams during drying. Beams which are cut normally from a log, exhibit quite large surface checks and splits when dried. On the 'star' sawn re-engineered material, this was the total opposite. The re-engineered beams exhibited very few, if any splits and checks on the surfaces of the beam after drying.

A number of alternative species (Sweet Chestnut, Birch and Ash) have been kindly received from Jock Macpherson of the Welbeck Estates, Nottinghamshire. It is hoped that the results on these species are similar to those exhibited on re-engineered oak.

Pine Quality (HIE and GW)

This project has been established to determine the quality of Scots pine from Scotland with the aim of accessing higher value added markets where possible. The project will provide the growers with a better understanding of the quality of the timber which can be produced from their trees.

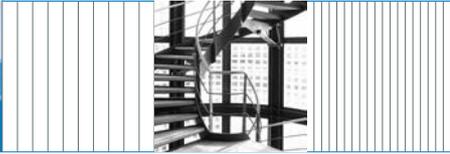
Scots pine logs from six estates in the Cairngorm and Grampian region have been delivered to James Jones and Sons at Aboyne for processing and

drying. The material will be delivered to BRE where it will be assessed for quality and specification of potential markets.

The feasibility of creating a 'green' gluing enterprise based in the Greenwood Community Forest (Nottinghamshire and Derbyshire area)

This project has been funded by the East Midlands Development agency and the Forestry Commission to investigate the potential for creating a 'green' (wet) gluing enterprise based in the Nottinghamshire and Derbyshire region. The project will investigate the type of material available in the area for use in this type of process, the quality and quantity of material available, the processing technology required to initiate such an enterprise and to demonstrate the potential for products to be produced from low quality, local timber.

The study is well under way. The first workshop describing the process and objectives of the project was held in Nottinghamshire on the 18th March 2004. The project is generating a great deal of interest as timber suppliers often struggle to find markets for their low-grade timber. The green gluing process utilises this low quality timber to produce value-added products e.g. window frames, flooring, joinery blanks.



Compression Wood (EU, FC and Ind.)

Compression wood is a type of reaction wood that can cause major problems in the wood processing industry, resulting in deterioration in both mechanical properties and distortion (bow and spring). This project aims to produce advanced decision support tools in the form of predictive models linking silvicultural practice with raw material properties and end product performance. BRE is a partner with 9 other European participants, including Forest Research.

Detailed analysis and testing has been completed at BRE on 500 battens obtained from 186 specially selected and categorised logs from 4 stands. Tests included machine grading, bending tests to derive MOE/MOR, Xray imaging and conditioning to in-service moisture content.

Preliminary results were presented at The Timber Quality Seminar at Roslin on October 2003. Final project results will be presented at The Forestry Woodchain conference on 28-30 Sept 2004 at Heriot Watt University.

See; Conferences and Workshops ... Wood chain conference at Heriot Watt University on 28-30 Sept 2004



▲ Compression wood in battens (darker bands)

Modelling wood quality (FC & EU)

The aim of this project is to investigate growth characteristics that affect the strength, grading and drying distortion of sawn timber. This information will help forest managers and tree breeders produce a higher quality crop.

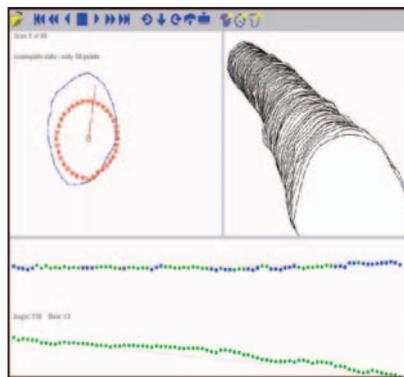
The models being produced use the low cost scanner developed at BRE and are part of the MEFYQUE (Forecasting the dynamic response of timber quality to management and environmental change) project.

The overall objective of the project is to increase

understanding of the relationships between site conditions and growth, yield and timber quality for current and future scenarios of atmospheric change. This objective will be achieved by developing a prototype modelling system operating at an appropriate forestry management scale (the forest stand) to forecast timber growth, yield, quality and marketability suitable for application in the EU. The system will also predict and quantify reversible and irreversible energy fluxes to and from the forest, including those due to fossil fuel consumption. BRE, the CTTC is a partner in this 5th Framework project along with the Forestry Commission and other institutes from Finland, Belgium, Italy and the UK.

The project is progressing very well. BRE, CTTC has received some 180 trees, in 2.5m logs, from 10 sites distributed around the UK and Italy. The trees have been scanned to generate shape distributions. These tree shape distributions will be input into the tree growth model, created by the Forestry Commission and Antwerp University.

Scanning was carried out partly by industry and the remainder using a prototype of a low-cost scanner developed by CTTC staff. After scanning, battens of 100 x 50mm were produced from the logs and dried down to 12% mc. The mechanical properties of the battens were measured (density, stress grading, distortion, knot area, and compression wood).



▲ Programme to generate tree shape distribution from scanned data

For those logs that were too small to be sawn into battens, small clear specimens were produced to generate bending and strength modulus.

The results from this testing are currently being used to generate three models;

- A cross-cut model - generates logs from the felled tree to utilise its original length,
- Batten production model - generates battens from the log to utilise its volume,
- Stress grading model - predicts the quality of the sawn timber.

Further analysis of the results to compare site conditions will soon be processed.

BRE - CTTC have also developed an energy model that predicts the costs and energy associated with the production of sawn timber. The model considers all aspects relating to the production of sawn timber, from the trees growth to its transport to the mill and from primary processing to end products (including pulp and saw dust).

Best value from UK Timber (DTI)

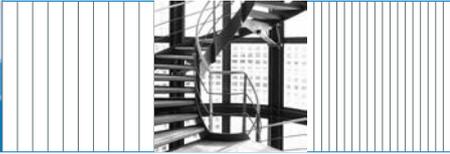
The overall objective of this project is to develop more efficient processing methods, innovative material compositions and enhanced wood modification systems that improve quality, performance and fitness for purpose, increase manufacturing efficiency and reduce production costs.

Innovations in sawmilling techniques and in wood-based composite materials, along with wood modification to enhance UK timber, are all being investigated. CTTC is pleased to confirm that this project is at its final stages and the results look very promising.

Wood modification (DTI, EU, HIE)

BRE continues to progress the development of opportunities for UK timbers that have been modified (chemically or thermally) to improve their performance properties.

Work is ongoing to establish the changes in properties of species such as Sitka spruce, Scots pine, Douglas fir, Larch, Western hemlock and Beech. To date there have been significant improvements in the durability of the modified timber, and improvements in the dimensional stability. Work is still ongoing to understand changes in mechanical properties, coating adhesion, workability and fire performance.



BRE are currently in discussion with wood modification companies in Norway and the Netherlands, to run large scale treatment trials for UK timber. This timber will be used to develop installations of demonstration products.

Work on the hot oil modification of timber has continued, BRE is contributing towards the scaling up requirements of the Dutch industrial partners. As part of this work, large scale samples of UK and European timbers will be treated and tested to assess the mechanical properties and overall suitability of a variety of exterior timber products.

Many of the existing projects have progress meetings in April when the latest results will be disseminated to partners. An overview of wood modification treatments has been presented by BRE at the COST Action E22 meeting in Portugal ('Environmental optimisation of wood protection'). BRE is represented on the Management Committee and within the Working Groups.

Timber Cladding (FC, HIE, SE, SFT, THC, EU, Ind)

BRE are involved in two projects to evaluate different cladding systems.

- External timber cladding on the Maritime Periphery of Europe
- UK Sitka spruce for cladding

The main emphasis is on the use of Sitka spruce for cladding. Aspects being researched include the potential of wood modification processes, the importance of the selection of cladding profile and the coating performance. Work will be compared to previous BRE research for other timber species.

In addition to Sitka spruce, BRE will evaluate Norway spruce as part of a Northern Periphery programme entitled External timber cladding on the Maritime Periphery of Europe. This project will see BRE working with Napier University and partners from Norway, Iceland and the Faroe Islands.

Among the key aims of this project is the comparison of UK grown timber to Scandinavian whitewood and the promotion of the use and best

practice of locally grown timber cladding in the region.

UK Spruce for joinery (2) (SE)

Following on from a successful feasibility study on the use of Scottish spruce for joinery, Scottish Enterprise commissioned BRE to carry out a follow on project to trial the production of spruce joinery in a commercial environment and to evaluate its performance. BRE worked with Jeldwen, the UK's largest joinery producer and BSW one of the UK's largest sawmilling companies, to carry out the work programme.

Specially selected, freshly sawn falling boards (thin boards sawn from the outside of logs) and battens (sawn from the inside of logs) were selected from BSW (Carlisle) to meet the growth rate requirements for joinery. The selected falling boards and battens were then optimised by marking specified defects (such as large knots or dead knots) using a fluorescent crayon and cutting them out using an optical sensor cross cut saw. The defect free lengths of timber were then fed through the finger jointing machine. Using a special enhanced polyurethane adhesive, the samples were glued and fed through a continuous press. The new enhanced lengths of timber were then cross cut at 3.0m, and returned to BRE and kilned to approximately 16-18% moisture content.

Once dried the finger jointed material was machined to the required thickness and cut to the required width for the production of joinery blanks. Jeldwen supplied BRE with details for making windows in their 'Sovereign Stormsure' range. Using this information, BRE manufactured laminated sections from the dried finger jointed materials. Enough blanks were made for four casement windows. These were sent to Jeldwen for machining. Once machined they were assembled and a factory finishing was applied.

Two of the windows were a single window narrow module casement with an opening lights (W-N10C), the other two were two window casement narrow module with a casement vent (W-2N10CV).

Jeldwen have supplied to BRE matched windows manufactured in Redwood for exposure alongside

the laminated spruce windows at their Garston exposure site. They will be assessed for comparative performance.

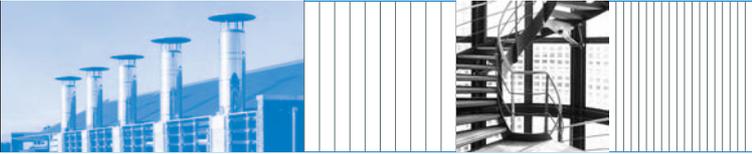
The windows produced from laminated and finger jointed Scottish spruce were of a high quality. The finished product could not be easily distinguished from the production redwood windows.

Incising UK grown spruce (FC, SE)

This project explores the incising process as a means for increasing the end use applications of UK grown timbers, in particular Sitka spruce. The project looks at improving the penetration of preservative treatments in the timbers by incising so that new applications and increased durability can be achieved.

Incising timber by creating small slits or pin holes in the surface of the timber to improve uptake and penetration of preservative has long been recognised in the USA and Canada as an accepted method for improving the durability of preservative treated timber. Preservative treated spruce is used extensively in the UK, but applications are limited up to Hazard Class 3 (EN335-1). While Hazard Class 3 includes applications like highway fence rails, it does not include fence posts or other in-ground applications (Hazard Class 4) which currently provide a very sizeable and lucrative domestic market.

BRE data from a long established and ongoing field trial show that the in-ground performance of preservative treated incised spruce posts far exceeded traditional expectations - after 30 years of the trial no incised posts have failed. The current project exploits this knowledge and uses a new incising rig in order to take preservative treated Sitka spruce into the Hazard Class 4 applications, such as highway fence posts and landscaping timber. In addition incising might provide extended service lives for Douglas fir and Larch in these conditions (both timbers are used as highway fence posts) as well as the provision of a more consistently treated material that is easier to assess for quality control purposes. Recently completed trials document the consistency of preservative penetration and the retention of the active ingredients in order to understand the conferred durability. Alongside this work laboratory biological tests are being conducted.



Sections of a demonstration fence made of incised UK grown Sitka spruce will be installed in the next two months at various sites around the UK. This demonstration phase is essential to evaluate the opportunities for incised spruce. A BRE best practice guidance document will be published towards the end of 2004 that will promote the benefits and opportunities of incising UK grown timbers. This publication will provide a platform for increasing the end use applications of UK grown timber.

Establishing timber as a main stream construction material in the UK countryside by enhancing its aesthetic, environment, sustainable and structural credentials, is the aim of an independent network known as InTEC (Innovation Timber Engineering in the Countryside)

The network has recently identified areas where increased knowledge is needed if timber is to fulfil its potential in engineering applications. It plans to persuade government and industry to fund projects that will generate this information to allow the industry to modernise and expand.

InTEC will also encourage an international exchange of information, focusing on the identified knowledge gaps allowing the UK to learn from other countries when appropriate.

Vahik Enjily, Head of the CTTC, BRE (a member of InTEC) says, 'New markets are needed for the increased supply of timber coming on stream in the UK over the next few years. The challenge for the specifiers and users of timber is to find ways to maximise its special qualities and overcome any difficulties that they may face'.

Topics identified as needing further information include:

- UK-grown stress laminated timber, friction test data needed
- Truss bridges
- Covered timber bridges
- Pontoon/floating timber bridges
- Timber signs and barriers
- Steel/timber beam composites
- FRP/timber beam composites

- Timber piles
- Round timber connection systems
- External green gluing timber bridges
- Log retaining walls
- Standard agricultural buildings
- Timber crib walls
- Timber decking
- New innovative structures

InTEC would like to hear from anyone with information on these subjects.

Contact Dr Vahik Enjily 01923 664392

Email enjilyv@bre.co.uk

For more information on InTEC go to www.forestry.gov.uk/intec

InnovaWood

Data Base

BRE has been involved in the development of a European, multi-lingual, web-based, dissemination tool that gives users access to research projects carried out within the forestry and wood-chain sectors. The project is funded by the European Commission and aims to increase the awareness of relevant research to industry, research institutes/organisations and the general public.

The web site has been up and running for about 6 months. There are currently some 700-800 project summaries that are active, with more being added each week. The database has a search engine. Key word(s) are put in the search text box, which provides check boxes for the type of search you would like to run (title and/or main content and/or contact info) and then the 'search' is run. All summaries are available in English and the native language of the contributors.

The web site is located at www.innovawood.com. This site can provide a valuable tool for your company or organisation/institute, both as a source of information and for disseminating any projects in these areas. For project submission please contact Tim Chase at chaset@bre.co.uk, +44 (0) 1923 664 672.

The Network

The InnovaWood network was first introduced in March 2001. It was launched to bring together four existing European networks (Eurofortech, Eurifi, Eurologna and Eurowood) that supported the Forest, Wood-based and Furniture industry. These Networks covered four vital areas:

- Eurofortech; Education, Training and Technology Transfer.
- Eurifi; Furniture Industry Research and Development.
- Eurologna; Advanced Wood Processing and Engineering Education.
- Eurowood; Wood Industry Research and Development.

There have been two general assemblies which have focused on the strategic objectives of the above four networks.

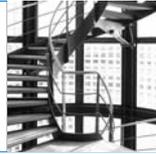
The InnovaWood umbrella organisation consists of over 60 members, consisting mainly of research organisations. Currently, InnovaWood is seeking more industry members. By becoming a member of this organisation, not only will you increase your networking with research organisations but you will be able to voice your views on the industry needs. This will play a key role in the future of the Forest, Wood-based and Furniture industry.

For more info, visit www.innovawood.com or contact Charles Harper (Innovawood Secretariat) at charles.harper@innovawood.com, +353 1 676 3181

BRE news Employment

Since the departure of Dr Richard Thompson in November, 2003, his place as Principal Consultant in Wood Processing has, until now, been left open. BRE is pleased to confirm that Mr. Geoff Cooper, a current employee of the CTTC, BRE, will be filling the position shortly.

The CTTC has further enhanced its timber engineering and construction capability with the employment of Dr Julie Bregulla (full-time) and Dr Bob Griffiths (part-time), both are experts in



these fields. Julie and Bob have joined us from The University of Surrey, where they were involved in the research, development and design of structural sandwich and timber framed walls. Their work at CTTC is based on the research and development of structural building systems including composite structures such as SIPs (Structurally Insulated Panels). Julie also participates in the European research and committee work of CTTC and has an extensive knowledge of fire testing.

Two new graduates joined us in the summer of 2003. Mr Matt Cornwell and Mr Tim Chase. Both are now full-time members of staff following their graduation from The University of Birmingham where they studied material science and engineering. They are both becoming very involved in the on going work carried out in CTTC.

Conferences and Workshops

June 5-6th, 2004. Ljubljana, Slovenia. COST E37 'Sustainability through new technologies for enhanced wood durability'. First conference of this new Action will focus on state of the art. Please contact Ed Suttie suttiee@bre.co.uk, +44 (0) 1923 664 158.

September 28-30th, 2004. Heriot-Watt University, Edinburgh, Scotland. 'Quantifying and forecasting quality from forest to end products'. The objectives of the conference are to bring together the latest international research throughout the forestry wood chain. Every stage in the wood chain will be explored, with the emphasis on quantifying and predicting quality. Please see www.forestry.gov.uk/forestrywoodchain for more info or contact Tim Chase, chaset@bre.co.uk, +44 (0) 1923 664 672.

October 5th, 2004. BRE-Garston. One-day event on 'Structural Insulated Panel (SIP) construction: SIPs - The future generation of housing?' The event is to introduce this highly energy efficient and novel form of construction to clients, designers and architects. As part of the event, delegates will be able to witness a live demonstration of the SIP erection process. Together with presentations about the manufacture and benefits of SIPs, their technical credentials and client experiences, this event will be especially useful for representatives of housing associations, as yet not familiar with this increasingly popular, innovative construction method. For further information, please contact Julie Bregulla, bregullaj@bre.co.uk, +44 (0) 1923 66 4174.

October 27-29th, 2004. Florence-Italy. COST E29 'Innovative Timber and Composite Elements for Buildings'. The main objectives are to improve design, construction, manufacturing and maintenance of innovative timber and wood-based composite elements for use in the construction of buildings. This is the first symposium organised by COST Action E29 dealing with innovative timber and composite elements for buildings. For further information, please contact Julie Bregulla, bregullaj@bre.co.uk, +44 (0) 1923 664 174.

October 6th & 7th, 2005. Second European Wood Modification Conference. Following the success of the first conference (held as the final part of the European Thematic Network for Wood Modification), it has been decided to organise a Second conference, which will be held in Göttingen, Germany. BRE is represented on the organization committee by Dr. Dennis Jones. For further information, please contact Dr Dennis Jones, jonesd@bre.co.uk +44 (0) 1923 664 159

We hope that you find this newsletter helpful and look forward to providing you with updates in due course.

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Harwood Beams from Small Diameter Log Steams (FC)
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The Feasibility of Creating a "Green" Gluing Enterprise

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Best Value for UK Timber (DTI)

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UK Spruce for Joinery

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