JANUARY 1986 Vol. 2 No. 1

Forest Products NEWSLETTER

'Sticks and Stones...!!'

by R. S. P. Coutts

Sticks and stones have been used in the construction industry ever since man first started to build shelters instead of huddling in caves. In this article we will consider the modern version of this on-going saga—wood-fibre reinforced inorganic building materials.

'Sticks . . . !'

Man has always relied on wood as a construction material. Some of the properties of wood in a structural form can be altered during conversion. For example, the drying with the proper control of relative humidity and temperature can improve strength properties and dimensional stability. Chemical treatments can reduce biological degradation (preservatives) and combustibility (fire-retardants). In addition dramatic property modifications can be achieved through re-assembling smaller structural units of wood. Plywood, particle board, fibre board and paper are examples of wood being reduced to smaller particles and re-assembled to provide products selected for specific performances.

Firstly, let us briefly examine the structure of wood (Fig. 1). If we consider a piece of lumber it may have defects (knots, cracks etc.); by selection a piece of clear wood (near macro-defect free) could be obtained with a tensile strength value of say 70 MPa. However if we look at the single fibres which constitute the reinforcing unit of bulk wood, they have been tested and found to have tensile strengths of greater than 700 MPa. If one considers cellulose as the basic molecule which makes up the fibre, and if one could express the strength of the chemical bonds which make up the structure of cellulose in terms of tensile strength

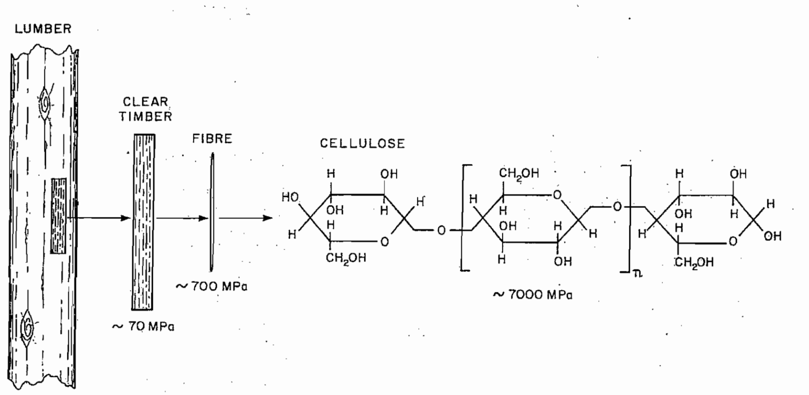

Fig. 1. A schematic representation of some of the substructure of a tree.

in this issue . . .

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CSIRO Division of Chemical and Wood Technology

Fig. 2. A scanning electron micrograph of kraft wood pulp fibres

an even greater value would be recorded of around 7000 MPa. In this article we will be restricting ourselves to the use of individual wood fibres as the reinforcing element.

Cellulosic fibres have a long history of being used for reinforcing purposes. Despite this long history and the existence of well-established cellulosic materials such as wood, plywood, paper and paper laminates, recent developments in composites have been concerned with fibres such as asbestos, glass, carbon and steel, with glass being used the most widely.

The properties of wood fibres (Kraft pulp, *P. radiata*) are compared with those of other reinforcing fibres in Table 1. It is evident from the ratio of cost to load carried by the fibre that wood fibres are highly cost effective reinforcement. However, the lower absolute properties of the fibres means that considerable care should be exercised in the selection of the matrix.

'...and Stones...!'

Stone Age man had very few materials; rocks, skins and wood were his major assets; yet with these man became the dominant species. From Stone through the Bronze and Iron Ages, to our present Atomic Age (or should that be Plastic Age) he has continued using 'sticks and stones'.

Inorganic materials such as rocks and minerals contain no carbon atoms (by definition) and as such bring less risk of thermal instability and oxidation. The world's only inexhaustible resources are inorganic—sand, limestone and thousands of other fascinating minerals.

During the next twenty years or so we are likely to see a dramatic, though gradual, movement away from many of the organic polymers that we have grown accustomed to using, towards a new generation of materials that will be largely or even entirely inorganic.

There are two main reasons for this change. Firstly, one of the reasons for this change is a number of environmental factors, such as health and safety. The combustibility of organic plastics has already stimulated extensive legislation in many countries to control their use in furniture and buildings.

Secondly, a more important reason, for the gradual but inevitable disappearance of the commoner organic plastics, is the long-term exhaustion of natural gas and oil deposits.

We read about the new inorganic materials used as tiles on the 'space shuttle', artificial bones for prosthesis and ceramic parts for diesel engines; but a much greater 'rumble' is gathering force in the building industry.

World use of hydraulic cements is close to one thousand million tonnes per year and along with steel are the most important constructional materials. It has been proposed that by the 1990s this figure could be doubled.

The cheapness and ready availability of the raw materials (limestone, clays etc.), the facts that the energy consumed in manufacture is considerably less than for metals and plastics (see Table 2), and that hardening takes place with water at ordinary temperatures, provides the incentive for optimizing the strength, toughness and durability of hydraulic cements not only for their more conventional uses, but also so that they might be used in quite new applications as replacements for energy intensive plastics and metals. Did you know bottle tops and spring can now be made from cement?

'Sticks and Stones...'

Hydraulic cements cover a range of products; silicate cements (ordinary Portland cement etc.), plasters (gypsum etc.), Sorel cements (magnesium oxychloride etc.) and phosphate cements. All these materials suffer from one common fault—they are brittle. Most inorganic materials fail in a brittle manner under tensile stress or impact loading.

Our forefathers made many a mud-hut with horse hair or straw to 'keep things together'. Early plaster formulations contained hessian, sisal or horse hair (to stop the brittle material from cracking under stress).

Table 1.

Material	Cost/tonne[a] A$	Specific gravity	Tensile strength[b] MPa	Specific strength MPa	Cost/MN A$
Kraft pulp (*P. radiata*)	550	1·5	500	333	1·7
Sisal	1350	1·5	300	200	6·8
Asbestos JM 5R	600	2·6	700	269	2·2
Glass rovings	2120	2·5	1400	560	3·8
Steel	717	7·9	2100	267	2·7
Kelvar pulp	10,500	1·5	2800	1867	5·6

[a] *Approximate costs April 1983 to Australian manufacturing industry.*
[b] *Realistic tensile strength values for commercial fibres.*

Table 2.

Materials	Density	Approx. price ($ per tonne)	Energy of production (GJ/tonne)
Portland Cement	2·5	75	8
Plaster of Paris	2·4	110	very low
Polyester	1·3	1500	100–150
Polyethylene	1·0	1000	
Glass	2·5	2120	20–25
Steel	7·9	460	50
Aluminium	2·7	1600	200

Broadly, the reason why weak, brittle materials are made stronger by very small additions of fibre is that cracks are stopped or deflected by the presence of the fibres and the toughness or ductility is dramatically increased.

Failure in a fibre-reinforced composite emanates from defects in the material. These may be broken fibres, flaws in the matrix and or debonded fibre/matrix interfaces. Figure 3 shows a schematic representation of a cross-section through a fibre-reinforced matrix. The diagram shows several possible local failure events occurring before fracture of the composite.

At some distance ahead of the crack which has started to travel through the section, the fibres are intact. In the high stress region near the crack tip, fibres may debond from the matrix (e.g. fibre 1). This rupture of chemical bonds at the interface uses up energy from the stressed system. Sufficient stress may be transferred to a fibre (e.g. fibre 2) to enable the fibre to be ultimately fractured (as in fibre 4). When total debonding occurs, the strain energy in the debonded length of the fibre is lost to the material and is dissipated as heat. A totally debonded fibre can then be pulled out from the matrix and considerable energy lost from the system in the form of frictional energy (e.g. fibre 3). It is also possible for a fibre to be left intact as the crack propagates. This process is called crack bridging.

Figure 4 shows a scanning electron micrograph of the fracture surface of a wood-fibre reinforced cement composite after bending to failure so that both fibre fracture and fibre pullout can be observed.

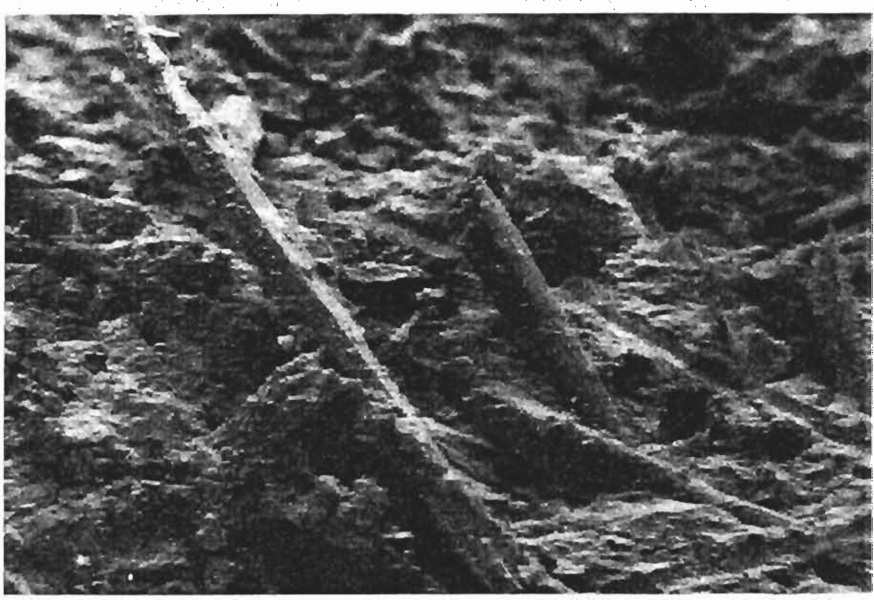

Fig. 4. A scanning electron micrograph of the fracture surface of a wood fibre reinforced cement product.

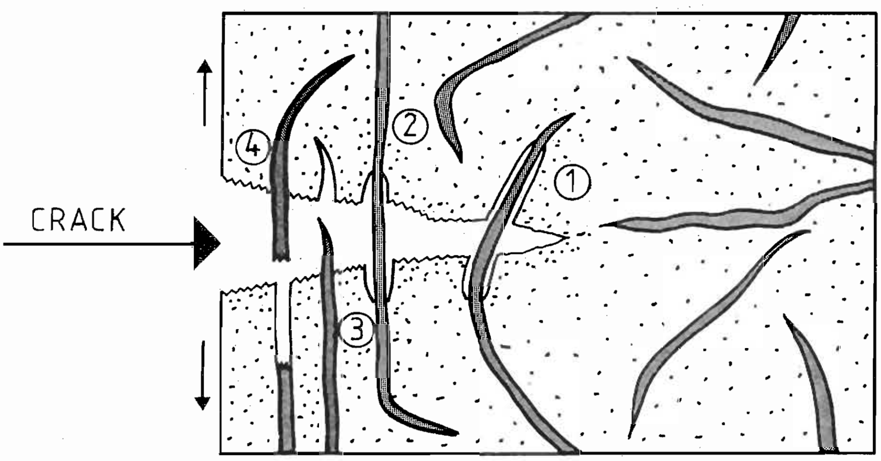

Fig. 3. Schematic representation of a crack travelling through a composite material.

Manufacturing industry collaboration

At the Division of Chemical and Wood Technology we are involved with using wood fibres as reinforcement for a number of inorganic systems and covering a range of manufacturing industries.

Worldwide, the asbestos-cement sheet industry had been searching, during the 1970s, for an alternative reinforcing fibre because of the limited supply and rising cost of asbestos and the health risk associated with it.

During 1978–1982 a collaborative research project, between James Hardie Industries and the Division of Chemical and Wood Technology, examined, among other things, the reasons why wood pulp performed poorly in asbestos-free formulations. It was found that cellulose fibres formed webs incapable of retaining cement and silica particles. The open nature of the web permitted rapid drainage and the loss of matrix particles and thereby resulting in poor product strength.

It was demonstrated at the Division of Chemical and Wood Technology, that, by beating (or refining) kraft wood fibres, the surface area of the fibres was increased and the normally smooth fibres now had exposed fibrils and microfibrils on the surface which increased the capacity of the fibres to retain the cement and silica particles during commercial production.

To modify their production process James Hardie Industries spent in the order of $A10 M. The conversion of flat fibre-reinforced cement board to asbestos-free manufacture began in May 1981 and is now complete. The corrugated sheet product is now being made asbestos-free, with the commissioning in late 1984 of a $A4·5 M press at the Company's Western Australian plant. Non-pressure pipes are now also asbestos-free but the pressure pipes still contain asbestos.

Telecom Australia is studying the use of kraft wood-fibre reinforced concrete connection pits, a product which in the past was asbestos-fibre reinforced.

The fibre-cement manufacturing industry in Australia is in excess of $A250 M per annum and employs thousands of workers.

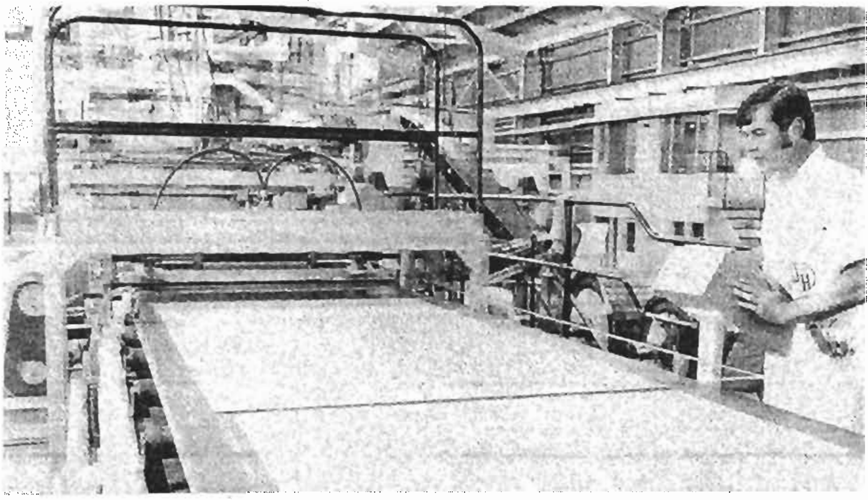

Fig. 5. Hardie Industries production line for asbestos-free wood fibre reinforced cement sheet.

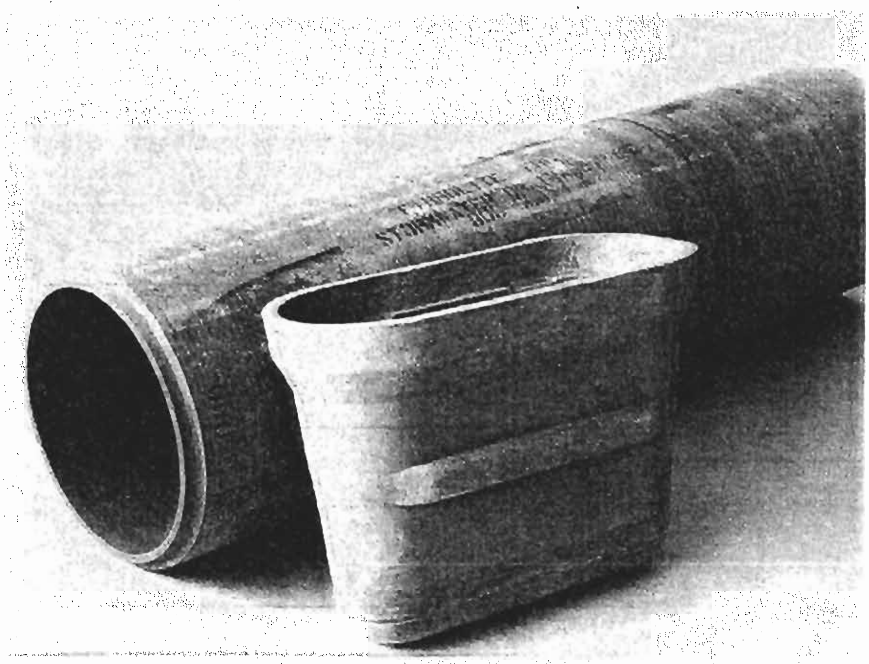

Fig. 6. Commercial products reinforced solely by wood pulp fibres.

Unlike chemical pulp (i.e. kraft), high yield mechanical pulps of *P. radiata* could not be used in autoclaved cement products (due to the effect of wood extractives on the cure of cement). The Division of Chemical and Wood Technology has shown that useful products are obtained with high yield mechanical pulps, in air-cured cements and mortars. These products could be used as renders or in moulded products and are being considered by severeal manufacturing firms.

Fibrous plaster is historically very much an Australian building material, which is also used extensively in New Zealand. It is basically set plaster of Paris reinforced with vegetable fibres such as sisal or glass fibres. Earlier work in this area of fibre plaster had been conducted at the CSIRO Division of Building Research.

Wood fibres can also be used as a source of reinforcement in plaster of Paris. Table 1 shows the great cost disadvantage of both sisal and glass fibres when compared with wood fibres.

Another related product widely used in todays buildings is low density plaster board which is primarily a foamed plaster sheet encased in a paper wrap. The cost of the paper wrap is escalating at a greater rate than the cost of plaster and some alternative approach such as the distribution of the fibre through the matrix must also be considered.

At the Division of Chemical and Wood Technology we have demonstrated that the incorporation of wood pulp fibres into plaster of Paris causes the mode of failure to change from a brittle type to that of a pseudo-ductile material. At a fibre loading of 8 to 10% by mass, the flexural strength is greater than 27 MPa (three times that of the matrix material) and the fracture toughness (or resistance to impact) increases to greater than forty times that of the matrix material.

In this area of the manufacturing industry Australian companies are again showing interest in the application of wood fibre as the source of reinforcement to produce materials with improved mechanical properties.

Australian Timber Research Institute Inc. —a Research Association

by John Carson
Executive Director

The creation of the Australian Timber Research Institute (ATRI) arose out of the perceived need, by the five State Timber Promotion Research and Development Organizations, to establish a collective organization operating at the national level, which could act as a focal point to identify and co-ordinate research and development, and technology transfer.

The Commonwealth Government's Research Associations Programme provided the real incentive to establish ATRI. This programme provides support funding to approved organizations by way of annual grants matched on a dollar-for-dollar basis up to a maximum level of $200,000 per annum. A Research Association is essentially an organization established for the purpose of carrying out or arranging scientific and industrial research, technology transfer and associated activities for the benefit of the particular industry groups supporting the Research Association.

The primary purpose of the Research Associations' Program is to encourage industry groups to engage in applied research and technology transfer on a co-operative basis (i.e. a self-help situation). The aim is to improve the competitive position of Australian industry on local and international markets through the increased use of local technology and adapting advanced methods.

ATRI was incorporated in January 1983 under the sponsorship of the five State Timber Promotion, Research and Development Organizations listed below:

- Forest Products Association (W.A.)
- Timber Research & Development Advisory Council (South and Central Queensland)
- Timber Research & Development Advisory Council (North Queensland)
- Timber Promotion Council (Vic.)
- Tasmanian Timber Promotion Board
- Timber Advisory Council, N.S.W.

The incorporation of ATRI was facilitated through the auspices of the Australian Timber Producers Council. ATRI, having satisfied the requirements of the Research Associations' Program, was approved as a recognized Research Association in June 1983 and became eligible to receive annual grants. This approval was formalized through a five year agreement with the Commonwealth Government.

ATRI is only one of eight approved research associations receiving support funding through the Research Associations' Program, they are as listed below:

- Bread Research Institute of Australia
- Sugar Research Institute
- Australian Welding Research Association
- Brick Development Research Institute
- Radiata Pine Research Institute
- Australian Timber Research Institute Inc.
- Australian Particleboard Research Institute
- Medical Engineering Research Association

Membership

The membership of ATRI is drawn from eleven organizations representing State Sawmillers Associations and State Promotion, Research and Development Organizations as follows:

- Queensland Timber Board
- North Queensland Forest Products Association Ltd.
- N.S.W. Forest Products Association Ltd.
- Victorian Sawmillers Association
- Forest Industries Association, Tasmania
- Forest Products Association (W.A.)
- Timber Research & Development Advisory Council (South and Central Queensland)

- Timber Research & Development Advisory Council (North Queensland)

Council

The operations and activities of ATRI are controlled through an elected Council comprising representatives nominated by the Australian Timber Producers Council, State Timber Promotion Research & Development Organizations and the Commonwealth Government. Members of the Council are listed:

TPC	Mr. I. Sherwen
TAC	Dr. I. Bevege
TRADAC	Mr. N. Keating
FPA(WA)	Mr. P. Kelly
ATPC	Mr. C. Hogarth (Chairman)
	Mr. K. Last (Vice-Chairman)
	Mr. W. Hyne (Inaugural Chairman)
CSIRO	Dr. W. Hewertson
DITAC	Mr. L. Ward

Aims and objectives

ATRI's aims are to initiate, co-ordinate, co-operate and promote the research and development into or

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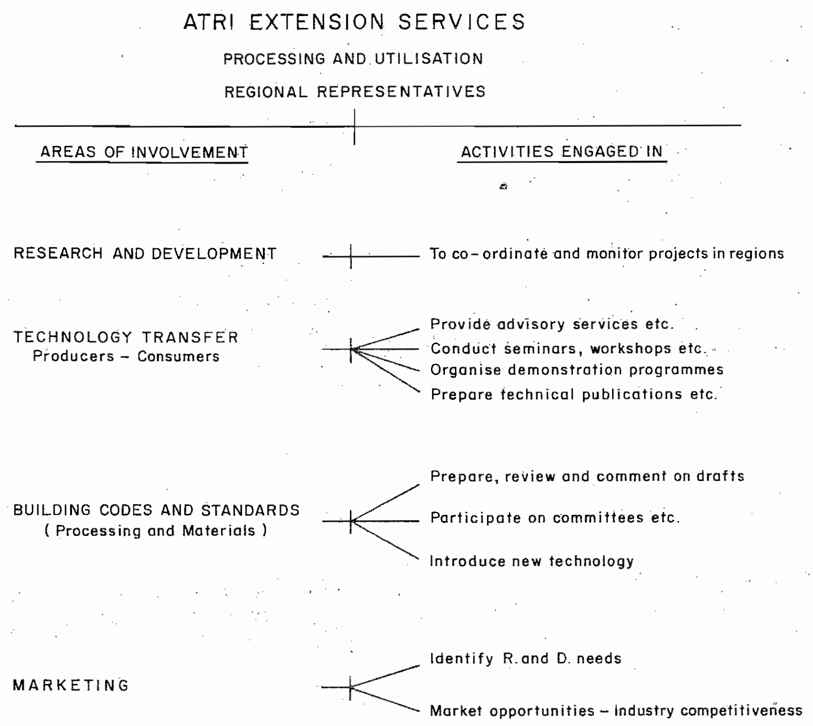
related to improvements in the processing, manufacture and utilization of Australian grown timbers and the transfer of information and technology to timber producers and consumers (specifiers, users and educators).

The mechanisms by which these aims and objectives are achieved are briefly discussed in the following.

Research Organizations

ATRI is not set up as an industry research laboratory as may be implied by the word 'Institute'. ATRI's role in relation to the established or traditional research organizations or institutes is to:

- communicate the research needs of its members to the established research organizations
- provide an interface between its members and the established research organizations to effect technology transfer of research and development
- participate with the established research organizations in the formulation of research programs.



Collaborative and Contract Research

The Institute, wherever possible, endeavours to enter into collaborative arrangements to undertake applied research with the established research organizations. Co-operation in research also extends to collaborative research arrangements with other forest products industry research associations. Where projects cannot be undertaken through a collaborative arrangement with a research organization then they are fully funded through a formalized Contract Agreement between the research organization and ATRI.

Extension Service

To further the objectives of ATRI a Regional Office Extension Service network has been established. These Regional offices are represented by the State Timber Promotion, Research and Development Organizations which provide services to both producers and consumers of forest products. The extension service network provides a multiplier effect to the technology transfer function of ATRI. The functons undertaken by the State Timber Promotion, Research and Development Organizations are illustrated in the above diagram.

Technical Advisory Group (TAG)

TAG is comprised of the technical personnel from the State Timber Promotion, Research and Development Organizations and other related industry Associations and provides valuable input and support to ATRI activities.

The organizations represented within TAG are as follows:

Timber Promotion Council (Vic.)
Tasmanian Timber Promotion Board (Tas.)
Timber Research and Development Advisory Council (Queensland)
Timber Advisory Council/Timber Development Association (N.S.W.)
Timber Development Association (S.A.)
Plywood Association of Australia (Qld.)
Radiata Pine Research Institute (S.A.)

Project Activities

During the year 1984–85 ATRI provided funds totalling $148,488 to finance a total of nine projects. Four of these projects involved research associated with processing and conversion, and cost $68,200. The remaining five projects were associated with timber utilization. Details and funding of the projects are as follows:

Conversion practices with small diameter sawlogs

This is a collaborative research project with the CSIRO Division of Chemical and Wood Technology and involves the survey of current sawing technologies being applied by producers currently converting small diameter sawlogs. It also involves the collation of data and information and the setting up of a data storage/retrieval system for use by industry. Funding 1984/85 $8,200

Two-dimensional, mass transfer stress—analysis model

This is a collaborative project being undertaken by the Technical Services Group of the Tasmanian Timber Promotion Board. It is intended that the results of this

project will be applied to species in other States for use as a predictive tool in drying timber.
Funding 1984/85 $20,000

Control drying of degrade in hardwoods

A collaborative project with the CSIRO Division of Chemical and Wood Technology which builds upon the previous collaborative project 'Detection of collapse prone hardwoods'. The previous project developed a laboratory technique for detecting collapse prone wood. This project builds upon this knowledge to develop a technique for practical application in industry.
Funding 1984/85 $15,000

Durability of Australian Timbers

A collaborative project with the CSIRO Division of Chemical and Wood Technology. The initial phase involves a review of all published and unpublished data relevant to the durability of Australian timbers and creating a data-base on preservation and protection. The review will cover forest products from both mature and regrowth/plantation forests for inground and aboveground end uses. When this phase of the project is completed a program of future research into the treatment of Australian timbers will be developed.
Funding 1984/85 $25,000

Timber Designer's Handbook

A handbook on timber engineering, structural design and analysis. The Handbook has undergone significant changes in its preparation to accomodate the revision of the Draft Timber Engineering Code AS1720. The Handbook is directed at both practising engineers and architects as well as students. A significant effort has gone into the development of numerous design aids to simplify engineering analyses of structural timber members. The Handbook will be launched on an Australia-wide basis through seminars and workshops and will be released during 1986 through Academic Press.
Funding 1984/85 $22,448

AMUBC Study

The Australian Model Uniform Building Code (AMUBC) provides the basis on which State building regulations can be drafted. The AMUBC is a performance orientated code and therefore requires careful interpretation with regard to the fire performance of structures using timber. The study employs computer techniques to thoroughly analyse and interpret the AMUBC provisions as they apply to timber and the identification of those areas where timber can be utilized, where restrictions might apply or where timber may not be utilized. This project is collaboratively funded between ATRI, the Australian Particleboard Research Institute and the Radiata Pine Research Institute.
Funding 1984/85 $21,000 ATRI
$5,000 APRI
$3,000 RPRI

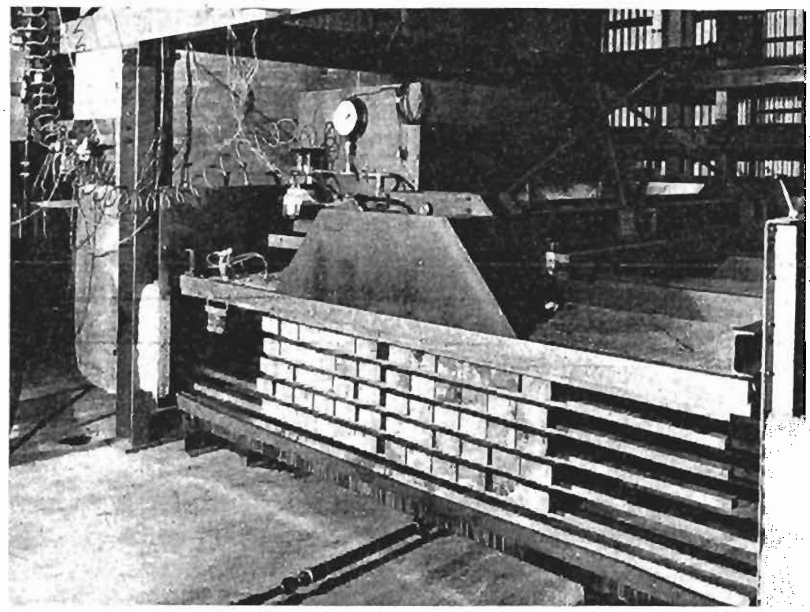


Fig. 11. Hardwood timber being tested so as to detect those that are prone to collapse.

AUBRCC Full-Scale House Project

A full-scale house testing program whose objective is to investigate the effects of wind loading on the structural performance of timber framed brick veneer houses constructed to resist high wind loadings. This is a collaborative project with the Cyclone Testing Station at James Cook University, Townsville. The project is also receiving sponsorship from the Australian Uniform Building Regulations Co-ordinating Council.
Funding 1984/85 $10,000

Stress-Skin Panelised Floor

This project represents the first stage of a proposal for the development of an Engineered Whole House. Stage 1 involves the development of a fully marketable stressed-skin modular floor system, capable of being transported to the construction site and easily assembled on a previously prepared substructure.

Stage 1 will be developed over two years at the Timber Wood Products Research Centre at CIAE, Queensland. The project is collaboratively funded between ATRI and the Plywood Association of Australia.
Funding 1984/85 $15,000 ATRI
$15,000 PAA

Timber Portal Standard Designs

Specific designs are being prepared to cover standard portal frame configurations for use in industrial, commercial and rural buildings. These portals are being designed to accomodate a range of timber sizes, stress grades and wind loadings. Portal joints will use plywood gussets which have been subjected to extensive testing at the Queensland Institute of Technology in Brisbane.

The project will provide typical details, monograms and computer programmes for design, analysis, fabrication and erection.
Funding 1984/85 $15,950

Your views

Readers have continued to write to the Editor in appreciation of the return of the Forest Products Newsletter. The following letter from one of CSIRO's early researchers demonstrates his continuing interest and supplies some relevant history: '*...I was delighted to receive a copy of the New Series* Forest Products Newsletter, *October 1985. I congratulate you and your colleagues for an excellently produced and informative issue. The article on High Temperature Drying of hardwoods etc. reminded me of the first visit to an operating kiln by members of the original Division of Forest Products. It was to Grant's kilns at Alexandra, Victoria, and was undertaken by I. H. Boas, first Chief of the Division and myself in 1929. I look forward to seeing the Newsletter regularly. Yours sincerely, J. E. Cummins.*'

FPRAP

The Forest Products Research Advisory Panel met in Melbourne during December. Foremost on the agenda of items under discussion was the forthcoming incorporation onto a database of the Register of Forest Products Research Projects in Australia—a FPRAP working document which will be available to members of the Panel for dissemination to both the industry and researchers.

FPRAP, now in its thirteenth year of operation, is the major consultative body through which the industry communicates its research needs and priorities to the Government research laboratories. It is made up of representatives from the Australian Timber Producers Council (hardwood and softwood), the Plywood Association of Australia, the Australian Particleboard Manufacturers Association, the hardboard industry, the building industry, the Australian Forestry Council Standing Committee, the Australian Timber Research Institute, the Radiata Pine Research Institute, the Australian Particleboard Research Institute and also the four main Government forest products research laboratories—CSIRO Division of Chemical & Wood Technology, CSIRO Division of Building Research, the Wood Technology & Forest Research Division of the NSW Forestry Commission and the Technical Services Division of the Queensland Department of Forestry. Any enquiries regarding FPRAP should be made to Doug Howick who is the Panel's Honorary Secretary.

Come and see us at FIME

Several Divisions of CSIRO as well as industry research institutes will be at the Forest Industries Machinery Exposition at Myrtleford in April. A large marquee will house the display based on the theme: 'Research from Forest to Marketplace.'

Formation of NAFI

Further progress towards the realization of a national forest industries association was made on the 19th December when the inaugural meeting of the foundation Executive Committee was held in Melbourne. Decisions were taken regarding the formation of the National Association of Forest Industries Inc. (NAFI) to be incorporated and registered in Canberra ACT. Objectives and articles of incorporation will shortly be made available to all interested parties.

Members of the foundation Executive Committee are:

Chairman — Mr Dick Darnoc, *Weyerhaeuser (Aust) Pty Ltd*
Members — Mr John Duncan, *Duncans Holdings Limited*
— Mr Thorry Gunnersen, *Gunnersens Pty Ltd*
— Dr Warren Hewertson, *CSIRO Chemical & Wood Technology*
— Mr Warren Hyne, *Hyne & Sons Pty Ltd*
— Mr Peter South, *Woods & Forests Department*
— Mr Kevin White, *APPM Ltd*
Secretary/Treasurer
— Mr Doug Howick

The involvement of this Division's Chief, Dr Warren Hewertson and our Forest Products Industries Liaison Officer, Doug Howick, is indicative of their support for the realization of the concept of a national body to formulate and implement a national strategy for Australia's forestry and forest products industries. The philosophy of this approach was discussed at some length in Hewertson, W. (1985)—Organization of the Forest Products Industry in Australia. *Aust. For. Ind. J.* **51** (4), 25–31.

Update on SCRIMBER

Further to our article about SCRIMBER in Newsletter No. 1, we are pleased to announce that CSIRO and REPCO have now finalized the contractual agreement with the South Australian Timber Corporation (SATCO) to continue the development of SCRIMBER. The agreement took effect from December 1985.

SATCO proposes to maintain the existing experimental plant at Dandenong for 6–12 months so as to continue experimental work already well under way. Concurrently, the design and installation of a production plant in the south-east of South Australia will be commenced as soon as possible. This plant will be designed to produce 10,000 cubic metres of SCRIMBER per shift, per year. After installation and commissioning, a decision will be made concerning the viability of SCRIMBER production through the plant, and therefore its immediate productive capacity and operation.

The Corporation will be appointing a technical committee of 6 people to direct the project and monitor the progress of SCRIMBER. The Chairman will be SATCO's Bob Cowan and will include CSIRO's Dr Warren Hewertson. Project Manager, Max Campbell, will be an *ex officio* member.

Neil Carr retires

Well-known forester and industry identity, Neil Carr, retired as Chief Executive of A. Dunstan & Sons, Wodonga, Victoria, at Christmas. In a forty-year career, Neil spent the first twenty with the Forests Commission of Victoria before becoming involved in production management with Dunstan's. His contribution to the industry through such bodies as the Victorian Sawmillers Association, the Radiata Pine Association and the Timber Preservers Association will be greatly missed—as will his cheery smile and his willingness to help anyone with a genuine interest in forestry and forest products.

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Forest Products NEWSLETTER

The interdependence of research and marketing

by C. D. Howick

Background
If marketing is the identification of a need and the setting out of those things that are necessary to satisfy that need—at a profit, then research and marketing should be interdependent.

Early research was necessary before the diversity of species making up the Australian forest resource could be presented in the marketplace to customers more familiar with products from the forests of the Northern hemisphere. In the 1930s, research in the CSIRO Division of Forest Products was therefore largely mission oriented towards resource development, with a strong Utilization Section interfacing with industry and an active collecting of information on the properties and best uses of Australian woods (Hillis 1984). Research in the areas of paper science, preservative treatment, sawing and drying practices, sawn product specifications and in veneer and plywood manufacture, dramatically improved the utility value of many indigenous forest species. This work greatly assisted the Australian forest industries in becoming established during the harsh years of the 1930s and enabled them to make a significant contribution to the war effort and to participate in the post-war boom years. Over recent years however, the technological advantage once enjoyed by the Australian timber industry has been lost. Rising costs, a dramatically changing resource base and competition from cheaper imports accompanied by a market with a declining growth rate, are all factors which have contributed to a high level of uncertainty within the industry. This had led to a lack of confidence in reinvestment for innovation and new products within the industry.

The effort devoted to forest products research in Australia has likewise undergone some years of decline. However, expertise and facilities still actively exist within CSIRO and the State forest services to conduct research and development projects capable of assisting the forest products industries so as to improve their performance in the marketplace. In 1986, it is the responsibility of those engaged in forest products research to address some of the wider issues affecting industry confidence and permanence. Clearly, there is little purpose in conducting research and development for the benefit of an industry, if that industry is unable or unwilling to implement the resultant recommendations or processes. Against the background of the future low availability of a large, mature forest resource, the CSIRO Division of Chemical and Wood Technology and other laboratories have on-going programs that represent a major commitment to improved technology and to raising the quality and value of the Australian forest resource.

Doug Howick, the Division's Forest Products Industries Liason Officer.

in this issue . . .

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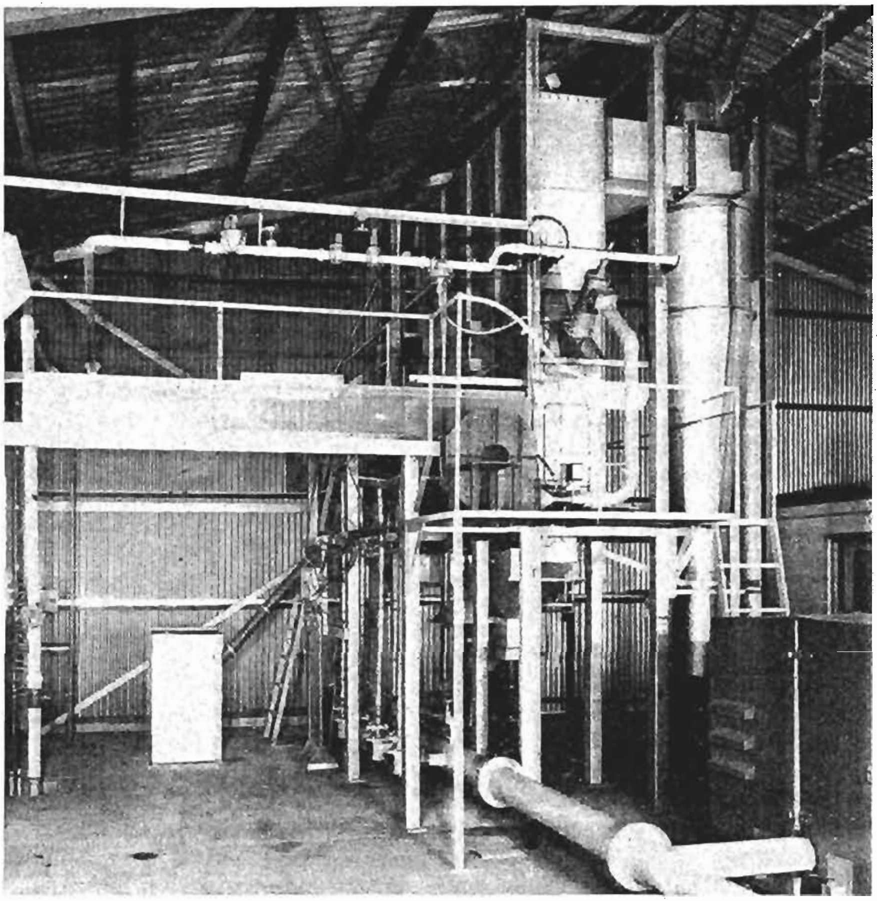
CSIRO Division of Chemical and Wood Technology

There are many examples of sucessful research and development as an aid to marketing forest products in Australia. In a limited review, it is possible to select only a few, and those cited below have been chosen to demonstrate diversity. That the majority refer to CSIRO research does not imply any lack of recognition of the excellent contribution of the work conducted by other forest products research organizations, merely that these are examples with which the author is more familiar. Some details are also given of one project that is still in its developmental stage because it is considered the biggest and possibly the most significant collaborative research programme in forestry and forest products that Australia has seen.

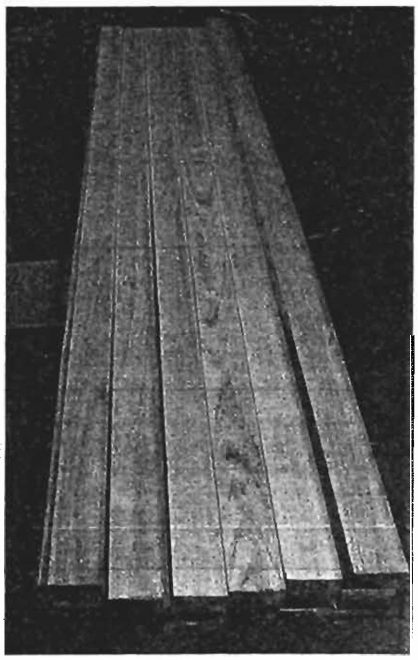


Pilot-scale, fluid-bed carbonizer for converting wood residues to carbon.

Seasoning Research

High temperature drying of softwoods:

The development of high temperature drying techniques for sawn softwoods in Australia commenced in the late 1960s when it became apparent that severe drying distortion could seriously affect the utilisation of juvenile wood (Christensen 1969). As increasing volumes of such material became available from early plantation thinnings, improved drying systems became necessary for producing framing timbers, lining boards, mouldings, dressed boards and select quality furniture timbers. As explained by Christensen (1983), the general experimental approach to control drying distortion involved the use of high dry-bulb temperatures, low relative humidities and high air velocities in conjunction with the application of physical restraint to the wood, by top stack weighting, throughout the complete seasoning process.



50 mm thick appearance boards, from fire-killed mountain ash regrowth, after predrying and final high temperature drying.

CSIRO development of high temperature drying, with collaboration from the Queensland Department of Forests and the Radiata Pine Association of Australia, has optimized drying schedules and reduced distortion. The Australian softwood industry was quick to adopt this greatly improved drying technique for both radiata and slash pine. This provided faster drying, lower costs, greater yield of saleable products, lower capital investment costs per unit throughput and a more stable and valuable product in the marketplace.

The CSIRO progressive kiln:

The CSIRO-designed, low-temperature, low-cost progressive kiln development was initiated in 1973 to determine the feasibility of reducing both the installation and operating costs for the non-critical drying requirements of certain hardwood products. Four years later, the first commercially built system was produced (Fricke 1983). More recently, four more were installed in Tasmania to boost the predrying capacity for F17 structural timbers (Lembke 1984). The result of this last installation has enabled the timber company to complete its total drying schedule within two months of cutting in the sawmill, thereby reducing interest charges on capital investment for stock in yards. This permits quicker response to customer needs as requirements are changed or new end-products developed.

Seasoning of back-sawn hardwood:

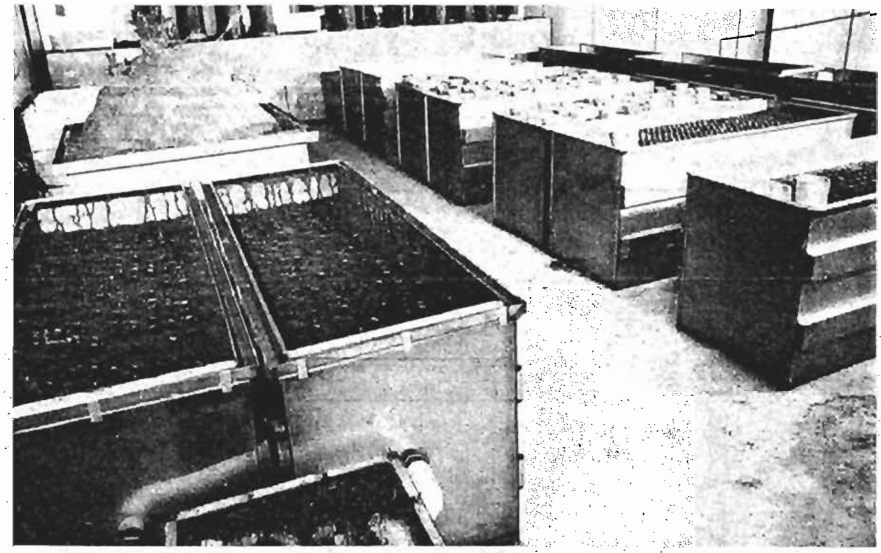
Faced with the problem of an unacceptably high level of degrade from surface checking in seasoned back-sawn Tasmanian oak, the Tasmanian Timber Promotion Board began an extensive research program, in conjunction with Hobart University, some five years ago. The project has resulted in a successful technique in which boards are wrapped in a thin plastic membrane immediately after sawing. Initial rapid surface drying is impeded, thereby resulting in a final after-kiln product of vastly improved quality and higher market value (Anon. 1984).

SCRIMBER ®:

As a result of the diminishing availability of mature sawlogs suitable for producing long structural beams of large dimensions, Australian sawn timber is increasingly being displaced from the market by imported species or by the use of alternative materials.

SCRIMBER® is a unique, reconsolidated wood product that has uniform properties comparable to those of select grade sawn timber (Coleman 1981). The process involves woody stems from young trees being reduced to a mesh of strands and then combined with an adhesive and pressed into a desired shape. The cellular structure of the wood is unaffected by this process and the orientation of fibres is largely preserved in the product. Thus the mechanical properties of SCRIMBER® approach those of structural timber more closely than do those of particleboard or other reconstituted board products. It is therefore the ultimate reconsolidated structural product, having little variation along its length, and has the potential of large section clear timber. Because small diameter stems are used rather than large trees, the process is able to use plantation forests at an early stage, thus utilizing large volumes of otherwise unmerchantable wood, either on a planned cyclical basis or from thinnings.

Patents are held for producing and aligning the 'scrim' and for the product itself. After the invention of SCRIMBER® by Mr. John Coleman of CSIRO, an industrial partnership was entered into with Repco Limited, to take the development from laboratory to pilot-plant scale. Having proven the feasibility of producing the material, CSIRO and REPCO have recently licensed the process to SATCO to further scale-up the process into the production phase. The successful development of a production process for this product could make a significant inroad into markets lost by Australian timber to both imports and to substitute products such as steel and concrete (Hewertson 1985a).



The CSIRO Accelerated Field Simulator showing various tests in progress.

Wood preservation and biodegradation

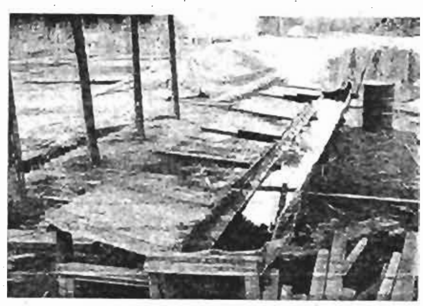
Timber Durability Studies—AFS

Timber is often subject to both decay and insect attack. Knowledge of the durability of a particular species or preservative treatment is therefore essential to the designer or product specifier. CSIRO has pioneered a novel approach to natural durability studies by developing an Accelerated Field Simulator (AFS) in which large numbers of timber specimens may be assessed by being simultaneously subjected to both termites and decay micro-organisms (Johnson et al 1983). The facility permits useful information to be obtained in the comparatively short term as opposed to long-term field derived data. Such information has obvious potential in providing a basis for successfully utilizing wood and wood-products in decay and insect prone environments.

A dip-diffusion preservative treatment process:

In the middle 1950s, CSIRO devised, tested and patented a borofluoride-chrome-arsenic diffusion preservative with a high boron content and very high solubility in cold water. Because of this high solubility, green timber of scantling size, when dipped momentarily into the cold solution, could carry sufficient preservative in the surface film for effective treatment to a depth of more than 10 mm. This penetration was obtained by holding the green treated timber in closed sheds or covered stacks for about four weeks to prevent drying, while the required diffusion occurred.

The preservative was first used commercially at Bulolo (PNG) for the treatment of green klinki pine building timber for houses erected in Port Moresby in 1956. The satisfactory performance of the treated timber in about 100 Port Moresby houses resulted in this dip-diffusion treatment being generally adopted for Government housing in Papua New

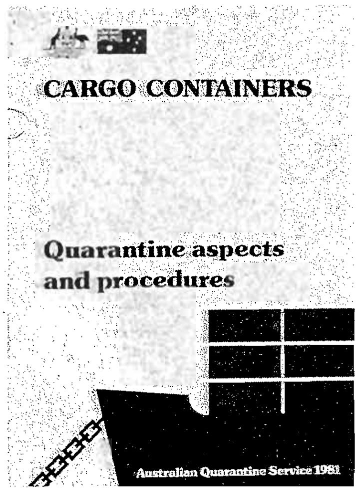


Simple BFCA dip-diffusion treatments in PNG. Left: clipping off-saw. Right: block stack for diffusion.

Guinea (Tamblyn et al. 1968). Frequent monitoring by the Department of Forests assured proper control of the process. To date, some 600 tonnes of the preservative have been used and thousands of cubic metres of local timbers found a market in Government housing that would not otherwise have been achieved.

Use of timber in shipping containers

With the introduction and growth of containerised shipping in the 1960s and its subsequent acceptance and expansion, the Australian Department of Health (Plant Quarantine) drew up stringent regulations pertaining to the sawn timber and plywood components of cargo containers. These regulations were aimed at totally excluding wood-inhabiting insects as well as laying down preservation specifications which, if followed, would guarantee that timber components did not habor such pests.



The publication issued by the Australian Department of Health (Plant Quarantine) in which approved preservatives and processes for the wooden components of shipping containers are listed.

Commercial formulations having organochlorine compounds (aldrin, dieldrin, chlordane etc) were initially approved both as impregnants for sawn timber components and as glue-line additives for plywood components. However, in 1981, research work in Britian and Australia indicated that, under certain circumstances, migration of organochlorine insecticides could occur, thus posing a threat of contaminating cargo. With the resultant withdrawal of approval, retention of the container market for timber could only be achieved if satisfactory, environmentally acceptable alternatives could be found. Fortunately, as early as 1975, CSIRO had begun laboratory assessments to determine the termiticidal effectiveness of a number of candidate synthetic pyrethroids (Creffield & Howick 1984). The results of this work led to the acceptance of two such compounds (permethrin and fenvalerate) by the relevant authorities (Anon. 1981) and the container market for timber was saved.

Industry/research liaison

In conducting research aimed at solving strategic and tactical problems of industry, that research must aim for a series of targets rather than satisfy intangible academic principles. It is thus necessary to encourage and improve direct cooperation with the industry's representatives in producing a research strategy for products and processes with defined marketability. The Forest Products Research Advisory Panel (FPRAP) and the Wood Fibre Research Advisory Group (WFRAG) have become instrumental in guiding national research strategey and in the setting of priorities. This has been achieved and enhanced by the unified approach of industry delegates and has more recently been further improved by including the industry Research Institutes.

It is imperative that industry be involved in the development of ideas and innovations from their inception. This helps the researchers to participate in providing the appropriate products at the right time to satisfy the market demand. Research planning must therefore take into consideration the industry's perceived need for the work to be done and the researcher's considered assessment of the likely success of the work. Further, in the area of technological development, there is no point in doing the research unless there is a reasonable indication that any successful result obtained will be taken up and used by the industry for which it has been carried out. The Techno-Economic Program within the CSIRO Division of Chemical and Wood Technology has the objective of providing both a market and process assessment for the research worker and to assist in the establishment of fruitful industrial collaboration.

Future trends in forest products research

For both hardwoods and softwoods in Australia, the forest resource will increasingly consist of smaller diameter, fast grown, regrowth material. There is a need for further research and the application of techniques to provide the basis for rational decisions by industry to efficiently convert research into marketable products. Of prime importance is the development of methods for rapid quality control of both the logs and materials produced from them. Likewise, improved efficiency in the timber industry demands some total overview of demands on the forest resource. There is a need to assess the economics and effects of using all the available material in the most efficient way as sawlogs, products, pulpwood, derivatives and residues (Hewertson 1985b).

Two projects currently at an early stage of their development concern carbon production and heat recovery from wood residues and the growth, harvesting and utilisation of young, even-aged eucalypts:

Continuous fluidized-bed carbonizer

A continuous fluidized-bed carbonizer developed by CSIRO (Fung 1983), offers the ability to carbonise particle sizes from fine sawdust to coarse chipped wood as well as to handle a wide range of moisture contents without expensive predrying. Economic analysis of a commercial fluidized-bed plant for a typical hardwood mill, with seasoning operations producing some 2,300 tonnes of charcoal from 17,000 tonnes of residue per year, shows a discounted cash flow return after tax of 22% for charcoal production only and up to 34% if heat recovery and electricity generation facilities are included. The development has currently progressed through to the practical pilot-plant stage and considerable commercial interest is being shown in the process.

Young eucalypts program

With regard to young, even-aged eucalypts, agreement has now been reached with the Tasmanian Forestry Commission and the Victorian Department of Conservation, Forests and Lands to collaborate with the CSIRO Divisions of Chemical and Wood Technology, and Forest Research in an extensive research program aimed at improving commercial aspects of the intensive management of eucalypt forests. Major thrusts will be the development of technologies for non-commercial and commercial thinning, studies on growth and yield after thinning, and of utilization of thinnings in pulping and in the production of milled and other forest products.

These two projects are based on the understanding that efficient use of a resource is an essential and responsible prerequisite. Increasing proportions of the hardwood resource for example, could be utilised for high value-added products if research were continued into the technology to make processing effective. There is thus a need for an aggressive move in Australia to place hardwoods at their true world value. This may, in part, be achieved by further development of 'second level' specialist conversion centres to take the output of smaller mills and upgrade the product by seasoning, selection, fabrication, grading and subsequent marketing of a high quality, controlled, reliable and value-added product.

Funding

The Division of Chemical and Wood Technology of CSIRO is currently using federally allocated funds to support research work in strategically-aimed areas in the longer term, and supplementing funding for shorter term research through collaborative projects with industry. A significant proportion of the Division's research is aimed in one way or another towards techniques of processing, utilisation, upgrading and the development of products from the forest resource. It is therefore appropriate that a significant part of this industrial supplementation should come from the solid wood sector. In current times of severe constraints on federally allocated funds, we will increasingly look to the forest products industry for further tangible support of the research on which its future markets may depend.

The markets of the future

The existence of a market does not ensure the existence of a customer! The Australian forest products industry needs to increase and improve its skills in the marketplace. There is a need to develop both national and international strategies and to integrate into these, the need for research.

If research and marketing are to be interdependent, each must be strong if this industry is to prosper.

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N.A.F.I.
A national association for the forest industries of Australia

Industry leaders including chief executives and senior managers of major forest industry companies and representatives of a number of major forest industry companies and representatives of a number of associations from within the industry attended a meeting in Sydney in late October 1985 to consider the formation of a national industry body.

Mr. P. W. R. Darnoc, Managing Director of Weyerhaeuser Australia and Chairman of TDA, New South wales, addressed the meeting on a range of issues, particularly the significant downward trend in per capita consumption of forest products in Australia and the fragmented approach the industry has to solving problems.

Following the third meeting of the inaugural Executive Council in Melbourne on 13th March the Chairman, Mr. Dick Darnoc announced that a senior executive had been seconded from the industry to take on the role of Executive Director of NAFI for the remainder of 1986. He is Mr. Dennis Mutton, Assistant Director, Support Services, South Australian Woods and Forests Department.

Mr. Darnoc emphasized that the Executive Council of NAFI needed to communicate with all facets of the industry and State and Federal Government during the investigatory stages. Arrangements have already been made to have discussions with the Minister for Industry, Technology and Commerce, Senator Button and the Minister for Primary Industry, Mr. Kerin.

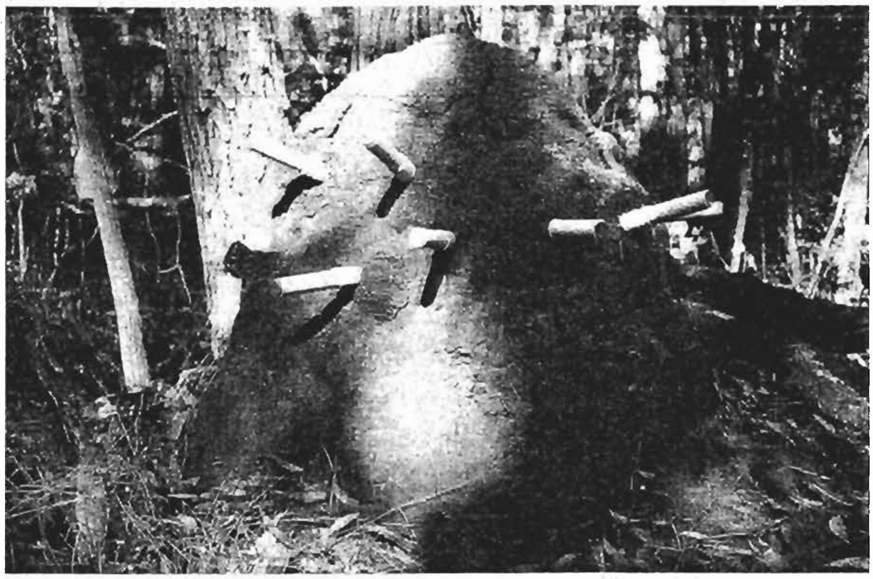
Any comments from individuals, organizations or companies from within the industry would be most welcome and should be directed to one of the members of Executive Council or the Executive Director, Mr. Dennis Mutton (08) 216 7211.

NAFI's postal address is Private Bag 10, Clayton, Victoria 3168. Tel. (03) 542 2208.

Doug Howick, Secretary

Wood and forest-based program of CSIRO's Division of Chemical and Wood Technology

The Division improves present, and devises new, technologies to support Australian industries concerned with more effective use of Australia's lignocellulose resources, water purification, biotechnological processes and grain processing. Research related to the wood-based industries comprises 55% of the Divisional effort. In this, the Division is concerned with improving technology for two major situations. First, to increase both the value of wood products and the proportion of the log converted. Second, an improved understanding of the changing nature of Australian forest resources. Details of each of the wood and forest-based programs have been prepared for the Forest Products Newsletter by the Program Coordinators.



Studying the role of termites in forest management.

1. Conservation and biodegradation:
Coordinator: Dr. Harry Greaves

This program examines the processes involved in the degradation of lignocellulosic materials and uses this knowledge to develop both wood preservatives and wood preservation systems. In addition, information on degradation processes is applied to the bioconversion of lignocellulosic residues to useful products, e.g. Chemicals, feedstocks, etc.

The program deals with biodeteriogens, preservation and durability, and rail sleeper performance.

(a) *Biodeteriogens*

Decay, insect attack, including termites and marine borers are all studied so as to provide a broad base upon which to develop control measures. In particular, methods of bioassay (determining the effectiveness of chemicals on organisms) of wood protection chemicals are continuously under development and the relationship between laboratory and field performance of preservatives (and preservative-substrate combinations) are studied. The role of termites in forest management is a new area of activity involving studies of the ecology of termite colonies in the forest, as well as insect physiology. Other pest control techniques are also being examined, such as baiting for termite control in dwellings. Also the role of marine borers around Australia's coastline is being carefully assessed with attention given to precise indentification of the level of hazard. The program also studies methods of utilising sawmilling and forestry wastes in the production of added value chemicals and products,by microbiological processes e.g. fungal protein derived via composted sawdust.

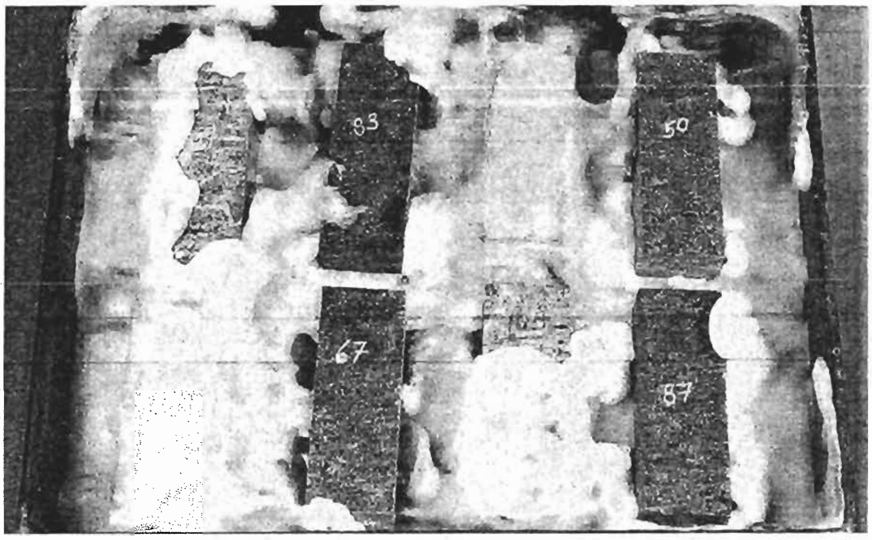
(b) *Preservation and durability*

The major aims are to develop new, improved and environmentally acceptable preservative systems for wood in use.

The major efforts have been directed towards commercialisation of copper-ethanolamine-nonanoate (CEN) and the family of pigment emulsified creosote (PEC) preservatives. In addition, a potential plywood preservative (a 'cocktail' of fungicide and insecticide) has been shown to be effective against both termites and decay and mill trials are planned in a full-scale production run.

Particleboard studies are aimed at producing bioassay procedures as well as comparative testing of various preservative treatments. These studies and the plywood research are being conducted in collaboration with the various industries concerned.

Wooden poles continue to be studied in view of the millions of dollars invested in their serviceability throughout the country. The work is well supported by the different utilities and pole producers, and is aimed at developing new or improved preservative systems for protecting



Bioassays are used in research to develop environmentally acceptable third generation wood preservatives. Shown above is an assessment of particleboard treatments against decay fungus.

poles, as well as devising effective remedial treatment processes for existing pole populations. PEC continues to play a significant role as a novel, acceptable preservative for new poles.

(c) *Rail sleepers and performance*

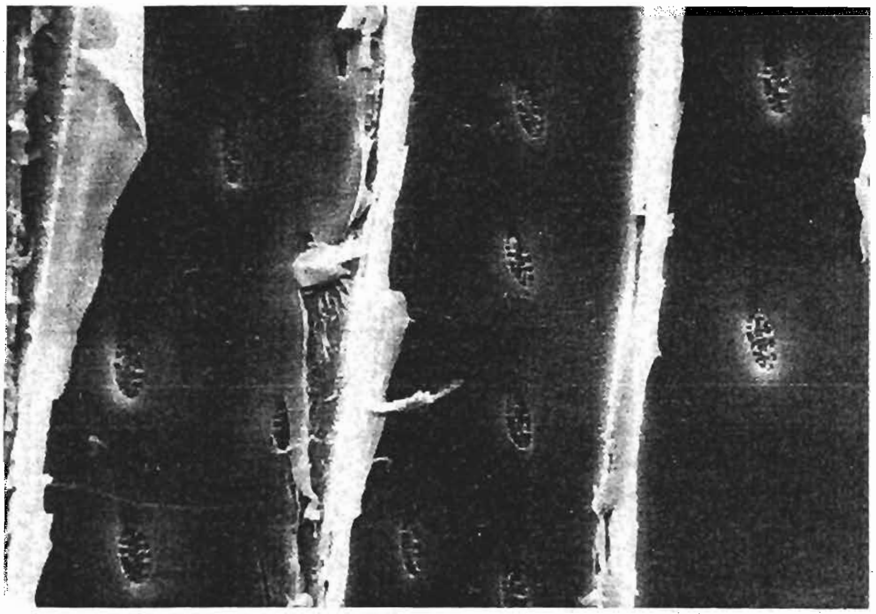
This aspect of the program monitors the service performance of treated and untreated wooden railway sleepers installed in many parts of Australia; develops and studies the feasibility of producing new types of railway sleepers and improved fastenings; and assists with practical problems associated with rail sleepers. The work is well supported by the Railways of Australia, and has provided 25 year in-track data on a range of preservative/wood combinations at a number of locations throughout Australia. Composite sleeper studies, using smaller sized material to build up to full sleeper size are being undertaken.

2. Wood Science:

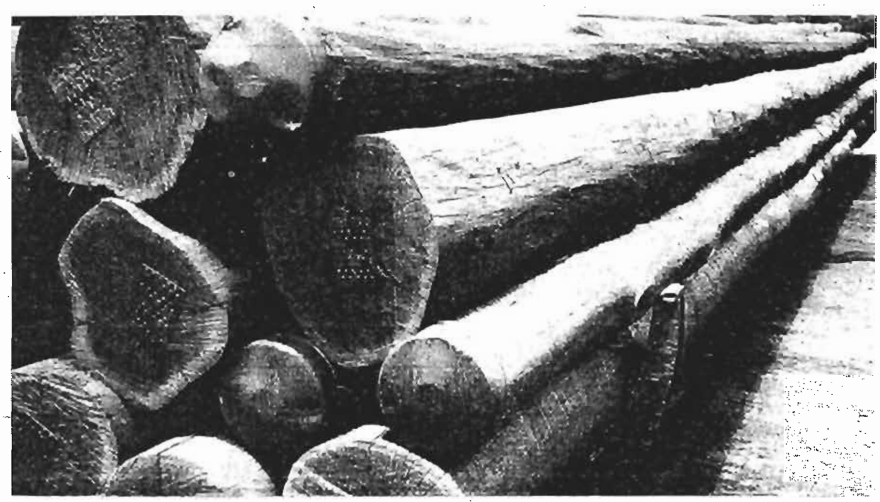
Coordinator: Dr. Harry Greaves

This program is primarily concerned with the application of fundamental wood science principles to the more practical nature of many of the Division's tactical research goals. It is also committed to the general philosophy of defining the most appropriate/suitable utilisation of timber species for specified end-use requirements.

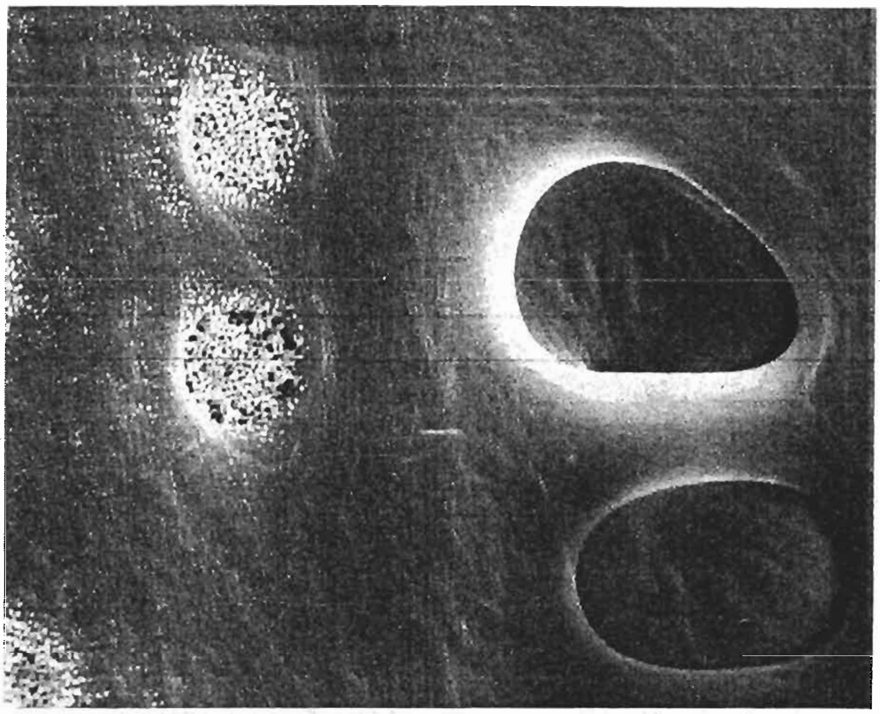
At the present time the program is concerned with wood-water relationships primarily with respect to shrinkage and collapse in eucalypts. Recent investigations using mountain ash have shown a strong relationship between cell wall properties, e.g. density, moisture content, and collapse. We hope to apply the relationship in developing a predictive method for collapse susceptibility in timbers. This type of work has a strong fundamental wood science component, but it also demonstrates the tactical value of such endeavours. The response of wood cells to environmental circumstances is also being studied by looking at fundamental characteristics. For example. the extent to which extractives contribute towards cell permeability, and hence ultimate dimensional stability in service, is under investigation.



Investigating the structure of fibre pits will provide a better understanding of wood permeability (E. regnans *fibres* ×c. *1000).*



Hardwood poles freshly removed from the treatment cylinder following vacuum pressure impregnation with PEC, our new, cleaner cresate-based preservative.



A knowledge of cell ultrastructure will improve utilization—scanning electron micrograph of mountain ash vessel wall showing the structure of simple and vestured pits (× c. *2000*).

Methods of chemically modifying the cell wall structure—in addition to the more traditional preservation processes—could also provide enhanced durability of timber in service.

As the marketplace increasingly receives timber from relatively young plantations, it is important to understand, and quantify, the differences which exist between this juvenile wood and the mature timber with which we have become more familiar. In particular a knowledge of the detailed anatomy and the formation of extractive material could assist in better use of juvenile wood. Basic wood quality assessments are clearly of value in choosing the right timber to do a particlar job, and with the aid of low-cost microprocessors and minicomputers in the collection, processing, and application of these assessments, the knowledge gained can be put to maximum use.

It is hoped to apply a sound knowledge of wood science to a number of the more practical needs of other forest products programs within the Division. For example, a small multidisciplinary team will be established to study the kinetics and processes of liquid movements both out of and into wood cells. A detailed knowledge of wood structure at both macroscopic and microscopic levels will be essential to the success of this project, and the information gained could bear directly on seasoning and preservation practices.

Australian Standards play a major role in improving the productivity of industry and in providing the consumer with incalculable benefits. Both these programs continue to contribute very significantly to a range of timber standards. Aspects of wood preservation, timber engineering, selected wood properties, etc. are dealt with by the Timber Standards Board, and officers of both programs are involved in the various Standards committees in these areas. Information transfer from the two programs' research activities is not just confined to technical input to Australian Standards however. We continue to provide expert advice also to the general public and the forest products industry. In addition, the building sector frequently seeks our assistance with specifications, end use requirements, serviceability, and so on. This balance between research and practical usage of the results will always be a foremost consideration in the programs' planning, while forecasting the needs of industry will also have a strong influence on our ongoing endeavours in wood preservation, wood science and utilization.

3. Timber Conversion:

The work of the Timber Conversion Program (formerly Forest Conversion Engineering Section) is directly related to the needs of the Australian timber and plywood industries. The formal objectives of the Program are to improve timber conversion practices, upgrade derived products and utilise residues effectively, all with the aim of maximizing yield from the raw material. We are endeavouring to increase the services we can provide by engaging in collaborative projects with the timber industry and others with a particular or collective problem to be solved. This approach provides some additional finance for temporary staff and special equipment needed for performing the sponsored work.

The Timber Conversion Program is organized around three distinct areas of work: Resource Evaluation and Utilisation; Production Technology; and Residue Utilization.

Coordinator: Mr. Frank Christensen

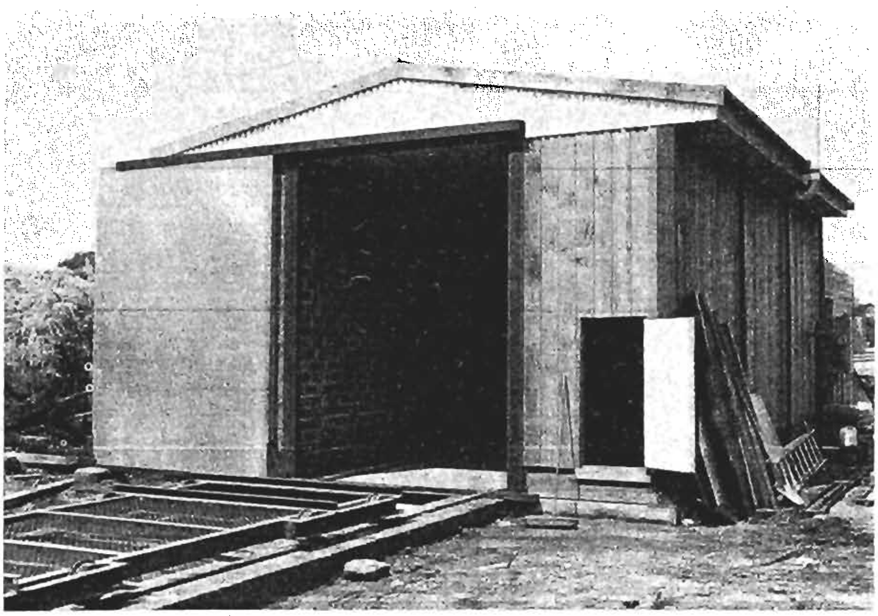
(a) *Resource evaluation and utilization*

Research on the conversion of trees to veneer and sawn products is largely concerned with (1) the underlying principles and practices of the processes involved and (2) the prediction from tree and log characteristics of the properties and performance of various end-products. The Australian resource can now provide only 75% of the strong and continuing demand for timber by the construction industry. At the same time, sawmillers are having to cope with an increasing proportion of small diameter logs from plantation softwoods and regrowth hardwoods. In contrast to mature logs, sawn products from small logs have a significantly higher proportion of defective corewood and are more prone to distortion. These changing resources make the costs of such operations more difficult because of increasing production costs, the relative reduction in product yield and the limitation on the range of product sizes attainable. Continuing research is needed to develop appropriate technology to optimise all facets of small log conversion including the drying of an increasing proportion of the sawn timber produced. Currently, supplies of rainforest logs for the veneer and plywood industry are being phased-down. The suitability of certain regrowth eucalypts for peeler logs is being evaluated in terms of productivity, recovery and end-uses for products. The sawmilling and plywood industries are important in the Australian economy for their products and socio-economic value, particularly the significant level of employment provided in rural areas.

Current work in resource evaluation and utilization comprises:

1. An examination of the characteristics and properties of the changing Australian forest resource and the determination its most effective utilisation potential and conversion characteristics.
2. The investigation of optimal drying regimes for the changing forest resource.
3. The investigation of drying mechanisms through modelling techniques and the effects of process variables on wood properties.
4. The evaluation of the potential peeler log resource and the identification of any need to develop new technology for its conversion.

Low quality sawlogs now being obtained from mixed species forests.



Low-cost screen-kiln recently designed for direct heating with LPG. Suitable for either low or high temperature operation.

(b) *Production Technology*

It is important to have a detailed understanding of wood conversion processes that is specific to Australian raw materials and operating conditions. Local differences can often lead to difficulties in the direct application of overseas technology and do create a need for Australia actively to maintain its own technological base. A good example is the need for a sound appreciation of the "grade" sawing method for regrowth eucalypts, which have high growth stresses and hidden defects. The influence of both these factors on the sawn product is being studied with the aid of computer modelling techniques, so that a large number of parameters can be examined within a relatively brief time. Modelling is also being applied to a study of veneer and plywood manufacture where mills may use three raw material inputs to produce up to eight types of speciality products in multiple sizes. Optimisation of product-mix and costing can be highly complex under these circumstances. The substantial benefits to be derived from the upgrading of sawn hardwoods by drying is being more widely recognised by the Australian timber industry which is tending to improve its performance in this area. The principal reasons for much of the research are the changing nature of the available resource and the need to upgrade and increase the added-value of hardwood timber products which are becoming scarce on a global basis.

Current work in production technology comprises:

1. Establishing optimal sawing regimes for logs of different size and quality in order to maximize the yield and grade of sawn products, with particular reference to the application of computer modelling to this task.

2. Developing, or modifying, kilns and drying processes for maximising the drying rate and quality of timber products.

3. Investigating the accelerated drying of commercially important hardwood timbers.
4. The development of appropriate conversion technology, as required, for new peeler log resources and products from them, collaboratively with industry.
5. The development of computer models of veneer and plywood manufacture for evaluating production and product-mix strategies.

(c) *Residue utilization*

Within the Australian timber industry, an estimated five million or more cubic metres of wood residues are produced annually. They attract a full share of the total raw material/processing cost in the course of becoming residues as well as the costs involved in disposing of this potentially valuable resource. Furthermore, their disposal by incineration or dumping may lead to air or water pollution. The profitable conversion of these residues by the sawmiller could support the economic use of lower quality resources that yield reduced recoveries of saw timber. The prospects and economics of utilising forest, sawmill and other lignocellulosic residues as sources of energy and higher value-added products are being investigated. Such products range from activated carbon with limited demand but very high added-value to metallurgical carbon with high demand but still moderately high added-value. An alternative method of utilising part of the excess residues is in gasification to supplement or supplant the use of petroleum-based fuels in boilers, furnaces and kilns of various types.

Current work in residue utilization comprises:

1. The most effective utilization of forest, sawmill and other lignocellulosic residues for their carbon and energy potential.
2. The completion of the development and testing of a fluidized-bed carbonizer with heat recovery for cogeneration.
3. The investigation of the production and properties of charcoal and carbon for industrial, mining and metallurgical applications.
4. The supplementation or replacement of petroleum-based fuels or natural gas burnt in small oil - or gas-fired furnaces with gas generated from wood residues.

4. Cellulose Technology:
Coordinator: Dr. Tony Michell

This program has as its objective the development of improved processes for separating and using fibres from wood and other plant sources, and for converting dissolved materials in spent pulping liquors to valuable chemicals.

The manufacture of fibrous products and chemicals from lignocellulose is a very important component of the Australian economy and is based on a growing and renewable natural resource, furthermore, the participating companies are largely Australian-owned.

The Program's work in fibre-based composites is directed at developing new materials based on cellulosic fibres and at improving processes for making known cellulosic materials. Advancing technology requires new materials which are often better achieved with composites, such as those combining fibres and polymers, than with single components. Examples of this from the high technology sphere are the carbon fibre-based resin composites which are used in aerospace applications and from the more everyday scene glass fibre reinforced polyesters as used in boat hulls, tanks and truck cabins. Asbestos fibres were often used in fibre composites but have lost popularity because of concerns about health. Dry cellulosic fibres have reinforcing properties which compare favourably with those of glass fibres on the basis of cost per unit reinforcement and can be produced at lower energies per unit volume. However, research is needed to improve the performance of cellulosic fibres in materials exposed to wet environments.

The Program has been actively involved with a number of Australian manufacturing companies and commercial products have resulted.

A major thrust has been in work concerned with replacing asbestoc fibres by wood pulp fibres in cement products. James Hardie Industries Ltd have substituted wood pulp fibres for asbestos fibres in their ranges of cement sheet products and low pressure pipes. There is also interest in certain aspects of wood pulp fibre reinforced plaster and work is continuing in that direction. Attention is also being given to the use of wood pulp fibres in organic matrices.

Another major effort has resulted in the development of SCRIMBER, a new timber product made from pine thinnings and small trees, which matches the quality of high grade natural timber. This product which was invented by Mr J D Coleman and developed by CSIRO, in collaboration with Repco Ltd, will be manufactured from radiata pine thinnings by the South Ausraliam Timber Corporation (SATCO) at a new plant to be built at Mt Gambier.

Personnel from the program have also been involved in a team formed to develop an industrial process for the production of wood adhesives from radiata pine bark.

As well as these technological developments the Program has an interest in the underlying science in matters such as the properties of the interfacial regions and the relationship between the properties and structures of the materials of interest as evidenced by microscopic and spectroscopic examination, mechanical testing and mathematical modelling.

5. Pulping and Pulpwood Resources:
Coordinator: Mr. Bill Balodis

Australian wood resources are changing from native forests to forest plantations. Conservation pressures to preserve native forests as parks, reduced log quality from forests which have been selectively harvested

Print this page

a number of times and the significantly higher growth rates in plantations, are some of the factors which are altering our traditional wood resources. During this transition period most pulpwood is still derived from native forests in the form of forest and sawmill residues. The use of forest residues for local and export woodchips enables the State Forestry Departments to upgrade their cut-over forests, and using sawmill offcuts for pulpwood reduces pollution and provides cash flow to the sawmilling industry. Work is continuing on assessing the pulpwood quality of residues and non-commercial species in various States of Australia and from tropical forests and plantation species from Papua New Guinea as part of external aid projects.

Plantation grown pine is becoming one of the major sources of chemical and mechanical pulps. The paper-making properties of mechanical pulps can be considerably improved by chemical pretreating the chips. With the recent commissioning of a pilot-scale Sunds Defibrator it is now possible to explore industrial high pulping processes. In close collaboration with the Australian pulp and paper industry, the pilot-plant is being used to develop new commercial pulping processes for radiata pine for use in specialized paper products.

Here in the pulping laboratory there are various items of equipment used in the manufacture of pulp.

6. Chemical Conversion:

Coordinator: Dr. Adrian Wallis

Petroleum and natural gas are the dominant feedstocks for producing organic chemicals and derived materials, largely because of the development of efficient process technology for their conversions. In many cases, however, the extended use of renewable plant materials (chiefly wood) as a replacement for petroleum can be advantageous. Research in the Chemical Conversion program seeks to make use of the unique properties of plant constituents to advance the technology for their conversion to chemicals and derived materials. The key to this approach is to aim for products which would substitute for those obtained from petroleum only after a multistep synthesis. An example of this strategy is the Section's project to devise new technology for the conversion of wood to regenerated cellulose (chiefly as fibres) and cellulose derivatives, which would substitute for polymers, e.g. nylon, derived from petroleum monomers. Other areas of interest include using bark polyphenols as a substitute for synthetic phenol in adhesives, using other wood polymers, lignin and hemicelluloses, and producing high-value carbons from wood.

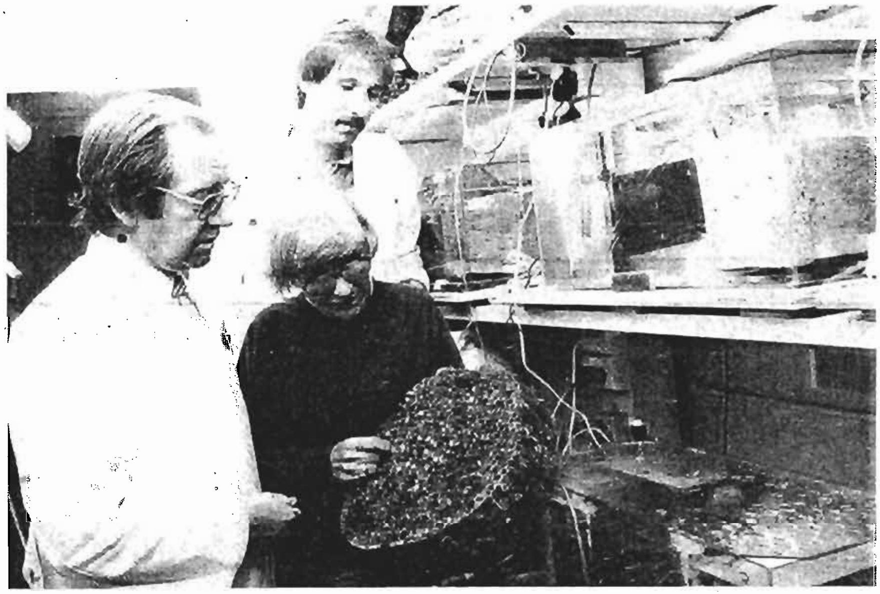
7. Techno-Economics:

Coordinator: Dr. Geoff Gartside

This program was set up to assist research scientists to assess the feasibility and commercial reality of their work. Individual members from the group work alongside the scientists helping them to answer such questions as: "Is there a need for the prospective invention or discovery?; What will be the economic impact?; Am I tackling an aspect that will significantly reduce production costs? The object is to identify the need for the research work. Having decided on the need, the feasibility of the research work reaching a successful conclusion has then to be determined. By using such an approach, it is expected that the projects undertaken in the Division will be more responsive to industrial and community needs. This process of analysis is not intended to replace the close contact between individual scientists and the customer, only to supplement that contact.

Recently the group has helped to focus the work on the carbonization of wood and to establish the relevance of new work on cellulose fibre production.

The Group's contact with the forest products industry has been improved by the appointment of Mr Doug Howick as Forest Products Liaison Officer. His task is to improve the flow of information on research achievements and commercial opportunities to the industry, and to provide a focus for industry statistics and knowhow that is needed from time to time in our assessment work.



Professor Turner (centre) is discussing shipworm damage in a eucalypt pile with John Barnacle (left) and Laurie Cookson (right).

Professor R. Turner visits Australia

Professor Ruth Turner, Professor of Biology, Harvard University, Massachusetts, USA and Curator in Malacology at the Museum of Comparative Zoology at Harvard, visited the Division of Chemical and Wood Technology when she was in Australia in March. While in Melbourne, Professor Turner gave a lecture entitled 'Marine borers and their relationship to micobiological research' at the CSIRO site at Highett and had discussions with Laurie Cookson and John Barnacle about their work with crustacean and molluscan wood borers. Professor Turner has a number of projects with the US Navy and one of these is associated with food chains in the deep ocean (to 4000 metres), she also lectured on this topic at Latrobe University during her stay in Melbourne. During her visit to Australia, Professor Turner collected some Australian marine borers on which she will do further historical and taxonomic work when she returns to Harvard following a visit to Pakistan.

Letter to the Editor

I refer to the Forest Products Newsletter Volume 2 No. 1. In the article about the Australian Timber Research Institute under the heading 'Council' the Tasmanian Timber Promotion Board represented by Mr Barry Lumley has been omitted.

Also under the heading 'Technical Advisory Group (TAG)' we omitted to include the Forest Products Association of W A.

I would be pleased if you could include these corrections in the next issue of your Newsletter.

Yours faithfully
John Carson
Director
Australian Timber Research Institute Inc.

Retirement of Dr. W. E. Hillis

Dr. Ted Hillis, FTS, one of Australia's best-known wood scientists retired from CSIRO in early February after 44 years service.

His field of activity covered almost the whole spectrum of wood science with a bias towards the quality and utilization of the fast-grown eucalypts. This interest was reflected in the two books to which he contributed and edited or co-edited. viz. *Wood Extractives and their Significance to the Pulp and Paper Industries* and *Eucalypts for Wood Production.*

He has published widely on the influence of forest practices on wood and bark quality and his work has impressed foresters in many countries. His distinguished international reputation led to numerous invitations to speak at scientific gatherings in many parts of the world and on many occasions he was the Keynote Speaker. At various times he has been Co-ordinator and Executive Board Member of the International Union of Forest Research Orgasnizations (IUFRO). President of the International Academy of Wood Science, Foundation Chairman of the Australian Branch of the Institute of Wood Science, Fellow of the Australian Academy of Technological Sciences and Visiting Fellow at the Australian National University.

In recent years he has become increasingly aware of the changing nature of the forest products resource and its essential role in a world of diminishing resources. He advocated strongly for increased basic research in wood science to take advantage of the renewable nature of wood and its ability to satisfy many of society's needs through production from fast-grown plantations and multi-purpose forests.

Dr. Ted Hillis recounting some of the many highlights of his career.

On 19 February a large gathering of friends of Dr. Hillis attended a retirement dinner in his honour, including a former Chairman of CSIRO, Sir Robert Price. Several appropriate presentations were made. In addition advantage was taken of the occasion for the Australian Branch of the Institute of Wood Science to present to Dr. Hillis its Stanley A. Clarke Memorial Medal for his many distinguished contributions to the field of Wood Science in Australia.

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Forest Products NEWSLETTER

Visual Grading Standards for Structural Timber

by Bill Keating and John Stuart-Smith

The recent issue of the Australian standard AS 2858 *'Timber—Softwood—Visually Stress-Graded for Structural Purposes'* is the latest chapter in more than 50 years development of timber standards in this country.

In Australia, timber-grading rules had their beginning in the 1930s with a large scale field study in Western Australia of jarrah (*Eucalyptus marginata*) and karri (*E. diversicolor*). As a result of this work a comprehensive system of recommended grading rules for those species was prepared by F Gregson, Forests Department, Western Australia and R F Turnbull, CSIR Division of Forest Products. These recommendations formed the basis for other hardwood grading rules that eventually became Australian standards. The close involvement of CSIRO in timber standards still continues.

World War II prompted various Commonwealth Departments to request the Standards Association of Australia to prepare a series of standards for use in relation to the supply of materials required for defence purposes. These were the Emergency Standards of which No.(E)0.54-1942 [Grading Rules (Emergency Series) for Sawn and Hewn Structural Timbers] was one.

The preface to this standard stated, *inter alia*, *'Tests on a number of species have shown that an imperfection of a given size and in a given position causes approximately the same proportional reduction in strength irrespective of species'*. This fact has permitted the preparation of structural grading rules covering a wide range of timbers. Working stresses for parcels of timber of the same grade are adjusted in proportion to the relative inherent strength of each particular species as determined by tests in clear specimens.

Bill Keating,
Senior Experimental Scientist, CSIRO Division of Chemical & Wood Technology

Thus, in 1942, we had one standard that applied *'to all recognised structural timbers used in Australia irrespective of the country of origin or species of timber'*. It covered scantlings, beams, planks, posts and columns in select, standard and common grades.

By today's requirements, (E) 0.54-1942 was not a sophisticated standard. There was basically nothing wrong with it, but experience gained through its use showed up

John Stuart-Smith
Executive Officer, SAA Committee TM/101, Structural Timber Products

in this issue . . .

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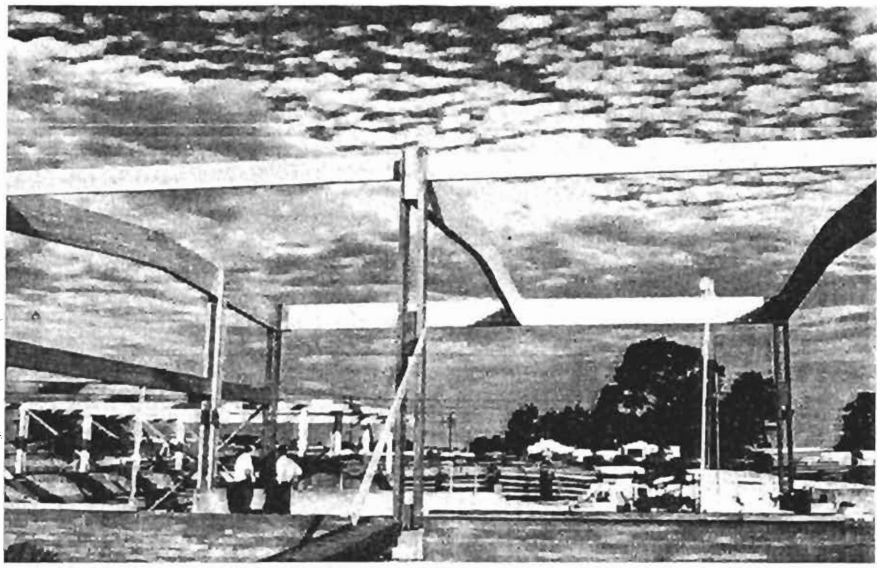
CSIRO Division of Chemical and Wood Technology

some shortcomings. Revision of this standard on a national basis was hampered by wartime and immediate post war travel restrictions. SAA, therefore, set up State committees which produced a group of standards, each reflecting the attitudes and requirements of specific regions such as South-East Australia, Western Australia or specific groups of timbers such as rainforest timbers or, later, particular species. These standards had a common technical basis, but as they were prepared at different times by different committees several inconsistencies became apparent. Worse, was when suitable timber was available, but unable to be graded, there was no standard for that species.



The Present

If consideration is only given to the inherent variability of the numerous species of merchantable timber available, the difficulties in marketing and utilisation are legion. On the other hand, if the focus is shifted to fitness for purpose, many of the variables lose relevance and the difficulties diminish. From the users' and designers' points of view, the prime factors in fitness for purpose of structural timber are predictable load bearing performance, limitations on distortion, and for some end-uses, durability and appearance.
This realisation brought about the consolidation of the standards for structural hardwood which was published in 1977 as AS 2082 and revised in 1979. A somewhat similar situation has occurred with softwoods. AS 2858 now encompasses all softwood timbers from whatever source. Provision has been made for cypress pine (*Callitris glauca*), (one of Australia's few native softwoods), to cope with its special nature. To make grading easier and more accurate a change has been made to the method of measuring knots, the main strength reducing characteristic in softwoods. The previous technique of measuring the cross-sectional dimension of the knot on one face of the piece of timber has been replaced by what is called the Knot-area Ratio (KAR) method. Now the grader estimates the percentage of the cross-section of the piece that the knot occupies. Previously, this has been done intuitively.

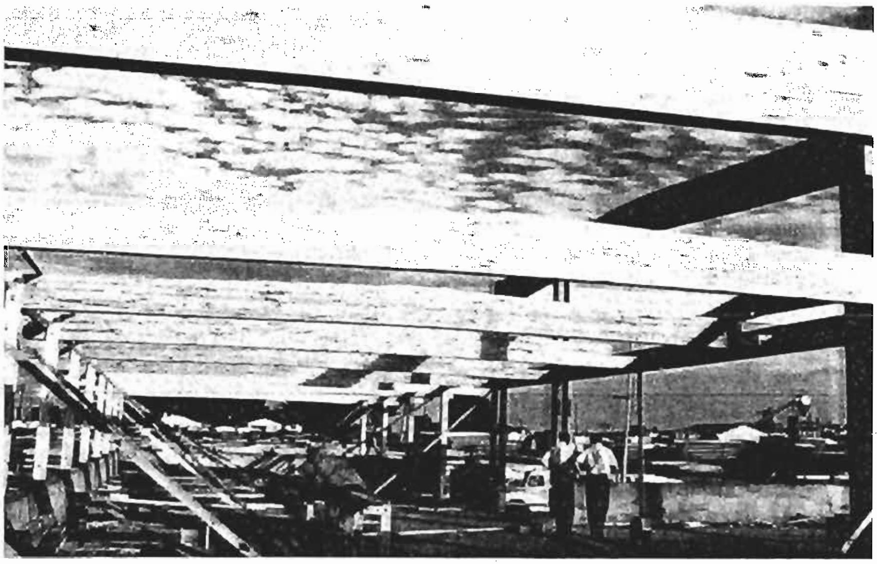
How the two standards, AS 2858 and AS 2082, are able to handle any softwood or hardwood is due the existence of the Australian strength grouping system developed and refined by CSIRO over forty years. In this, the very large number of species that may possibly reach the market are divided into a small number of groups based on the mechanical properties of small, clear specimens. The interaction of the grades described in the grading rules and the small number of strength groups produces a set of values called stress grades, F5, F7, F8, etc. Once the stress grade is established, reference to the Timber Engineering Code, AS 1720, or the Timber Framing Code, AS 1684, enables the design process to proceed. The new standard, AS 2858, has an appendix explaining the system in clear terms.

As timber graders and inspectors will be applying the standard under operational conditions, descriptions of each grade must be set down as clearly as possible and this information presented to meet the needs of a variety of users. The provision of summary tables in AS 2858 is a contribution towards this objective.

From the foregoing, it is clear that a necessary companion document to any grading rule is one that lists the appropriate strength group for each species. Coincidentally, the appropriate Australian standard giving this information has just been revised and published as AS 2878, 'Timbers—Classification into Strength Groups'. In this standard over 700 species, softwoods and hardwoods, locally grown and imported, have been given a strength group. While the assessments for those species supplying approximately 90 per cent of the market have been based on laboratory testing, the large number of species remaining have had to be assessed by means of their densities. This is a less precise method and so must adopt a conservative approach. However, it does permit these species access to the system.

Assumptions

As described, the structural grading of timber by visual means is based on a series of assumptions relating to the loss of strength caused by the presence and size of a defect. As the system has limitations certain safeguards have been incorporated. A refinement to produce a more accurate and hence more efficient assessment is available, but at some considerable expenditure of time and funds. For this reason, it is really only applicable to the leading commercial species. The technique is called 'in-grade' testing. As its name suggests it involves testing a fairly large sample of full-size pieces covering the range of grades typical of normal production. Usually, but not always, such a program results in an increase of the permissible working stresses for that species. Cypress pine and jarrah are two species that have been tested by this technique and no doubt others, such as radiata pine (Pinus radiata) will follow.



Laminated beams of structurally graded softwood as shown in both photographs have gained increasing market acceptance

When we talk about 'a standard for structural timber' it must be remembered that 'a standard' does not stand on its own. There are standards for determining certain properties; there are standards concerned with design; there are standards that deal with connections; all these standards form a suite or series that must harmonise, keep up to date and apply. And application entails the teaching and learning of these standards.

The Future

Structural timber standards aim to improve resource utilisation, increase efficiency, ensure suitability and provide safety. AS 2082 and AS 2858 do all that and more. Their intelligent use will provide a sound basis in the future for producers, specifiers and consumers.

1986 GOTTSTEIN FELLOWS

The J W GOTTSTEIN Memorial Trust Fund has announced the award of two Fellowships tenable in the latter part of this year. Details of the successful Fellows and their projects are as follows:

Peter Juniper—Technical Director, Timber Promotion Council of Victoria. Peter, who is a professional civil engineer, has been with the Timber Promotion Council for more than ten years. During this time, he has specialised in the field of timber engineering and is responsible for a range of technical activities including the formulation of research and development programs for the industry in Victoria. Peter is a member of various SAA Committees including TM/102 (Timber Engineering) and TM/103 (Timber Framing), and has played an active role in the development of standards and regulations governing the specification and use of timber as a building material.

In recent years, TPC has been actively encouraging the design professions to consider timber as a high technology building product which is suited to many non-domestic construction applications, in addition to the already accepted and established domestic markets. With this background and the knowledge that the value of timber as a structural materials is well appreciated in North America, it is appropriate that Peter Juniper's Gottstein Fellowship involves a 7-week study tour in Canada and USA to investigate timber's role in the non-domestic construction industry.

Peter Juniper, 1986 Gottstein Fellow

Dr John Davis, 1986 Gottstein Fellow

Dr John Davis—Lecturer, Department of Applied Physics, Chisholm Institute of Technology. John, a physicist, graduated BSc with Honours from Monash University in 1974 and obtained his PhD, also from Monash three years later. After being a Research Associate at Imperial College of Science and Technology in London, he joined Chisholm Institute some five years ago. He has been assisting the forest products industry in various ways, with the development and application of sophisticated technologies to be used for the solution of practical problems.

One such technology is computerised tomography (C.T.), an extremely powerful technique most commonly used in medical diagnostics. However, John's work at Chisholm and recent experience overseas has demonstrated the high potential that the C.T. technique offers as a totally non-destructive evaluation tool for the industry. This is because C.T. enables quantitative, three dimensional image information to be obtained from solid objects such as trees, logs and timber structures and products. C.T. may have application in such areas as quality evaluation of logs prior to milling, defect assessment in utility power poles, inspection of laminated products and structural members, densitrometry studies of Australian hardwoods as well as other problematical areas.

Australian Particleboard Research Institute Inc. – Another Research Association

by Dr Alan Halligan
Research Director

The Australian Particleboard Research Institute (APRI) was incorporated in October 1982. It was established by the Australian Particleboard Manufacturers Association (APMA) to participate in the Commonwealth Government's Research Associations Program. This is the same incentive that also allowed the creation of The Australian Timber Research Institute (ATRI) (see *Forest Products Newsletter*, Vol. 2, No. 1) The aims and objectives of APRI are briefly:

* to carry out research and development work relating to particleboard products and their application and performance.
* to provide the means to transfer technology to the particleboard industry and users of particleboard. This applies to relevant technology developed in Australia and overseas.
* to represent the Australian Particleboard Industry in technical matters in general (e.g. Standards Association, Forest Products Research Advisory Panel, Conferences etc).

Membership

APRI consists of four members who, between them, produce about 88% of all the particleboard manufactured in Australia. The members of APRI are as follows:

Burnie Timber (an enterprise of North Broken Hill Limited)

Pyneboard Group, CSR Limited

Softwood Holdings Limited

Westralian Forest Industries Limited

Council

The general functioning of APRI is controlled by a Research Council made up of industry representatives as well as members from outside the particleboard industry. Current Council members are:

Mr P K McConchie (Chairman)—Softwood Holdings Limited

Mr H F Pens (Deputy Chairman)—Pyneboard Group

Mr B Keily—Burnie Timber

Mr J H Slocomb—Westralian Forest Industries

Mr L Ward—Dept Industry, Technology & Commerce

Mr G Warden—CSIRO Bureau of Information & Public Communication

Dr H Greaves—CSIRO Division of Chemical & Wood Technology

Mr D Hanley—CIAE Timber & Wood Products Research Centre

Operation

APRI contracts out its research projects to other research institutions, e.g. CSIRO, Universities, Colleges and Institutes. This allows APRI to draw on the best available in skills, experience and equipment which is necessary to tackle each particular project. Sometimes this approach is difficult because many of these Institutions have other commitments to meet, both for themselves and other clients, so therefore they cannot always meet our deadlines. However, it is APRI's intention to continue this approach so that by drawing on the best staff and equipment the timber industry will only benefit in the long run.

The Timber & Wood Products Research Centre (TWP) of the Capricornia Institute of Advanced Education is worthy of special mention. APRI has built a close relationship with TWP and the skills and experience developed at TWP (due in part, to APRI involvement) will be of benefit to the whole timber industry.

Budget

The Research Associations scheme provides for Government funding to be matched by industry funds. Our budget for the year ending June 1986 was $300,000 through this scheme, and $100,000 through AIRDIS (Australian Industrial Research & Development Incentive Scheme). AIRDIS is also a dollar-for-dollar arrangement provided by Government to promote R & D work. The grant was awarded for a specific project and is quite separate from the Research Associations funding.

Project Activities

APRI has placed strong emphasis on the initiation stage of projects. Ideas are discussed with prospective researchers at an early stage and their contribution to project outline proposals is keenly sought. The likely costs and times involved are easy to estimate for some projects but very difficult for others. Nevertheless, this exercise has to be done and estimates made that can be the basis of formal contracts. Another difficult, but vital exercise, is the estimation of potential benefit to the industry from successful completion of the project. This must be done for each APRI project and at times involves a good deal of time, effort and wide canvassing of opinions. But the industry considers that a long term commitment of funds must be based on the expectation of a return on that investment.

Particleboard Structural Wall-Bracing

APRI's major achievement this year was the completion of the Wall-Bracing project. This work was undertaken at TWP and involved an extensive study of the behaviour of wall frames under racking and uplift loads. The program involved determining the failure loads for:

* braced softwood frames (2 stress grades, 2 stud sizes)
* braced hardwood frames (2 stress grades, 2 stud sizes)
* 2 sheet nailing patterns
* frames with and without cyclone bolts.

This kind of testing is based on full-sized house frames, made up in a realistic way, and thus results tend to be quite variable. Replication is important and the program used a total of 60 frames.

A series of exposure tests was also carried out because wall-bracing sheets would be exposed to the weather until a house is closed in. These tests confirmed that Particleboard Structural Wall-Bracing performs satisfactorily for up to three months of full weather exposure.

Sheet wall-bracing products are becoming more widely used in recent times. However, on the subject of bracing stud walls, the Timber Framing Code (AS1684-1979) is considered imprecise. It is clear from inspection of home building around Australia that builders and building inspectors are uncertain about requirements for bracing walls. Diagonal braces are either omitted or installed at too steep an angle in walls where large windows and front-door set-backs occur. Sheet-bracing materials provide solutions to these problems.

Flooring

Flooring continues to be an area of strong interest to the particleboard industry with attention being directed to several different areas.

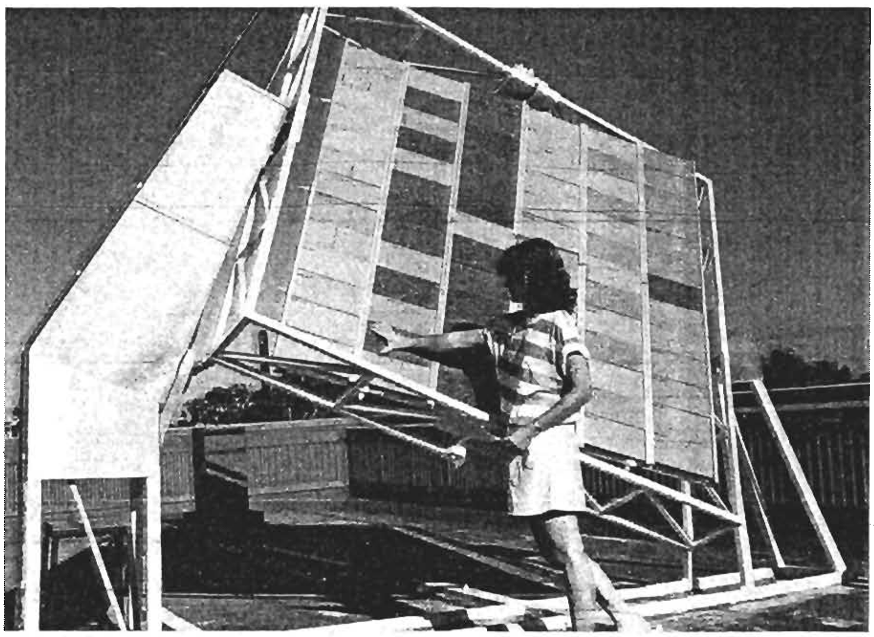
Wet Area Flooring

Particleboard Wet Area Flooring has been on the market now for about two years and has gained rapid acceptance. Early acceptance of the product was complicated by the exclusion of particleboard from wet area floors by the Standard AS1860-1976 (Installation of Particleboard Floors). The Particleboard Industry has been concerned about the technical basis of this exclusion as other timber products, particularly plywood, have been permitted as wet area flooring.

The restriction in AS1860 was overcome by developing a new product ie. by incorporating a fungicide in the board. With protection from fungal decay, the board has now been accepted by most building authorities throughout Australia. However, the same authorities do not require similar protection for other timber products.

This whole question was the subject of an investigation by the CSIRO Division of Chemical & Wood Technology who studied the nature and extent of attack by selected decay fungi on a range of timber flooring products. As is usually the case in these types of bioassay, results were quite variable. However, the researchers concluded that with all three fungi used, the performance of particleboard was not significantly different from that of plywood.

These results confirmed APRI's original view that there was no scientific justification for requiring particleboard, but not the other timber products, to be fungicide treated for use as wet area floors.



Sun Tracking Rig—Exposure rack for assessing the ability of particleboard to withstand the effects of weather

Wet Area Flooring—Installation

APRI, together with a number of other sponsors, is participating with the University of NSW, Building Research Centre, in investigating ways of eliminating leaks from wet area floors (i.e. shower recesses). Shower stalls have been constructed and several floor and wall systems will be subject to regular showers to try to pinpoint problem areas and to find solutions.

Footings Design

Aspects of house performance that become most noticeable relate to footings. If footings move, then cracks appear in brickwork and linings, and homeowners quickly become concerned. Concrete slabs have been promoted as providing a better foundation, whereas strip footings (the foundation for most timber floor systems) are said to give problems, especially in unstable soils.

Investigating design methods for strip footings is the subject of a joint project between APRI, ATRI and RPRI (Radiata Pine Research Institute). It became apparent in the early project stages that there was no design method for strip footings relating to soil type. Strip footings were specified from tradition and experience rather than designed for specific conditions. In some circumstances, concrete slabs too are specified from simple rules and tables but there is a rigorous design procedure to back up the tables. Our project was concerned with developing a design methodology for strip footings.

Future work will be concerned with costing strip footings and concrete slabs designed for several soil classifications. We are also interested in case studies to review actual foundation performance under various soil conditions.

Weathering

The ability of products to withstand the effects of weather is an area of research for many people concerned with a variety of different products. Much of this study is concerned with accelerating weathering effects so that the time factor becomes more manageable.

This subject is of concern to the particleboard industry as well - how to accelerate weathering effects yet retain realism in the testing. We are tackling the problem along two lines, both involving severe weather.

One test series is being carried out in Darwin, to assess the tropical combination of heat and relative humidity on particleboard products. Concurrently, TWP in Rockhampton has started with the design of a Sun Tracking Rig; that is, an exposure rack that would move during the day to keep the sun's rays normal to the exposed surface and so maximise radiation. The test rig is also fitted with water sprays so that the temperature, radiation and water effects of weather are involved. Thus elements of real weather have been boosted somewhat, but the intention is to remain within a realistic framework.

A test program is just underway on the rig and we hope to have results in two to three years time.

Formaldehyde

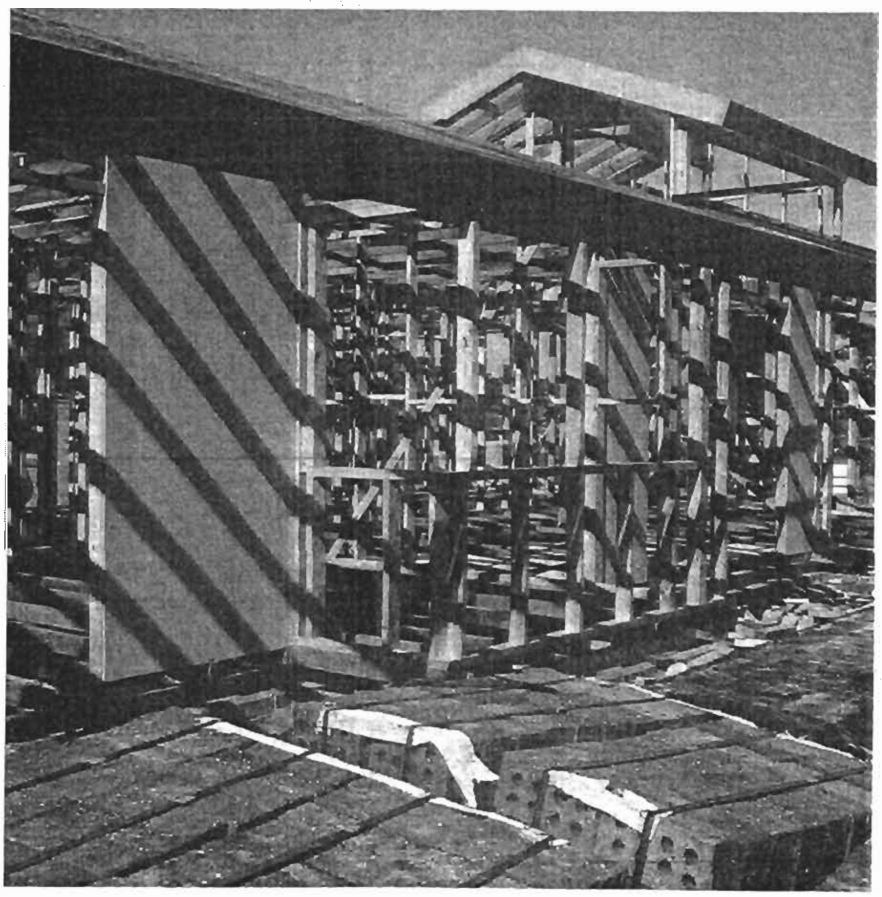
Formaldehyde is one of those materials that can be cast in the hero or villain's role depending on circumstances. It is a key ingredient in resins, glues and chemical treatment for activities ranging from plywood and particleboard production, to carpet and upholstery fabric treatment and to preserving tissue in hospitals, laboratories etc. However formaldehyde gas is emitted from these manufactured and treated products. It is detectable by smell at very low concentrations (say 0·5 parts per million) and some governments overseas have become concerned that it may be a carcinogenic.

APRI is constantly aware of overseas developments in its role of advisor to the Australian industry on general technical matters. Two recent events represent good news for particleboard and other industries involved with formaldehyde products.

The first was publication in USA of the National Cancer Institute study of over 26,000 people who had been exposed to formaldehyde through their working life. This was the latest of several similar studies which have all shown that the group studied had no more cancer problems than those of the general community.

The second event is the establishment of a special Chamber Test Facility in Sydney. This Facility enables formaldehyde measurements under conditions that reproduce domestic, office or work place environments. Parameters that can be varied are temperature and relative humidity (sq.m of board per cub.m of room) and air conditioning (air changes per hour). Product is loaded into the chamber as raw board or as finished components as appropriate to the particular case being studied.

Knowledge of formaldehyde concentrations with varying air conditioning, room loading and climate conditions and with different products, has already proved of benefit to users and specifiers of particleboard products.

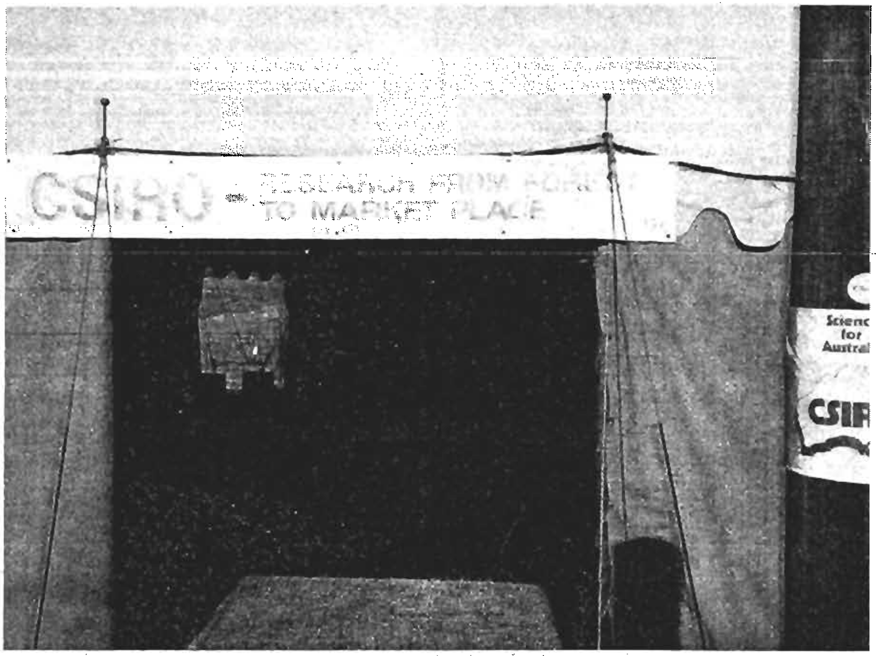


Timber-framed building using particleboard structural wall-bracing

Forest Industries Machinery Exposition

As foreshadowed in our last Newsletter, CSIRO was at FIME '86. It was a most successful operation, with $200 million of machinery and services on the site and approximately 22,000 visitors over the four days.

With FIME being described as 'a massive exercise in technology transfer', it was appropriate that the Exposition was officially opened by the Chairman of CSIRO, Dr Keith Boardman. In his opening address, Dr Boardman took the opportunity to inform visitors to Myrtleford that CSIRO had developed new policy initiatives aimed at forging closer and more effective links with industry. The Chairman stated that CSIRO is currently heavily committed to forest and forest products research, explaining that the work is spread across six Divisions and accounts for almost 5 per cent of total research effort.



CSIRO Exhibition at FIME.

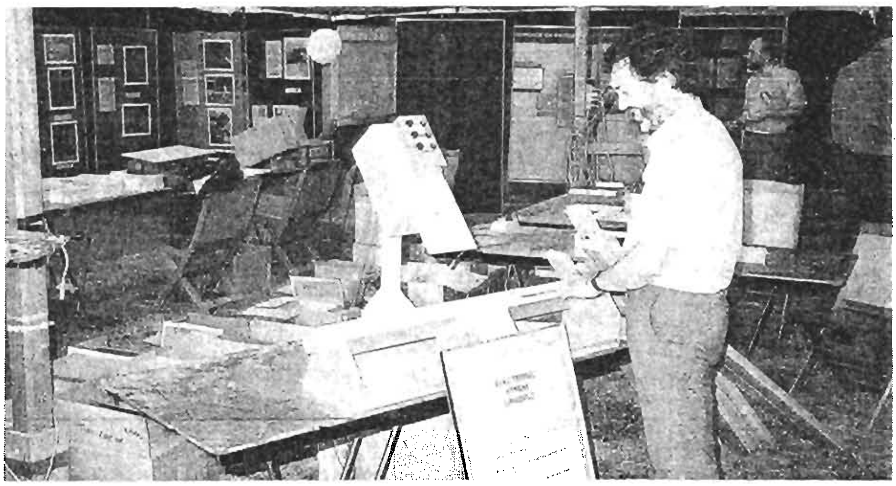
CSIRO

The CSIRO has a long history of close cooperation with the forest industries in many areas, and its cooperation has been much appreciated. Always its efforts have pointed to new directions for the industry.

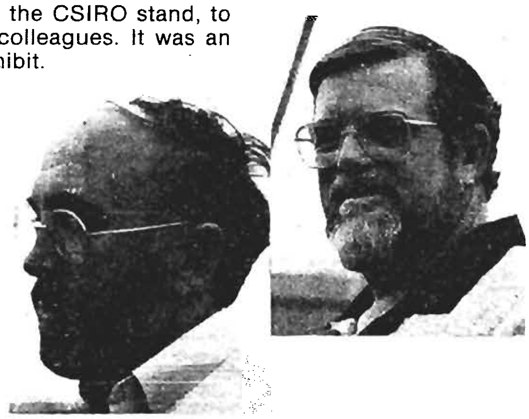
And so it was at this FIME. Doug Howick presented his familiar smiling face and extensive knowledge at the front of the CSIRO marquee. Bill Kerruish was everywhere about the sites, and the Eucalypt Regrowth harvesting demonstration must be considered one of the highlights of both FIME and the preceding logging conference programme.

But bearing in mind the 'HI-TEK' nature of this FIME, the computer applications developed and displayed were outstanding.

Ian McArthur and Bill Rawlins showed and demonstrated a complex yet 'user-friendly' computer programme which is a "MUST" for anyone using or buying forest machinery — or log truck. By keying in your own needs and particular conditions of operation, virtually all the machines available in Australia can be shown compared to each other in relation to costs of every description, with an extension through to as many years of machine life as you wish.



Bill Kerruish did the rounds of the CSIRO stand, to check out the displays of his colleagues. It was an interesting exhibit.



CSIRO's Bill Rawlins (left), and Ian McArthur. Both are members of the programming team.

Reproduced here is the official comment as appeared in the Australian Forest Products Journal, *(June), Vol. 52, No. 5.*

Industry R & D Board Members Announced

The inaugural members of the Federal Government's Industry Research and Development Board were announced in July. They will administer the recently announced Grants for Industry Research and Development (GIRD) scheme.

GIRD replaces the Australian Industrial Research and Development Incentives Scheme (AIRDIS) and will operate for five years from 1 July 1986.

The new board replaces the Australian Industrial Research and Development Incentives Board (AIRDIB) which conducted AIRDIS. It also will carry out the functions of the former Australian Industrial Research and Development Incentives Advisory Committee (AIRDIAC) which advised the Minister on the desirability of the Commonwealth undertaking public interest projects under the scheme.

Announcing the members, the Minister for Industry, Technology and Commerce, Senator John Button, said GIRD was designed to complement the recently introduced 150 per cent tax concession scheme for eligible research and development.

GIRD would provide grant assistance to companies unable to benefit sufficiently from the tax concession, he said.

Both schemes are central components of the Federal Government's strategy to revitalise Australian industry.

Senator Button said AIRDIB and AIRDIAC had played a significant role in encouraging private sector R & D in their 10 years of operation.

'I congratulate their members for their contribution', Senator Button said.

The Chairman and two members of the new board had served on AIRDIB. Their appointment to the new board would allow some continuity in the running of GIRD.

'I am confident the new board, possessing considerable expertise, is a worthy successor to AIRDIB and AIRDIAC', Senator Button said.

The Industry Research and Development Board would honour the outstanding financial obligations of AIRDIB.

The new board has been appointed for three years.

Members are:

Mr B. Kricker, Managing Director, Australian Consolidated Hosiery Ltd (Chairman)

Ms Elizabeth Ryan, Deputy Chief Manager, Industry Restructuring Unit, Australian Industry Development Corporation

Dr John Eady, Managing Director of Foundry Products, Comalco Ltd

Professor Bruce Holloway, Professor of Genetics, Monash University

Mr Peter MacGregor, Principal, P K MacGregor and Associates

Dr Peter Miller, AM, Principal, Miller Milston and Ferry Pty Ltd

Dr Peter Robinson, Group General Manager—Technical, Metal Manufactures Ltd

Dr David Solomon, Chief of the Division of Applied Organic Chemistry, Commonwealth Scientific and Industrial Research Organisation

Mr Terry Hilsberg, First Assistant Secretary, Technology and Business Efficiency Division, Department of Industry, Technology and Commerce.

Canberra Contact: Chris Cottam (062) 64 4375

Institute of Wood Science

The Annual General Meeting of the Australian Branch of the Institute of Wood Science was held on Wednesday 17th September 1986 at CSIRO Division of Chemical and Wood Technology, Clayton.

The Guest Speaker was DR Syd Shea, Executive Director of the Department of Conservation and Land Management (CALM), Western Australia. Dr Shea addressed the topic 'Management of WA Forests and the Efficient Utilisation of their Products'.

The evening commenced at 5.45 pm prior to Dinner at 6.30 pm, the AGM at 7.30 pm and the address at 7.50 pm. As is customary, a most cordial invitation was extended to non-members. For further information regarding future meetings, contact the Secretary, Jim Creffield on (03) 555 0333.

Gottstein Trust Essay Competition

'Wood as a 21st Century Resource'

The J W GOTTSTEIN MEMORIAL TRUST, a major forest products industry-based educational trust fund, has three major streams of ongoing activity in Gottstein Fellowships, industry seminars and industry study tours.

As a further inititative, the Trust now calls for entries in an essay competition from students at Universities or Colleges of Advanced Education who are actively participating in courses, the major content of which is concerned with timber technology, forestry or wood science, civil engineering, building or architecture.

The following conditions apply:

1. The subject of the essay shall be: 'Wood as a 21st Century Resource'.
2. Essays shall be approximately 5000 words.
3. Prizes will be awarded as follows:
   1st prize—$1000.00
   2nd prize—$300.00
   3rd prize—$200.00
4. Students may be engaged in full-time or part-time courses but MUST state the name of the course and at which educational institution they are studying.
5. Entries shall be typed, double-spaced on A4 paper.
6. The decision of the Trust's Panel of Judges shall be final and no correspondence will be entered into.
7. The Trust reserves the right to publish those essays it considers suitable.
8. The Trust reserves the right to abstain from publishing those essays it considers unsuitable.
9. The CLOSING DATE for *RECEIPT* of entries is 20th OCTOBER 1986.
10. Entries should be addressed to:
    The Secretary,
    J W Gottstein Memorial Trust,
    c/o Private Bag 10,
    Clayton, 3168, Vic.