CSIRO

Forest Products Newsletter

DIVISION OF FOREST PRODUCTS, CSIRO, P.O. BOX 310, SOUTH MELBOURNE, VICTORIA 3205

REGISTERED IN AUSTRALIA FOR TRANSMISSION BY POST AS A PERIODICAL

NUMBER 369 JANUARY—FEBRUARY 1970

1970##369

STORM DAMAGE THAT COULD HAVE BEEN AVOIDED

ON THE AFTERNOON of December 11, 1969, a freak storm caused extensive damage to buildings in parts of the southern and south-eastern suburbs of Melbourne. Although, as in most such cases, a final accurate assessment of the total cost of the damage will probably never be obtained, the cost to some individuals was extremely high, particularly where houses or flats were completely unroofed.

The severity of this particular storm in terms of wind speed was by no means unusual. Other storms with similar or greater wind velocity have been experienced within living memory and can be expected not once but several times during the normal life of the average domestic building. Such storms are not infrequent in country areas, but do less damage there in terms of total cost of repairs because of the lower density of housing.

Although many tiled roofs were damaged during the storm in Melbourne, the major damage undoubtedly occurred to relatively flat roofs covered with metal sheeting. Whilst it might be uneconomic to construct houses to withstand the exceptionally violent storm expected once every 50 or 100 years, nevertheless, the average householder should expect his home to be proof against those storms which occur frequently and those of even greater severity which occur once every few years.

It is not that little or nothing is known about the effect of winds in such storms, nor does it require expensive construction to provide against the sort of damage experienced in the recent one. It is known that in high winds the forces generated by the wind around house eaves, and particularly at the corners, can be very great and sufficient to dislodge terracotta or cement tiles. However, the sound practice of wire-tying tiles to the roofing battens reduces to almost negligible proportions the risk of losing tiles in a storm.

Scarcely a year passes without reports of buildings losing their low-pitched or skillion roofs in storms, sometimes of only moderate intensity. The physical principle involved in the tendency for a roof to lift is the same as the one that enables an aeroplane to take off and remain airborne. The reason why these roofs fly off is much more difficult to understand. More than 10 years ago, the Division of Forest Products drew attention to the danger of inadequate building practice in the construction of low-pitched light-weight roofs and recommended inexpensive methods to avoid these dangers (see Newsletters Nos. 244 and 362). Its warning and recommendations have since been taken up and repeated in trade journals from time to time. In spite of this, some builders still seem to be unaware of what constitutes proper practice, and continue to use the same methods as they would in dealing with a traditional tiled roof of higher pitch.

A check made on damage caused by the recent storm showed numerous examples of hopelessly inadequate fixing of roofs on houses and flats, and on verandahs over shop fronts.

The foreseeable danger is that some builders may consider this particular storm as something out of the ordinary and, in repairing the damaged buildings, repeat the mistakes that were originally made in the roof construction. If this happens, there is a good chance that a number of people will undergo the same unfortunate experience during the next severe storm. There is no reason why they should because there is no excuse for poor building practice, particularly when good practice is relatively inexpensive and certainly much cheaper than the cost of repairs.

United Nations Assignment for Dr. Kauman

The Executive of CSIRO has given permission to Dr. Walter G. Kauman, at present Assistant Chief of the Division, to accept a one-year appointment with the United Nations Industrial Development Organization (UNIDO) in Paraguay.

Paraguay, a small land-locked country of 2½ million inhabitants in the heart of South America, is making big efforts to raise the standard of living of her people. To promote exports and industrial development generally, a new National Institute of Technology and Standards has been set up as a cooperative project of the Paraguayan Government with the United Nations Development Program, with special emphasis on meat, forest products, and leather. Dr. Kauman will join this Institute as Timber and Wood Products Adviser and will be responsible for United Nations work in this field, in close collaboration with Paraguayan professional staff.

Timber is one of Paraguay's most important products, and reserves of excellent quality are said to be enormous. Tropical hardwoods and cedars in particular are among the most valuable species. A few years ago timber accounted for about 20% of total exports; in addition, Paraguay exports large quantities of quebracho tannin, tung oil, essential oils, and other forest products. It is hoped that the new Institute will progressively expand until it can act as a consultant body to industry, assist in development projects for process and product improvement, and undertake feasibility studies for new industries.

Over the last few years Australian interest in South America has been steadily growing and a number of new Embassies and Trade Commissioner posts have recently been opened in South American countries. Considerable efforts have already been made by the Commonwealth Department of Trade and Industry and by private industry to bring Australian products before potential consumers in South America through trade fairs and exhibitions. Similarly, South Americans are becoming increasingly interested in Australia. There is a steadily increasing flow of migrants coming to Australia from South America, and the Chilean airline, LAN Chile, has recently opened a connection from Santiago to Tahiti via Easter Island to link up with services to Australia.

Walter Kauman, who has been in South America previously on a mission for FAO in Chile, feels that his assignment will be a very worth-while exercise. He left Australia on December 20 and hopes to return to the Division early in 1971.

More Economical Use of Additives in Paper-making

ALTHOUGH WOOD FIBRES are a remarkably versatile raw material, not all of the properties that are required for certain grades of paper can be obtained without the addition of other materials. These may be incorporated in the paper in various ways, but the Division's research in this field has been concerned mainly with "wet-end additives", which are substances commonly added to the dilute fibre dispersion at the wet end of a paper machine, before the fibres are formed into a sheet. Examples of wet-end additives are starch, which improves the strength of the final paper sheet, titanium dioxide, which makes the paper more opaque, and synthetic resins, which by increasing the strength of the wet sheet during the forming stage permit faster running and greater productivity.

Investigations on wet-end additives have been concerned with the way in which additives are retained within the wet sheet. In the absence of retention aids, much of the additive is lost when the water is drained away from the pulp suspension on the paper machine. Retention may be improved by the addition of paper-makers' alum or certain water-soluble polymers. Factors controlling additive retention have been studied: these include the electrical potential on the surfaces of fibres and additive particles, the formation of bridges by long molecules between fibres and additives, and the aggregation of additives. The relative importance of these factors has been shown to depend on the order of addition of the components, the acidity of the system, and the chemical nature of the fibre and additive surfaces.

O B H IS ALSO OUT!

Does O B H mean anything to you? To a few Victorians it does, but to the majority of potential timber users and specifiers it is meaningless. Spelling out the full title, Ordinary Building Hardwood, helps a little, but even so its implication to the uninitiated is still uncertain. If pressed for an explanation those who use the term may suggest it is synonymous with Building Grade Scantling as described in Australian Standards. But is it? Nowhere in Standards documents is reference made to such a grade and no dependence can be placed on such material ever having been graded in accordance with an Australian Standard. The use of this term is most unsatisfactory and dangerous for structural material. Similarly, the use of other local terms, such as Select ex Merchantable in relation to Douglas fir (Newsletter No. 366), is equally unsatisfactory.

The point of this note is to draw attention to the necessity of being clear and precise in defining timber grades, particularly those used in the construction field. The correct terminology is given in Standards Association publications that have been prepared by groups such as sawmillers, timber merchants, architects, and others in the industry. The customer does not appreciate being confused with "trade jargon", particularly when there is no need for it. His natural reaction is one of suspicion.

The Light Timber Framing Code being prepared for publication by the Standards Association is generally acknowledged as a major step forward in the rationalization of timber usage in Australia. Its correct application will depend in large part on the understanding and use of standard timber terms and definitions.

In the past the timber industry has not only recognized this and supported the Standards Association but it has also been in the forefront in requesting and assisting the Association to formulate and publish timber grading and terminology standards. Accordingly, in its own interests, the timber trade would now be well advised to take active steps to eliminate the use of non-standard terms such as O B H and Select ex Merchantable. Similarly, it should not use the Australian Standard grading names for timber that has not been graded to the Standards. If these measures are taken confusion for the customer will be reduced and greater confidence in structural timber will be generated.

ABSTRACTS

German–English Nomenclature of Forest and Timber Fungi by E. Bolza and N. E. M. Walters. *Inst. Wood Sci. J.* **23**, 1969. (*D.F.P. Reprint No. 730.*) Availability.—Research workers, scientific libraries.

This glossary has been prepared to help mycologists and plant pathologists to trace the correct meaning of names used in German papers, where fungi are often referred to by their common names. The need for a reference such as this has become more apparent with the more extensive planting of exotic tree species and the expanding research into forest pathology and timber mycology throughout the world.

WIDESPREAD INTEREST in the possibilities of exporting wood chips has led in turn to an interest in methods of debarking eucalypt logs. Two aspects of this topic are discussed in recent papers published by the Division.

Manual Debarking of Eucalypt Pulpwood by W. D. Woodhead. *Aust. Timb. J.* **35**(4), 1969. (*D.F.P. Reprint No. 809.*)

Most eucalypt pulpwood at present harvested in Australia is debarked by hand tools, except in two pulp mills in Tasmania, where hydraulic debarking is used. This method is unlikely to be used widely, but there is a strong possibility that other types of debarking machines will be installed to handle the large volumes necessary in an operation designed to export wood chips. This paper reports in detail the results of a cooperative project conducted by the Division, the Forestry and Timber Bureau, the Forestry Department of the Australian National University, and A.P.M. Forests Pty. Ltd. The project was designed to establish manual debarking costs which could be used as a basis for assessing the performance of debarking machines.

Debarking of Eucalypts—a Review by W. D. Woodhead. *Aust. Timb. J.* **35**(7), 1969. (*D.F.P. Reprint No. 799.*)

This paper summarizes the factors affecting bark removal, the degree of separation required, methods of separating bark from the chipped wood, methods used for reducing bark adhesion, methods of removing bark, and, briefly, bark utilization. It provides useful background information for those likely to be involved in chipping either whole logs or mill offcuts.

The Contribution of Polyphenolic Wood Extractives to Pulp Colour by W. E. Hillis. *Appita* **23**(2), 1969. (*D.F.P. Reprint No. 794.*)

Polyphenols are present in all pulpwoods, but their amount, composition, and reaction to pulping conditions vary widely. Eucalypt woods contain a large amount of polyphenolic extractives which are dissolved during penetration of alkaline pulping liquors and are carried to the lumen wall of the fibre before pulping commences, producing varying degrees of discoloration of the resultant pulp.

The compounds responsible and the colours they produce are considered in detail in the paper, and possible ways of reducing the colour of pulp are discussed. In addition, attention is drawn to the possibility of reducing bleach requirements by attention to pulping procedures.

Printed by CSIRO, Melbourne

CSIRO
Forest Products Newsletter
DIVISION OF FOREST PRODUCTS, CSIRO, P.O. BOX 310, SOUTH MELBOURNE, VICTORIA 3205
REGISTERED IN AUSTRALIA FOR TRANSMISSION BY POST AS A PERIODICAL

NUMBER 370 MARCH 1970

1970##370

Laboratory Testing of Timber Preservatives against Wood-rotting Fungi

WITH THE DEVELOPMENT of many new wood preservatives in recent years, it is vitally important for assessment of their effectiveness to proceed rapidly. Should they be marketed commercially, sufficient background information is then available to ensure their correct usage.

Assessment of the effectiveness of preservatives against decay is one important aspect of this work and the three main methods used are service records, field tests, and laboratory tests.

The best assessment of a preservative is based on its performance in actual service, as in treated poles, railway sleepers, etc. However, it is generally many years before such service information is available and, for obvious reasons, the information provided by this method is limited mainly to commonly used preservatives.

In field tests timber specimens are treated with various loadings of the preservatives being tested and are exposed under conditions similar to service, e.g. "graveyard" tests. These tests are expensive to install and inspect and must be replicated in several sites. Again, information may not be available for several years and it may be at least 10–20 years before a test is completed.

A great deal of valuable information may be obtained in a relatively short time from accelerated laboratory tests on wood preservatives, even though it may not always be possible to interpret results in terms of service performance. However, Australian and overseas experience suggests that laboratory tests are a reasonably reliable guide to relative performance in service. Very quick answers to particular problems, which the field tests or service records cannot supply, may be obtained from laboratory tests. This is particularly the case with a new preservative which can be assessed for decay resistance in a few months (or even weeks) in the laboratory by comparing it with one or more reference preservatives of known performance. It is also possible to control test conditions within defined limits and so study the effect of certain factors. In general, pure cultures of test fungi are used so that decay is rapid; reproducible results may be obtained and results from different tests and from other laboratories may be compared.

Tests with Treated Wood Blocks

The usual method of testing preservatives for decay resistance is to impregnate small blocks of readily decayed wood with various amounts of the preservative and expose them to attack by wood-destroying fungi. Since permanence, as well as initial toxicity, is a

Fig. 1.—A typical soil-block decay jar.

necessary characteristic of a good preservative, it is usual to expose the treated blocks to a severe artificial weathering before the decay test. This weathering is intended to have the same effect on the preservative as prolonged exposure in service.

In our laboratory, the size and shape of the blocks vary with different tests, but may be $2\times1\times\frac{1}{2}$ in. down to $\frac{3}{4}\times\frac{3}{8}\times\frac{3}{8}$ in. The blocks are impregnated by subjecting them to a vacuum in a desiccator for about $\frac{1}{2}$ hr, then allowing the preservative solution to cover them, at the same time releasing the vacuum. The blocks are weighted so that they do not float and are thoroughly impregnated with preservative by remaining in the solution at atmospheric pressure for $\frac{1}{2}$–1 hr. Increasing concentrations of preservative solutions are used to give a range of loadings.

Laboratory weathering procedures have been standardized in Britain, France, Germany, America, and elsewhere. In testing creosote the volatility and solubility are important, and so the American or British standard methods of weathering are followed in which the blocks are subjected to alternate periods in water and in a dry atmosphere at 50°C, the whole procedure lasting 2 or 4 weeks. In the case of inorganic water-borne preservatives (e.g. CCA), which are non-volatile, the volatilization part of weathering is omitted and the blocks are merely shaken in frequently changed distilled water at about 30°C for 1 or 2 weeks, depending on the desired severity of the weathering.

The decay method used in this laboratory is called the soil block method, which is also used in America and New Zealand. The wood-rotting fungus is grown on thin strips of decay-susceptible sapwood (called "feeder strips"), which are placed on the surface of moist sterile soil in a glass jar. The soil is present merely to supply moisture necessary for growth of the fungus. The test blocks are sterilized and are then placed on the fungal mycelium in the jars (Fig. 1). The jars are incubated at 27°C and 70–80% relative humidity, the incubation period usually being between 6 and 20 weeks. The test blocks are then removed from the soil jars, wiped clean of fungal mycelium, and allowed to dry. Decay is assessed as the loss of weight expressed as a percentage of the initial weight. There are usually 2–6 replicate blocks for each treatment.

Threshold Value of a Preservative

The best way to express the effectiveness of a wood preservative as a single figure assessment is to quote the "threshold value". This is the minimum amount of preservative that is effective in preventing decay by a particular fungus, under the conditions of test, and is usually expressed in pounds weight of preservative per cubic foot of wood. The threshold value is obtained by plotting the amount of decay (or percentage weight loss) against the initial retention of the preservative.

In some laboratories, especially in England, Germany, and Scandinavia, and for some tests in the laboratory here, the fungus is grown on a nutrient agar jelly and the blocks placed on this culture instead of on feeder strips on moist soil. However, regardless of the method used for testing preservatives (or natural durability of wood), the selection of the test fungi is most important. Ideally, one should expose the specimens as nearly as possible to those fungi which would attack the wood in service, but these are not always known and, in any case, they would usually be too numerous to test. Between 2 and 6 fungi are selected which are of widespread occurrence, are active wood-rotters, grow well under the conditions of test, and cause different types of rot, i.e. white rot and brown rot. In addition to these requirements, when testing preservatives or toxic substances some fungi must be included which are known to be particularly tolerant of one or more constituents of the preservative. For example, the fungus *Lentinus lepideus* is used throughout the world to test creosote preservatives because it is tolerant of high creosote concentrations.

Actual evaluation of wood preservatives can only be done reliably in a wood medium, but much initial testing can be done by measuring the effect of a preservative on the growth of a fungus on nutrient agar jelly or nutrient liquids. This approach may be used for selecting the fungi most tolerant to different preservatives for further testing, or for making detailed study of the tolerance of fungi to a particular constituent of a preservative, such as copper or arsenic, and the effect that other factors or substances may have on this tolerance. It must be realized, however, that the concentration of preservative effective in agar is often very different from that in wood, and the relative ranking of various preservatives may also be different.

THE DIVISION AND EDUCATION

THE PART played by officers of the Division of Forest Products in helping to meet the increasing need for education in the field of forest products is not generally known. It is in many cases an "extra-curricular" activity which must be fitted in with the individual officer's normal duties, and since a one-hour lecture may take up to 10 hours' preparation, it is an activity that is not lightly undertaken.

The Division is keenly aware of the responsibility for providing specialists to lecture since it has the largest association of such specialists in Australia. The fact that there are no tertiary-level courses in wood technology specifically means that this situation will probably continue for some time, at least until industry recognizes the need to employ graduates in this field.

Industry education at all levels from operatives to management is beginning to emerge as an important factor in the demands for higher efficiency, lower costs, and an increasing share of a highly competitive market. These demands will be assisted materially if staff are properly trained for the job they are to perform and, in the case of larger companies, if there are specialist professional staff in the management group.

The following extract from the Division's Annual Report for 1968–69 will give some idea of the extent of its involvement in education.

". . . Joint supervision with Melbourne University of two postgraduate students in forestry was undertaken. Six lectures were given to postgraduate students at the Melbourne University School of Architecture. Lectures were given to undergraduate students at Melbourne University Schools of Forestry and Engineering, the Australian National University School of Forestry, diploma students of the Victorian School of Forestry and certificate students of the Royal Melbourne Institute of Technology. Some one hundred and twenty tertiary level students have visited the Division during the year.

"Assistance to the various industry sponsored courses has been extended and the Division is now represented on the Timber Development Council's Education Committee and the Victorian Sawmillers' Association Education Committee. Lectures have been given at seminars and symposia at professional and industry level, also to productivity groups. The course on "Latest developments in sawing equipment and techniques" was organized again during the year and was attended by a further thirty sawmill executives. The course has been repeated four times, with a total attendance of approximately one hundred and twenty. A new series of lectures and field studies is in course of preparation and will be presented late in 1969."

Since the above report was written, the sawmillers' course mentioned was held in Perth in October and registration closed with a waiting list.

At the present time industry courses of various types are in operation in all States except Tasmania, and in each case a general elementary wood technology course is available. These courses are suitable for operatives, sales staff, and all other employees in the timber industry who would benefit from such training. From this year, two new courses will be available by correspondence (no geographical limits) from the Royal Melbourne Institute of Technology. Both are certificate courses and have been designed in collaboration with the Division. The elementary course is for the "Timber Industry Supervision Certificate", designed for students of trade-technician status (overseer), in which passes must be obtained in four subjects. The more advanced course is for the "Timber Industry Administration Certificate" and is designed for students of subprofessional status (heads of departments, etc.); passes must be obtained in ten subjects.

Information on any of the above courses may be obtained by writing to either the Timber Development Association in the State concerned, the Timber Development Council of Australia, or the Victorian Sawmillers' Association in the case of the two certificate courses at the Royal Melbourne Institute of Technology.

New Radiata Pine Standards

The Standards Association of Australia has recently released a set of standard grading rules for radiata pine. All are of interest because of the importance of this species to the timber economy of Australia. Of particular significance is AS O78, Visually Graded Radiata Pine for Structural Purposes.

The grading rules in this standard are based on sound timber technology principles and, correspondingly, several useful innovations have been introduced. These permit the producer to take advantage of the inherent strength properties of the species, while at the same time ensuring that the purchaser receives a product with relatively uniform characteristics and predictable structural performance. An example of this is the limitation on the size of a knot in relation to its position in the piece of timber. Knots have a varying influence on strength depending on their location. AS O78 exploits this by permitting knots of larger size in the lightly stressed areas than allowed elsewhere. Similarly, as species density and strength are closely related, application of the grading rule on density leads to rejection of pieces in any parcel that may inherently be exceptionally weak.

Timber conforming to AS O78 must be dry, i.e. at a moisture content of 15% or less. This was also required in the previous radiata pine standards, Int. 376 and 377, but is mentioned here because it is not the usual practice with structural timbers in other species. Prior seasoning of the timber brings to the user the advantages of increased strength, lighter weight, improved stability and durability if kept dry, and superior nail-holding capacity.

Other examples indicative of the efforts made to supply a superior product may be found in the clauses relating to tolerances, branding, limitation on curvature of growth rings to exclude relatively weak and unstable material near the pith, assigning of stress grade values, and the provision of special stud grades.

The advent of this standard and others in the group, relating to sawn boards and milled products, indicates that the timber industry is prepared to satisfy the more sophisticated requirements of contemporary society and meet the challenge from other structural materials.

(Also recently released is another radiata pine standard of particular interest, AS O85 *Pinus* Structural Plywood. This will be the subject of a separate article in the near future.)

Printed by CSIRO, Melbourne

CSIRO
Forest Products Newsletter
DIVISION OF FOREST PRODUCTS, CSIRO, P.O. BOX 310, SOUTH MELBOURNE, VICTORIA 3205
REGISTERED IN AUSTRALIA FOR TRANSMISSION BY POST AS A PERIODICAL

NUMBER 371 APRIL 1970

1970##371

Drying Hardwoods for Structural Uses

By F. J. Christensen, Timber Conversion Section

THE DECLINING USE of sawn timber was reviewed in Newsletter No. 368, where it was suggested that this trend might be halted if more attention was given to (*a*) timber research and development, particularly in relation to new products and techniques, (*b*) market research and planned production, and (*c*) merchandising, especially promotion of timber. Reference was also made to the cooperative research being carried out by the Division and the Queensland Department of Forestry on the drying of studs sawn from young plantation-grown hoop and slash pines. This present article refers to three aspects of work currently being conducted by the Division on structural-sized "ash" eucalypts:

- an examination of drying behaviour;
- assessment of the most economic method of drying;
- prevention or alleviation of spring due to the release of growth stresses at time of sawing and/or uneven longitudinal shrinkage during drying.

If sales of hardwood scantlings are to be maintained or expanded above existing levels, there is an urgent need to increase the production of dried and dimensioned hardwood studs already being marketed in both Victoria and Tasmania. The principal species currently being considered are messmate stringybark, mountain ash, silvertop ash, and alpine ash, the drying behaviour of which is well-known to most sawmillers in the south-eastern States at least. The main problem of drying hardwoods in structural sizes is to find an economic method of drying a material that has a low moisture diffusion rate (i.e. dries slowly) and is prone to develop severe drying degrade unless treated gently.

Present thoughts are to dry 1½-in. and 2-in. material to an average moisture content of about 20%, recondition, and then dress to the finished width. Timber dried only to this moisture content is not fully "stabilized"; however, this processing would produce material having (i) most of the collapse shrinkage removed, (ii) normal shrinkage halved, and (iii) a common dimension when nearly dry. Although such material might cost $5 or so more per 100 super ft than green hardwood, improved performance in service is expected to more than offset its higher price (i.e. lower labour and maintenance costs). The use of spirally grooved nails, already available (although not yet manufactured) in Australia, should overcome the difficulty of nailing the above hardwoods in a substantially dry state. The reason for suggesting a dried moisture content of 20% is economic—removal of further moisture can increase drying costs disproportionately.

Customer acceptance of a product, particularly a new one, is greatly influenced by its appearance. It is desirable, therefore, that hardwood studs should be dried without appreciable degrade, even though extensive surface checking is unlikely to impair strength significantly. This means drying under relatively mild conditions. The Division has recently designed and constructed a low-temperature forced-air dryer with a 15-ft working section for obtaining information on the experimental drying of 2-in. hardwood under such conditions.

The Division is currently looking at the economics of a number of different drying combinations, and expects to be able to offer guide lines to industry in this area. In contrast to the drying of conifers, the main problem with 2-in.-thick hardwood is its slow drying rate: of the order of 9–12 months for natural air drying and 2–3 months for forced air drying. Either way, capital investment and/or operating costs are likely to be high, though probably still economic.

Another related problem receiving consideration is the prevention or alleviation of spring in dried hardwood. This can be minimized by back-sawing, which is suitable for stud material since practically no surface checking will then occur on working edges. Eliminating spring will improve log recovery by permitting material to be sawn to closer tolerances than would otherwise be the case. Jointing and laminating could also be used if spring cannot be controlled satisfactorily in other ways. And, finally, finger jointing of "shorts" into studs could be the solution required for effectively overcoming another of the problems in the hardwood production area.

THE USE OF BARK AS A MULCH

An apple tree six months after planting and mulched with radiata pine bark.

THE DIVISION OF FOREST PRODUCTS is investigating the uses of bark in anticipation of the large volume being made available as a by-product from the production of wood chips.

Bark may comprise up to 25% of the volume of a log, depending on its size, and the disposal of large quantities poses a problem for industry. Many different uses for bark have been proposed, but for technical or economic reasons one of the few that have proved suitable in Australia is as fuel for steam-raising. If this outlet is not available the disposal of large volumes of bark by burning in an incinerator, using as a fill, or by dumping may be at significant cost.

In some overseas countries, notably the U.S.A., bark is used as a mulch and as a decorative material for parks, gardens, and roadside borders. It is also now being marketed extensively as a soil amendment after the addition of fertilizers and a period of composting.

In association with the Victorian Department of Agriculture, the Division has initiated a series of trials using wood bark as an orchard mulch. In three trials so far established, pine bark has been used as a mulch under apple trees at Harcourt, Pakenham, and Pomonal in Victoria and plans are in hand to establish another trial in a vineyard.

The radiata pine bark was removed from logs by both hand and machine and transported in bulk over a short distance and from a more distant source in bags. The bark was spread by hand in 3-ft-wide strips running the full length of the rows or in 6-ft lengths for each tree; depth was from 3 to 5 in. Two of the trials were with young trees which have trickle irrigation from flexible pipes laid along the rows. Fertilizer and weedicide treatments have been incorporated as other factors in the trials.

It is anticipated that the mulch will improve growth by reducing moisture loss, lowering summer soil temperature, and also restricting weed growth.

Results so far from the trials are very promising; the growth of young trees five months after planting has been improved in comparison with control plants, which were not mulched. Detailed evaluation of the trial over a period of years will indicate how the yield of fruit is affected and provide data to show whether the costs of transporting and spreading the bark can be justified.

It is hoped to include hardwood barks in the series of trials and to extend the trials to other fruits. Further information and results will be given as the trials proceed.

What is "Stress Grade"?

STRESS GRADE is a term recently introduced into Australian timber standards, but it is one of rapidly increasing importance. It will be a basic feature of the Light Timber Framing Code and the Timber Engineering Design Code, both in the course of preparation. Generally, it is a grading index of the capacity of a piece of timber to perform satisfactorily in a structural capacity in a building. More precisely it would be defined as: "the classification of a piece of timber for structural purposes, by means of either visual or mechanical grading, to indicate primarily the basic working stress in bending for purposes of design and, by implication, the basic working stresses for other properties normally used in engineering or building design. The stress grade is designated in a form such as "1000f" which indicates that for such a grade of material, the basic working stress in bending is 1000 lb/sq in."

With a slight difference in wording the above definition parallels that given in AS O78, Visually Graded Radiata Pine for Structural Purposes.

Some may wonder why this term has been introduced and how it relates to others used in the description of structural timber and to the strength-grouping system used with Australian timbers (see Newsletters Nos. 324 and 329).

The advantages of the term "stress grade" are basically twofold. Firstly, by its use the descriptive terms for structural timber, Select, Standard, etc., can be avoided. This will help the timber industry by preventing an obvious confusion with appearance grades which also carry the same classification names, select and standard grade lining, for example. It will also help the buyer or specifier to whom terms such as Select, Select Merchantable, and Select Engineering Grade tell little of the structural adequacy of the timber and are capable of conveying incorrect impressions of the suitability of timber being ordered or specified for specific structural purposes.

The second advantage stems from the interlocking of stress grades, visual grades, and strength groups. With the seven strength groups now being introduced to replace the

Visual Grade (see AS O81, O82, O84)	Stress Grade Appropriate to Timber of Strength Group						
	S1	S2	S3	S4	S5	S6	S7
Select	4000f	3200f	2500f	2000f	1600f	1250f	1000f
Standard	3200f	2500f	2000f	1600f	1250f	1000f	800f
Building	2500f	2000f	1600f	1250f	1000f	800f	630f

old strength groups A, B, C, and D, and allowing for three structural grades in each, there is a total of 21 possible combinations. The stress-grade system effectively reduces this to nine combinations as illustrated in the preceding table. Unless there is a reason for requiring a particular species or visual grade, say for durability or appearance purposes, then the engineer is only concerned with the stress-grade value appropriate to each member.

For each basic working stress in bending as indicated by the stress-grade term, there are corresponding basic working stresses in tension, shear, and compression. At present, such combinations are shown in the Timber Engineering Design Handbook, but modified values based on latest research results will be shown in the Timber Engineering Design Code.

Shrinkage and Density of Marri *(Eucalyptus calophylla)*

THE DATA published in 1961 for marri (Div. For. Prod. Technol. Pap. No. 13) were based on only a small sample. Further tests have now been carried out and the information below should replace that previously published.

Data additional to those already published are included below the usual data, which should be interpreted as indicated in the instructions given on page 8 of the paper. The additional data include green density and moisture content as well as radial and tangential intersection point.

—R. S. T. Kingston and Beverley Budgen

TABLE 1

(Replacement data, p. 36)

Species	Density					Shrinkage (%)		
	Unit	Basic	Air-dry B.R.	Air-dry A.R.		Green to 12% M.C. B.R.	Green to 12% M.C. A.R.	Unit A.R.
MARRI *Eucalyptus calophylla*	lb/cu ft	41·3 19 0·91 32·8–49·8	51·6 19 1·14 41·1–62·4	51·1 19 1·13 40·5–62·3	T	6·9 19 0·29 3·6–10·7	6·3 19 0·29 3·2–10·0	0·38 16 0·007 0·29–0·46
W. Aust.	g/c.c.	0·662 19 0·0146 0·526–0·798	0·827 19 0·0183 0·659–1·000	0·819 19 0·0181 0·649–0·999	R	3·6 18 0·16 2·1–5·2	3·3 18 0·17 1·8–5·1	0·24 17 0·008 0·17–0·33

Additional information

		Green Density	Green M.C.			Intersection Point		
	lb/cu ft	75·3 19 1·09 66·1–84·1	83·2 19 2·86 54·9–111·0		T	29·4 16		
	g/c.c.	1·207 19 0·0175 1·060–1·348			R	25·6 16		

Printed by CSIRO, Melbourne

CSIRO
Forest Products Newsletter
DIVISION OF FOREST PRODUCTS, CSIRO, P.O. BOX 310, SOUTH MELBOURNE, VICTORIA 3205
REGISTERED IN AUSTRALIA FOR TRANSMISSION BY POST AS A PERIODICAL

NUMBER 372 MAY 1970

1970##372

WOOD, WIND, AND WATER

By F. A. Dale, Preservation Section

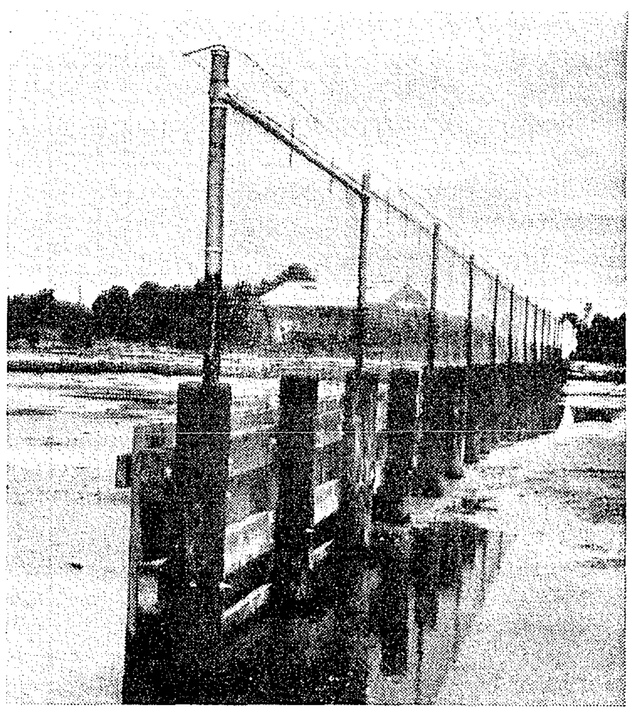
WHEREVER WIND AND WATER combine to attack sea-shore, lake, or river-bank, timber can be used to prevent erosion. *Growing* timber is the simplest protection and some varieties such as mangrove, tea-tree, and casuarina will thrive in or close to salt water. The famous silt jetties in the Gippsland Lakes are examples of this. Where man has to protect the shore himself, timber is often used because of its lightness, strength, and resilience, or ability to absorb energy from the waves.

A tradition of timber shore protection has evolved in the Northern Hemisphere, ranging from the groynes and breakwaters of the English coast to the fascines or woven willow mats used to protect the Dutch dykes.

Hitherto, Australia has been fortunate in having ample supplies of heavy, durable hardwoods which have given many decades of service. With the decline in supplies of these timbers other materials such as steel and concrete have been used in their place. In the course of this transition some of the unique advantages of timber have been overlooked, and the purpose of this note is to remind engineers and others of them and to show how valuable timber can be in foreshore protection and construction.

When timber is completely submerged in fresh water it will last indefinitely unless the water is highly oxygenated. Round piles and sawn timber removed from the Yarra bank in front of this Division after 70 years' service were intact below the mud line and only slightly softened on the surface above it.

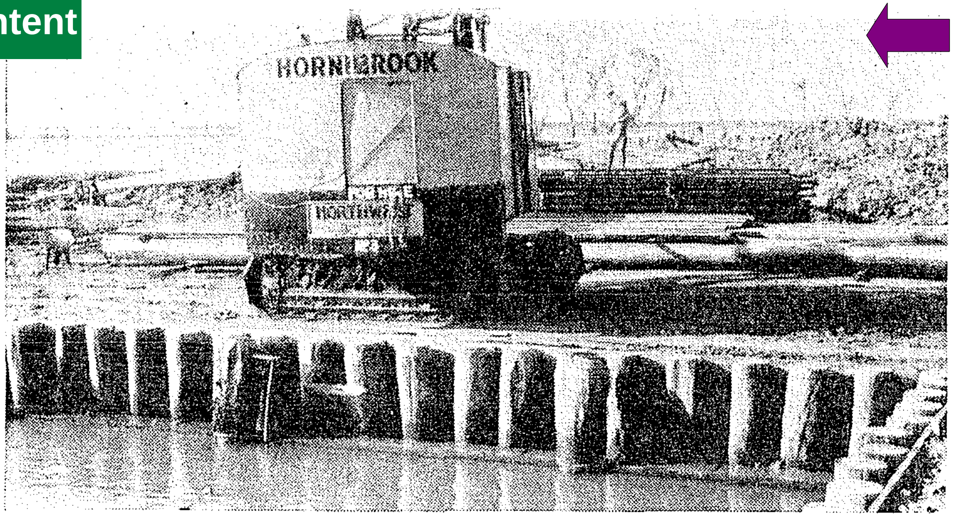
In salt water with moderate marine borer



Groyne of treated radiata pine installed in 1961 at Swan Island, Vic.

<< Content

Print this page



Dock wall of treated spotted gum piles installed in 1965 in the Brisbane River.

hazard, hardwoods such as turpentine, ironbark, red gum, and jarrah have given very good service which can now be matched by hardwood heavily treated with creosote or by pine with copper–chrome–arsenic preservatives. In northern waters where the hazard in some places is very severe additional protection may be needed.

Round timber piles are much lighter and generally much cheaper than equivalent piles of other materials. A 50-ft pressure-treated hardwood pile of $12\frac{1}{2}$ in. mean diameter weighs about $1\frac{1}{4}$ tons and costs about $2.10 per ft at the plant in Victoria. A 30-ft pile of $9\frac{1}{4}$ in. mean diameter weighs about half a ton and costs about $1.10 per ft.

Timber piles are easy to handle and stand up well to abuse. They can be spliced readily and their flexibility allows greater tolerance in driving.

Sea walls of masonry or mass concrete are very expensive to build and must be carried to bed-rock to avoid being undermined. Equivalent protection may often be obtained by driving timber piles and sheeting them with sawn timber. These walls are flexible and accommodate soil or sand movement. Preservative-treated plywood can be used instead of timber sheeting.

Beaches can be protected from erosion by *groynes* of sawn timber fastened to sawn or round piles which collect the drift sand and build up the beach. This is far more effective than dumping rock or old cars above the high-water mark and hoping for the best. The design and location of such groynes is a job for a specialist, but considerable information is available from previous experience. In many cases an open groyne that permits some passage of water and sand is just as effective as a fully sheeted one. In its simplest form, a row of posts driven or jetted into the sand with brush laced between is sufficient to catch and stabilize the sand.

Timber is equally well suited for launching ramps, landings, boat sheds, and slipways. During winter gales some years ago quite a number of brick and concrete structures around Port Phillip Bay were wrecked by waves, but only those timber structures on short stumps were undermined.

Unless naturally durable timbers are available preservative-treated timber should be used. Although the decay hazard below high-water mark is very slight, the tops of piles and other timber above it are vulnerable to decay and sometimes to termites.

Where treated sawn timber is not available, treated round timber can be used with minor changes in design. Treated hardwoods are stronger than pine but require proper protection to prevent water and decay entering the untreated heartwood. The tops of piles should be sealed and capped to prevent splitting. Cutting of treated sapwood for the attachment of braces or sheeting must not expose the heartwood.

The choice of *fastenings* for these structures is most important. Many fail prematurely because the plain iron bolts and nails rust and split the wood. Where stainless steel or non-ferrous fastenings are too expensive or attractive to vandals, only hot-dipped galvanized iron should be used, preferably with additional protection such as rust-preventive grease or coal tar–epoxy paint. Plastic sleeves will help protect bolts in green timber.

It is important for lighter timbers to be well secured to prevent them from floating and piles should be embedded deep enough to resist uplift from wave action.

More detailed information on design of foreshore protection works may be obtained from the Timber Preservers' Association of Australia or from this Division.

1970 Forest Industries Machinery Exposition

The *Australian Timber Journal* is organizing the Forest Industries Machinery Exposition (FIME), which will be held from October 27 to 29, in the Jenolan State Forest, 113 miles west of Sydney.

FIME will provide a unique opportunity for equipment manufacturers to show, and for loggers and millers to view, machinery and equipment operating in practical forest conditions. The accent of the Exposition will be on harvesting systems, that is, the use of a number of machines or units working together to produce a tree-harvesting operation.

Early response to the Exposition indicates that FIME will exceed any display of this kind held in the South Pacific or South-east Asian areas.

Further details are available from The Organizer, FIME 1970, c/- The Australian Timber Journal, 243 Elizabeth Street, Sydney, N.S.W. 2000.

ABSTRACTS

Latest Developments in Sawmilling Equipment and Techniques for Small Logs by M. W. Page. *Aust. Timb. J.* **34**(10), 1968. (*D.F.P. Reprint No. 808.*)

The profitable conversion of small logs is a problem facing increasing numbers of indigenous hardwood sawmillers in Australia. In this paper the author firstly considers what constitutes a "small" log in various sectors of the sawmilling industry, and proposes a method of comparison of machine performance by measuring the amount of sawing performed in unit time. After establishing criteria for production accuracy, a comparison of the performance of three types of machines sawing small logs is made.

An Uncommon Borer in Living Radiata Pine by A. Rosel and F. G. Neumann. *Aust. For.* **33**(1), 25–8. (*D.F.P. Reprint No. 751.*) Availability.—Forestry and entomological research workers.

The beetle *Pycnomerus blackburni* was discovered in decayed heartwood of living radiata pine in a 33-year-old plantation near Melbourne. It is the first record of attack in a conifer. There is evidence that a number of generations of the beetle can live within the decayed heartwood of a living tree without adult emergence from the host. The beetle was the secondary agent in destruction of the wood and is of little economic importance to the Australian timber industry.

Studies of Phenol–Formaldehyde Adhesives. I by K. F. Plomley and J. W. Gottstein. Div. For. Prod. technol. Pap. No. 51. Availability.—Plywood and adhesives industries.

Part I of these studies deals with the effect of glue formulation on bond quality with a relatively high-density wood species. A study of the effect of phenol–formaldehyde adhesive formulation on the bond quality obtained with *Eucalyptus sieberi*, a relatively high-density wood species, has demonstrated that paraformaldehyde and filler (coconut shell flour) are of major importance in the development of high bond quality. Greater resin advancement and resin solids concentration showed their effects mainly in the presence of both paraformaldehyde and filler.

Computer Processing of the Results of Standard Tests on Timber Species by Anne Ryan. Div. For. Prod. technol. Pap. No. 55. Availability.—Research workers.

Considerable advantages may be gained by the use of an electronic digital computer to process the results of standard mechanical tests on timber. Not only can the analysis be carried out rapidly but the resulting statistics can be printed out in a form suitable for final analysis. The methods discussed for preparing the data to facilitate processing by computer have been used successfully since early 1967.

The integration into the computer-oriented system of data already processed by conventional means is also discussed.

Pole Timbers and their Drying as Factors in Forest Utilization by J. E. Barnacle and F. J. Christensen. *Aust. For.* **33**(3), 163–74. (*D.F.P. Reprint No. 766.*) Availability.—Forestry authorities and transmission pole industry.

Poles from thinnings are of considerable importance to forest management. They can also contribute to regional development and conserve foreign exchange by avoiding imports of wood poles or costlier substitutes.

Planned forest management is essential to meet both short- and long-term demand for poles and to avoid the introduction of substitute materials. Production of poles may be increased by the use of rapid-growing exotics, and supply may be improved further by preservative treatment of poles from species of low natural durability.

Difficulties are sometimes experienced in controlling drying degrade in poles from some timbers before preservative treatment but they may usually be overcome by sound seasoning practices or special drying techniques.

Standards of acceptance for poles should be based on criteria relevant to their service requirements.

Research Projects

Pulp Blends for Fine Papers

The question of utilizing eucalypts of high density for pulpwood has recently been revived. Of particular industrial interest is the possibility of producing wood chips for export from the eucalypt species of the Northern Territory. Some of these fall into the basic density range 50–60 lb/cu ft.

The thick-walled fibres of such species have poor conformability, which results in lower values of those paper strength properties dependent on good bonding between fibres, compared with paper from lower-density species.

However, it is possible that such fibres could be blended with pulps of thin-walled fibres to produce a paper with reasonable bonding strength and the opacity and other properties required by fine writing or printing papers.

A detailed study is being made of the papers produced by blending bleached sulphate pulps of *Eucalyptus tetrodonta* (basic density approximately 55 lb/cu ft) from the Northern Territory, and young *Eucalyptus regnans* (basic density approximately 27 lb/cu ft).

DONATIONS

The Division gratefully acknowledges the following donations, which have been received over recent months:

	$
Beloit-Walmesley Pty. Ltd., Melbourne	500.00
Dunlop Australia Ltd., Melbourne	100.00
Perfectus Airscrew Pty. Ltd., Port Melbourne	45.00
Radiata Pine Association of Australia, Adelaide	500.00

Materials

Hickson's Timber Impregnation Co. (Aust.) Pty. Ltd., Melbourne Experimental material approx.	22.00
Kauri Timber Co. Ltd., South Melbourne 6 flitches of *E. obliqua*	20.00
Norman G. Clark (Aust.) Pty. Ltd., Brunswick, Vic. Airchamp combination clutch/brake .. .. approx.	285.00
Woodward Forest Products, Bungaree, Vic. 50 posts for fire-retardant experiment	15.00

Radiata Pine Association of Australia: Receipt of a parcel of scantlings is also gratefully acknowledged. This parcel is the latest of several that have been supplied by the Association to assist the Division in its research. The cooperation afforded the Division by the Radiata Pine Association is sincerely appreciated.

Printed by CSIRO, Melbourne

CSIRO
Forest Products Newsletter
DIVISION OF FOREST PRODUCTS, CSIRO, P.O. BOX 310, SOUTH MELBOURNE, VICTORIA 3205
REGISTERED IN AUSTRALIA FOR TRANSMISSION BY POST AS A PERIODICAL

NUMBER 373 JUNE 1970

1970##373

"MEASURE FOR MEASURE"

TIMBER for structural purposes in Australia has traditionally been supplied and used in the green condition. For some years, interim grading rules for radiata pine have required that this timber be seasoned, i.e. have a moisture content not exceeding 15%, and the standard AS O78 published last year confirms this requirement for radiata pine to be used for structural purposes. For some time, limited quantities of seasoned hardwood have been marketed for house construction. Currently, hardwood interests in the timber industry are examining the practicability of supplying seasoned material much more extensively for house building.

It is almost certain that, should a decision be made to supply seasoned hardwood scantlings, the question of dimensions will be a serious topic for argument. General thinking in the past has been in terms of the nominal dimensions of the timber when sawn green. Thus a seasoned hardwood scantling nominally 4 × 2 in. might be supplied to the customer at an actual size of $3\frac{1}{2} \times 1\frac{5}{8}$ in. In such circumstances, misunderstandings and sometimes ill will have developed when the customer has quite reasonably questioned whether he was receiving the amount of timber he ordered. In fact, in the example quoted, assuming the lengths were correct he would be getting only 71% of the volume of timber to be expected from nominal dimensions. It is not proposed to debate the argument further here but to draw attention to the fact that a similar argument has been going on in the U.S.A. for the past six years. The following report taken from the *Engineering News-Record* of last December indicates how the argument has been finally resolved.

"New nationwide (U.S.A.) lumber standards, defining, among other things, the size of the 2×4, which never was that size, go into effect March 1, 1970. With the agreement by producers, distributors and users of softwood lumber, a six-year wrangle has finally ended.

"The new standards, announced last week by Commerce Secretary Maurice Stans, mean that green and kiln-dried lumber will be cut to different sizes at the mill so that the consumer receives lumber of uniform in-use size, despite shrinkage of green lumber after cutting, and no matter where it is produced or bought.

"The National Forest Products Association, in applauding the move, said it will conserve lumber, reduce shipping costs, and 'return savings of approximately $150 to each buyer of a typical single-family wood frame house'.

"The old standard, explained Stans, failed to relate size to moisture content, so the user was not 'sure of the performance of the product he was purchasing'. Still to be worked out, however, is the continued use of nominal designations, such as 2×4, rather than actual lumber size. One government spokesman feels there will be no change, the carpenter will still place orders for the 2×4.

"The revision in standards came from a recommendation supported by 21 of 22 voting members of the American Lumber Standards Committee, and approved by 87% of producers, distributors and users of lumber, said the Commerce Department. Two previous proposals offered in 1964 and 1966 did not receive sufficient support to be enacted.

"The forest products group sees no difficulty in converting production to the new standards. In fact, says president L. L. Stewart, manufacturers have produced 'large volumes of the new-sized dimension lumber' since the Federal Housing Administration approved them in 1966.

"The Lumber Standards Committee plans a broad educational campaign to spread the word about the actual dimensions of lumber. Stans said his department will cooperate with the Federal Trade Commission in developing trade regulations to protect consumers from misgrading of lumber."

Survey of Wide Bandsaws

LAST YEAR, owners of wide bandsaws throughout Australia were sent a questionnaire and a letter asking for their cooperation in the provision of information about their saws. The object of the survey was to gain a pool of information about Australian experience and to obtain a broad view of problems as a guide to determining a suitable programme of assistance or research. Owners were asked specifically to state their problems with a view to "possible CSIRO assistance or research".

It is intended to publish the results of this survey at a later date; meanwhile, the following comments might be of interest to all bandsaw users.

The overall response to the survey was only 38% of the total number of companies approached, while in one State it was only 14%. Of more than 155 sawmills, only 20 listed problems, none of which suggested that a serious study was required and none of which were common to more than five mills; indeed, two mills stated candidly that their problems were trivial.

Some of the problems stated were technical and some managerial. Of the technical problems, the one most frequently mentioned was gullet cracking, but only five mills mentioned it; therefore it scarcely justifies the inauguration of a full programme of research, especially as the reasons for gullet cracking are well known.

However, a managerial problem stated by one sawmiller has been mentioned frequently in other contexts, and it is believed to be far more widespread than the survey indicated. Further, there is every possibility that many of the technical problems stated are tied to the managerial one, which is a difficulty in obtaining a competent sawdoctor.

This is not intended to malign the sawdoctor who, hard-working and conscientious as he must be, is a key man in any sawmill, but to emphasize that very often the man with the job has never had sufficient opportunity to gain the experience he needs. In other words, he has received little or no apprenticeship combining basic training and preliminary practical experience in his field of work. This is particularly applicable to the hardwood areas of the southern States where wide bandsaws are still something of an innovation in sawmilling. The response from this segment of the industry was about 75%, and from here came 50% of the companies listing problems. It was from this group, too, that the suggestion came for "proper training for present and future operators, who should also be competent in the operation, adjustment and maintenance of the machine".

Although some education authorities in Australia provide a sawdoctor training course, it is true that very few men have completed the courses provided and that these courses are not flexible enough to meet the range of needs.

This is in contrast to the situation in New Zealand, where a Timber Industry Training Centre at Rotorua, complete with a modern sawmill and the full range of saw maintenance facilities, catering for about 100 students per year in long or short courses, has been established jointly by the New Zealand Forest Service and the timber industry. Here, sawdoctors receive practical instruction in bandsaw maintenance, adjustment, and operation in courses which vary in duration to suit the convenience of sawmill management.

The survey was not specifically designed to determine how great was the need in Australia for skilled men to maintain and operate bandsaws. In fact, only one sawmiller stated this need, yet it would appear that others, perhaps many others, are feeling the effects of a lack of adequate training for their key men. If this is so, the Division would like to hear from them, or their representative association.

Research Projects

Preservation Field Tests

Recent articles in the Newsletter have discussed some of the tests, both laboratory and field, carried out by the Preservation Section. The field tests are examined at regular intervals and some recent results are summarized below.

It has been found that readily leachable boron compounds such as sodium borate give little protection to pine sapwood stakes in ground contact, at retentions up to 1 lb/cu ft. Even the addition of 30% arsenic has not prevented many decay failures in under five years, and painting has provided little extra benefit.

On the other hand, tests of commercial copper–chrome–arsenic (CCA) preservatives in which the toxic components are fixed are showing complete termite resistance after 6½ years in the ground in an area of high termite hazard, at arsenic retentions ($As_2O_5.2H_2O$) as low as $\frac{1}{20}$ lb/cu ft. Laboratory tests have indicated that the actual toxic threshold to termites may be even lower than this.

Other field tests are indicating that CCA preservatives are less effective in eucalypt than in pine stakes. This has been further confirmed by laboratory tests which have shown that toxicity as well as permanence is affected by timber species. The reasons for this are complex, and fundamental research will be necessary before a solution to the problem is found.

The first Australian marine test to compare the performance of CCA preservatives and creosote oils has been in progress for over 10 years and early indications have now been confirmed. These are that CCA preservatives have a higher resistance to *Limnoria* than creosote oils; however, against teredine borers CCA is very good in pine but much less satisfactory in the eucalypt used, while creosote is fairly good in both timbers but a little better in the eucalypt. Double treatment, first with CCA and then, after drying, with creosote, has so far proved most effective. A later, more extensive test in 10 ports will, it is hoped, provide an indication of the reasons for these differences.

Inspection of rail sleepers installed in Tasmania nearly 15 years ago has shown that untreated sleepers of messmate (*Eucalyptus obliqua*), silvertop (*E. sieberi*), and alpine ash (*E. delegatensis*) have a life of less than 11 years compared with an estimated 20+ years for the same timbers treated with preservative oils at high pressure (up to 1000 lb/sq in). Economic and technical considerations now appear to favour the commercial high-pressure treatment of rail sleepers in Tasmania. Extensive tests in other States have now provided technically satisfactory answers to any future shortage in Australia of naturally durable rail sleepers.

A survey of the causes of failure of untreated durable rail sleepers has shown that in many areas over 90% of these sleepers fail mechanically because of loss of spike-holding capacity at the rail seat. Research into improved methods of rail holding is therefore an urgent necessity.

Fibreboard Investigations

As the result of a contract between the Division and the Australian Fibreboard Manufacturers' Association, a research programme was commenced. Initially, a survey was made of 23 container plants in five States. Problems on which research work might profitably be undertaken were discussed, and methods of tackling these problems were formulated.

Mechanical properties, moisture response, and warping of fibreboard are subjects requiring early investigation, as they may have a profound effect on the manufacture and utilization of the corrugated board.

An alternative to the wax-dipping process usually employed for imparting moisture resistance to corrugated containers has been investigated. A provisional patent application has been lodged for a process in which the interior of the board is water-proofed, leaving the outer surface unchanged and available for printing or other treatment.

Certain of the test methods used by the industry have been examined and modifications for improved practice have been developed and are being evaluated.

Possible ways of utilizing waste corrugated fibreboard have also been investigated, and a panel with good thermal insulating properties and of possible decorative use in building has been produced.

Two types of experimental cell packs for apples exported from Tasmania to England were tested during the 1968 season. The packs were examined when shipped from Hobart and again on arrival in London, and a report on the results of the test was prepared and circulated.

Penetration of Preservatives in Radiata Pine

With the production of increasing quantities of sawn radiata pine from older plantations, the problem of obtaining satisfactory penetration of waterborne preservative into heartwood of this species is becoming more important. In recent experiments, dip diffusion treatments of green heartwood, which gave reasonably good penetration, were compared with pressure treatments of dry material and of green material preconditioned by steam and vacuum treatment. Results showed that in pressure treatments creosote oil penetrates pine heartwood much better than waterborne preservatives, but that both long (overnight) application of 200 lb/sq in pressure and preconditioning by steam and vacuum treatment considerably improve penetration of waterborne preservatives. Increasing the pressure to 400 lb/sq in was also effective but caused damage to the wood in some cases.

In an attempt to improve penetration, samples of green heartwood were soaked in bacterial cultures for several weeks before drying. This, however, had no effect on the permeability of the wood.

Treatability of Hardwoods

Further experiments involving incising have been carried out on eucalypt poles of some species where it is considered desirable to increase the penetration and retention of creosote. Results of this work on three species have again indicated that an increase in retention of between 10–20% can be obtained by parallel incising. This improvement is scarcely sufficient to justify the use of incising as standard practice in pole treatments.

The effect of boultonizing (drying in heated oil under vacuum) on the treatability of hardwood rail sleepers has also been examined. Retentions obtained were higher in the boultonized than in matched air-dried material, and in most cases penetration was better and distortion was reduced. A desirable internal checking pattern was induced, particularly marked in brush box (*Tristania conferta*), which was effectively treated. Apart from an improvement in treatability and in the pattern of surface checking, the advantage of rapid drying from the green condition, with consequent elimination of the drying for many months of large and costly stocks, is of very considerable commercial importance.

ECAFE ASSIGNMENT

Dr. H. G. Higgins, Officer-in-Charge of the Paper Science Section, Division of Forest Products, left on May 4 for a 2 months' tour of South-east Asia, as Regional Coordinator for Research in Pulp, Paper, and Cellulose Products for the Economic Commission for Asia and the Far East (ECAFE).

His task is to review the scope for possible cooperation between member countries of ECAFE in research on the production of pulp, paper, and other cellulose products from forest products, and if appropriate to set up a regional project or projects in this field.

Printed by CSIRO, Melbourne

<< Content

Print this page

CSIRO

Forest Products Newsletter

DIVISION OF FOREST PRODUCTS, CSIRO, P.O. BOX 310, SOUTH MELBOURNE, VICTORIA 3205

REGISTERED IN AUSTRALIA FOR TRANSMISSION BY POST AS A PERIODICAL

NUMBER 374 JULY 1970

1970##374

Current Results from Cooling Tower Tests

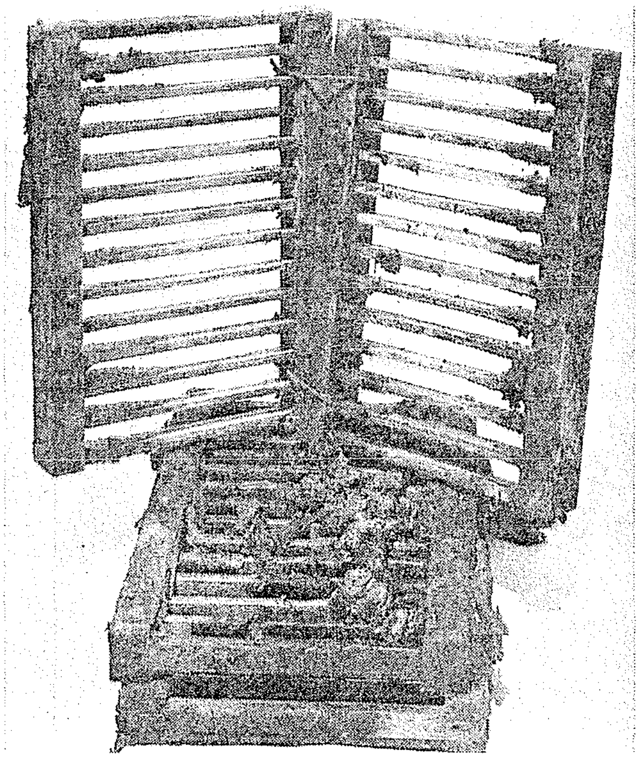
By N. E. M. Walters, Preservation Section

RAPID POST-WAR DEVELOPMENTS in industry, power generation, and air conditioning in Australia have led to a great increase in the use of cooling towers to conserve water supplies. These towers, especially the larger ones, usually are made largely of wood, which has important advantages over other materials but needs special measures to protect it from the form of biological deterioration known as soft rot.

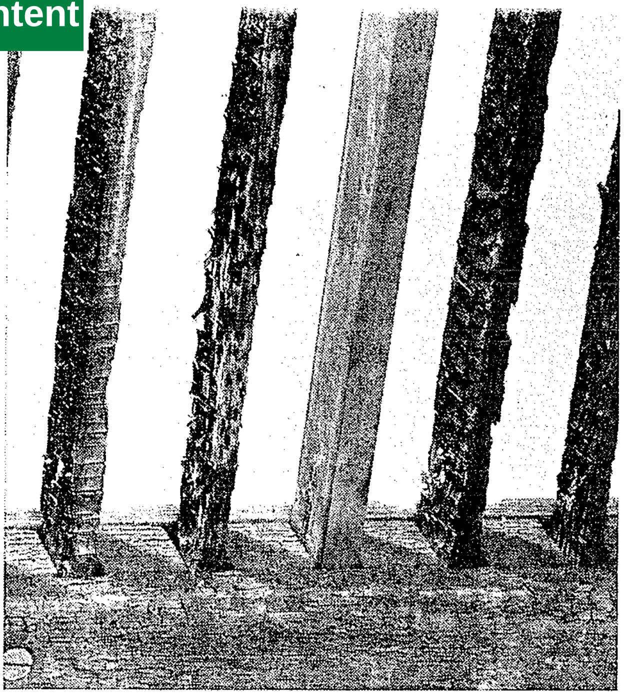
Decay of wood in service can be caused by many different fungi that can be classified broadly into two groups—the mould fungi (or microfungi), which typically produce a slow surface softening or shallow decay, and the higher fungi (or Basidiomycetes), which cause the more extensive and more commonly recognized types of rot. Under normal conditions of exposure most decay is caused by these higher fungi, but under the special conditions in cooling towers their activity is discouraged while that of soft-rot fungi is stimulated. Since the fill of cooling towers is made of thin slats, even a shallow development of soft rot can cause spectacular operational failure within a few years.

Service tests are preferred for these soft-rot studies because cooling tower conditions are not easily simulated in the laboratory and the results are slow and difficult to interpret. Hence, three series of service tests are currently being conducted in a variety of towers, chiefly showing severe soft rot, throughout Australia. These towers are in active use by public utilities or private industry, whose cooperation this Division gratefully acknowledges.

Series I.—A test to assess the resistance to soft rot of 24 untreated timbers with a wide range of resistance to ordinary decay, and to



Trays returned from Cresco tower, after only 2 yr in test, showing severe algal slime problem.



Sound CCA-treated pine slat flanked by heavily soft-rotted slats that were not treated. Cooling tower, Mt. Gambier, after 6 yr in test.

assess the effect of operating conditions on soft rot. Radiata pine sapwood treated with copper–chrome–arsenic to about 1·25 lb/cu ft was included in this test for comparison purposes.

Series II.—A test to assess the protection against soft rot given by many preservatives at various loadings in a single permeable timber (radiata pine sapwood). Forty-eight treatments are included.

Series III.—A test to determine the influence of different timbers on the performance of a single preservative. At this stage it is too early to discuss this test.

Series I: Natural Resistance of Untreated Timbers to Soft Rot

This test, installed in 1959–60, is nearing completion. For most timbers in the towers of high soft-rot hazard the general trend could be seen after as little as two years in test. Cooling towers vary considerably, not only in the general performance of each test timber but in the relative ranking of different timbers. In some towers chemical attack is also active and this undoubtedly has influenced the relative ranking of the timbers in them.

In general, when timbers are ranked on their average performance in all test towers, the softwoods dominate the top, more resistant end of the list, while the hardwoods dominate the other end. For example, kauri, non-durable against decay in ground contact, gives better results than wandoo, an extremely durable timber in the ground; and Douglas fir, similarly non-durable in ground contact, ranks above teak, jarrah, and tallowwood.

Of the softwoods, those listed below with an asterisk are encountered fairly frequently in commercially built cooling towers. Their performance, however, is still far below that of the CCA-treated pine, and unless they are treated it is unwise to use them as fill timbers (especially if the dissolved solids in the water are high). If they resist ordinary decay they may be suitable for thicker structural timbers, however, and if they are also absorbent enough to be preservative impregnated, they may be used in any tower situation that is compatible with their strength. It should be noted that some of these commercially used timbers neither resist ordinary decay or soft rot nor do they treat readily, and therefore should not be used in cooling towers at all. The softwoods best able to absorb preservatives are radiata pine sapwood, some other true pines, and some *Araucaria* spp. (e.g. hoop pine).

The mean rating after 10 years for the more important timbers (with best and worst performances in brackets) is expressed below as a percentage soundness that reflects a combination of present bending strength (compared with original strength) and the estimated depth of surface softening. 100 indicates sound timber, 0 failure.

*CCA-treated radiata pine sapwood	91	(100–72)
*Californian redwood	79	(100–10)
Vanikoro kauri	64	(97–17)
Wandoo	55	(92–10)
*Douglas fir	54	(92–2)
Teak	52	(95–2)
King William pine	51	(95–0)
Tallowwood	49	(90–10)
Brush box	47	(95–0)
Karri	45	(87–5)
Jarrah	44	(90–2)
*Western red cedar	44	(100–0)
*Scots pine	44	(85–0)
Radiata pine sapwood	35	(82–0)
Radiata pine heartwood	33	(85–0)
Bollywood	27	(67–0)
Mountain ash	14	(62–0)
European beech (worst)	10	(42–0)

Effect of Operating Conditions on Soft Rot

As already stated, towers vary greatly in soft-rot incidence. Their chief variable is, of course, the nature of the circulating water, for instance, its dissolved solids, suspended solids, pH, treatment, and temperature. A tower having very low dissolved solids can be almost immune to soft rot, while a tower with a high concentration is likely to be heavily attacked and produce a profusion of slime, containing moulds, bacteria, algae, and particles of decay and dust. In practice, a tower designer could be led astray if he assumed that a pure water supply would not be subject to a build-up of dissolved solids. They may be increased by long-term concentration or added intentionally or even accidentally. Concentration follows inevitably because cooling is the result of evaporation. Routine tower hygiene in a well-run plant allows for a periodic purge by "blow-down", i.e. a substantial proportion of the circulating water is drawn off at regular intervals to maintain the dissolved solids below a set level.

The nature of the dissolved solids is also important. They may affect the pH, boost the nutrient supply of the fungi, bacteria, and algae (or discourage them), or attack the timber directly. In these points, in particular on the adverse effects of chlorine in towers, this test supports overseas findings. For example, some of the test towers that have been chlorinated show unmistakable chemical delignification of their slats. Timbers exposed to a water pH above 8·5 are much more prone to soft rot than those in towers with a lower pH.

Series II: Effectiveness of Preservatives against Soft Rot

After only six years, quite considerable deterioration has occurred in untreated radiata pine and slight deterioration in untreated Californian redwood. Various coatings and dips were tested but have given poor results. Of the preservative oils, creosotes, especially high-temperature creosotes, have performed reasonably well at loadings of 16 lb/cu ft or more but not as well as the best waterborne preservatives. Pentachlorphenol (16 lb/cu ft, 5% solution in heavy oil) has also performed well.

The best preservatives were fixed waterborne salts, especially those based on chromated copper formulations. Commercial copper–chrome–arsenic preservatives are still giving complete protection at very high loadings (2–4 lb/cu ft) and show only very slight deterioration at commercial loadings of $1\frac{1}{4}$–$1\frac{1}{2}$ lb/cu ft. Acid copper chromate and copper–chrome–boron were as effective as the CCA preservatives.

These initial results appear clear-cut, but more precise comparisons among the better preservatives will be made available as the test progresses.

Growth Stress Investigations in Regrowth Eucalypts

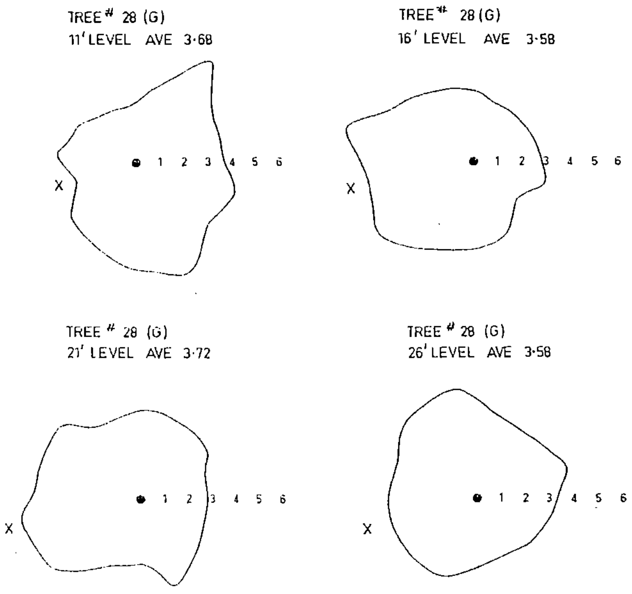
By J. E. Nicholson, Timber Conversion Section

PAST ATTEMPTS to saw regrowth eucalypts have met with considerable difficulty, generally in connection with the high growth stress gradients usually present within young trees. These gradients contribute to end-splitting which occurs when the trees are cut into logs, as well as to the severe "spring" that results when logs are broken down in the mill. Since the economic utilization of regrowth eucalypts will soon be necessary in some parts of Australia, the Division is currently investigating various aspects of their conversion. Among these, the reduction or elimination of the effects of growth stress on the final product is of prime consideration.

The investigation of this problem is being considered from two basic points of view:

- Reducing stress levels within logs prior to conversion;
- Adapting current conversion processes to allow straight timber to be produced from regrowth logs on a production basis.

The ability to determine the average stress level of a particular log is paramount to any intensive investigation of this subject. Accordingly, procedures have been developed which will allow an estimate to be made of the level of longitudinal stress present on the surface of a log or tree. The technique employed is



Polar strain plots for four positions along an "S" sweep in the log. The 11-ft level (upper left) was at the base of the sweep, while the 26-ft level (lower right) was above the top of it. The 16- and 21-ft levels were within the curved section. Note that although the pattern of strain has shifted, the average values have remained constant at the four positions.

one of releasing the stress* present in a small segment of the log, while measuring the amount of strain† resulting from release. Using Eastman 910 adhesive, two gauge points, in the form of small buttons, are attached to the log surface at points 50 mm apart. The gauge length is then measured to an accuracy of 0·001 mm with a Huggenberger Tensotast. Tension in the gauge area is released by chiselling two small slots, and the measurement is repeated to determine the change in length, and hence the strain. This strain, when combined with Young's modulus determined on wood from the same area, and corrected for errors of curvature, will provide an estimate of longitudinal stress present. When this procedure is repeated at various points about a circumference line stress patterns are obtained, and average values are determined for the log.

Preliminary investigation of *Eucalyptus regnans* and *E. nitens* has revealed interesting patterns of variation in longitudinal stress about the circumference of individual trees. Longitudinal stress values from 800 to over 4000 lb/sq in were encountered on the surface of *E. regnans* logs. In those logs examined it was usual for the stress level at any one point about the circumference to fall within ± 1000 lb/sq in of the mean value obtained for the log, although individual logs were occasionally found to exceed this range greatly. This fluctuation appears to be dependent upon the straightness and balance of the tree crown, with well-balanced vertical stems exhibiting the least variation about their circumference. More highly stressed areas tend to appear where needed by the tree to maintain a vertical position, and more lightly stressed areas in the opposite position. Typical polar plots are shown in the figure.

* Stress, force acting across unit surface area.

† Strain, dimension change per unit length.

Stress Reduction

Procedures for reducing stress prior to conversion are generally based upon creep or relaxation occurring within the log. The extent of relaxation appears to be time- and temperature-dependent, and the initial investigation in this field is concerned with determining the conditions necessary for effective relaxation to occur. Storage of logs under water spray has been advocated in the past as a means of stress relaxation. However, preliminary investigation indicates that while some relaxation undoubtedly occurs during storage, it is not likely to be appreciable at normal outdoor temperatures.

Because the procedure described for measuring stress levels is applicable to living trees as well as to felled timber, the opportunity may exist for selection of low-stress trees for tree-breeding studies and future propagation. Considerable variation has been observed in the average stress levels of trees within the same apparent environment. Although at this stage it has not been determined that this variation is genetic in origin, this seems most likely, and if true will lead to the selection of parent trees with low stress levels. The offspring from these parents might then be used for reforestation of high-quality sites following normal logging operations.

Published by CSIRO, Melbourne

CSIRO
Forest Products Newsletter
DIVISION OF FOREST PRODUCTS, CSIRO, P.O. BOX 310, SOUTH MELBOURNE, VICTORIA 3205
REGISTERED IN AUSTRALIA FOR TRANSMISSION BY POST AS A PERIODICAL

NUMBER 375 AUGUST 1970

1970##375

Treated Wooden Fence Droppers

By F. A. Dale, Preservation Section

Wooden droppers for wire fences are as much a part of the rural scene as wooden fence posts. Ever since farmers realized that they could save time and money by spacing posts further apart, wooden droppers have been used to tie the wires between them.

Droppers of other materials have been available for many years, and each of them has certain advantages and disadvantages. As some manufacturers have no scruples about condemning wooden droppers for alleged deficiencies, it is reasonable to put these in their proper perspective alongside the good points.

Wooden droppers are cheap, light, easy to handle, readily attached to the wires, and serve admirably to keep the wires at the right spacing to prevent their separation by stock. Above all, they are stiff and strong.

For untreated droppers a wide range of timbers can be used, and all but a few non-durable timbers will give satisfactory service in most climates. The combined effects of weathering, decay, and sometimes termites may weaken some of them eventually, so that they may need to be replaced before the fence posts. They may be destroyed by fire, but usually only if they are badly weathered and partly decayed.

Untreated droppers should be sawn from timber of reasonable quality, free of wane, sapwood, brittle heart, severe cross grain, large knots, and gum veins. This will ensure that they do not break, split, or decay prematurely. Eventually, they may decay at the bottom if it rests on the ground or in wet grass, or they may be attacked by termites, although this is not a major cause of failure. Droppers of heavy moderately durable timbers such as jarrah, red gum, or blackbutt last as long as the posts in the same fence, but those of less durable, more fissile timbers may last only half this time.

Since the introduction of commercial preservative treatment, a superior article has

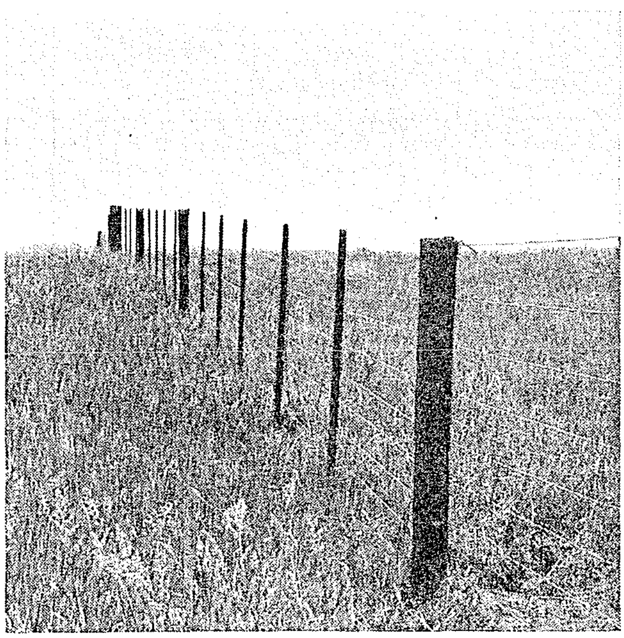


Fig. 1.—Treated droppers and small round treated posts make cheap and most effective fencing.

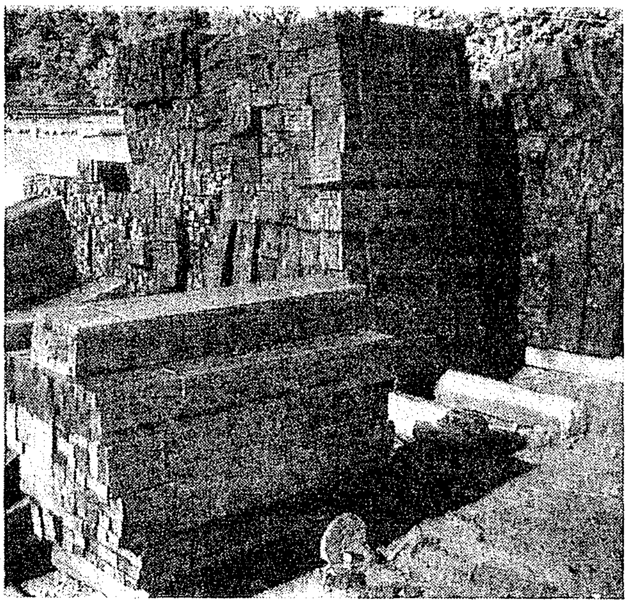


Fig. 2.—Treated droppers are available at preservation plants in most parts of Australia.

been available. Preservative treatment will prolong the life of any dropper but its main advantage is to permit the use of sapwood and timbers of low natural durability. Pressure treatment with creosote or pentachlorphenol in heavy oil will retard weathering and prevent decay and insect attack, as well as make the dropper fire-resistant. High-pressure treatment is desirable but 200 lb/sq in treatment gives adequate protection in the lighter eucalypts. Hot and cold bath treatment is permissible if the droppers contain at least 50% sapwood. Treatment with CCA preservatives gives very good protection against decay and insects but it does not prevent splitting, and precautions may need to be taken to avoid collapse and distortion in redrying. Also, it does not confer fire resistance and its use in areas where fire is a hazard is not recommended. The new CSIRO fire-retardant CCA preservative, while primarily developed for pine fence posts, should also improve the fire resistance of droppers, but its performance in hardwoods has yet to be evaluated (Fig. 1).

Because preservative treatment is most effective in sapwood, treated timbers like radiata pine are being increasingly used. Millions of pine droppers are treated annually in New Zealand, where native hardwoods are becoming scarce. Pine makes good droppers if large knots can be avoided but a larger section is needed than with hardwood. Fencing for cattle will require an even larger section.

Improved fastenings have been developed for treated droppers. Multiple slotting, using special wire clips, allows the wires to be fixed at any spacing. Power-driven staples have been used for rapid fastening, with a wire tie at top and bottom to prevent the dropper moving sideways. Pre-bored holes are not convenient if the wires have to be threaded and tensioned with the droppers in place, but a "hairpin" clip through the hole enables the dropper to be fixed after the fence is tensioned. The slotted dropper fixed with clips is the most logical development and is becoming very popular.

The electrical resistance of oil-treated droppers is very high and they can be used without insulators for electric fencing, at a considerable saving. One manufacturer now supplies creosote-treated $2 \times 1\frac{1}{2}$-in. hardwood posts, pointed and slotted, in place of ordinary posts for electric fencing. These are cheaper and stronger than posts made of other materials, but complete penetration and a minimum creosote retention of 10 lb/cu ft are essential for long life.

With these advances, the future for wooden droppers should be assured. In the sizes commonly used, $1\frac{1}{2} \times 1$ in., $2 \times 1\frac{1}{2}$ in., 2×1 in., and 3×1 in., they represent a useful recovery item for many sawmills and with proper promotion the market should be very large. As long ago as 1954 the Division estimated that Australia could use about 60 million fence posts per annum. Although posts are now generally spaced much further apart, this should increase the demand for droppers so that a potential market of 60 million droppers per annum would not be unreasonable (Fig. 2).

A note of warning: One or two unscrupulous suppliers already have attempted to pass off "dipped" posts as being pressure-treated. The buyer of treated droppers should make sure that he is getting *properly treated* material from a reputable supplier. A creosote retention of 6 lb/cu ft should be specified with substantially complete penetration in high-pressure-treated droppers and 2–3-in. end grain penetration in those treated at 200 lb/sq in. All sapwood must be completely penetrated.

Research Projects

Sawmilling

Future developments in the lumber industry depend not only on external competitive pressure but also on improvements to current conversion techniques.

The sawmill is the first step in the timber conversion process and improvements in productivity at this point can lead to substantial gains in economic efficiency. To this end, attention is currently being given to the effect of log characteristics on conversion costs and of sawing patterns on profitability. The design and operation of sawmills and sawing machinery are also being studied with the aim of producing greater flexibility, better quality control, reduced labour requirements, and increased economic return.

The influence of log harvesting and storage treatments on the amount of spring in quarter-cut boards can be particularly important in fast-grown logs. In addition to the stress-relief techniques being investigated, sawing techniques are being developed and analysed which maintain a stress balance in the log during conversion. Related to this is an investigation of back-sawing as an alternative to quarter-sawing, with the purpose of producing bow, which is easily accommodated, instead of spring, which requires special straightening techniques. However, back-sawing produces seasoning problems in some ash eucalypts and work is in hand to overcome this.

Concurrently with experimental work on sawmills and sawmilling, the Division is examining the whole question of sawing as a conversion process for logs. This will consider not only the future price relativity of sawn wood to alternative products but also the type of wood product likely to be required 10 or more years from now.

Operational Research

Four separate projects under this heading have been carried out during the past year.

A study of the economics of various combinations of air, kiln, and predrying in the seasoning of sawn timber has been continued. A computer simulation has considerably speeded up this investigation and an article discussing the results has been prepared.

When veneers are being prepared for plywood manufacture they are usually cut oversize to allow for trimming of the final plywood sheet. Obviously, if the oversize allowance is too large, valuable material is wasted, while if it is too small, finished sheets will have veneers that are not full size. A small study to establish a method of finding the optimum oversize allowance has been made and an article summarizing the procedure and results has been prepared.

The economics of the finger-jointing of material from knotty hoop pine thinnings to make clear mouldings have been studied. The minimum length between knots which should be processed has been established for certain conditions and likely recovery of select material has been calculated.

In addition, a study of the economics of manufacturing 3×2 in. dried studs from hoop pine thinnings by docking of twisted material, straightening, and then finger-jointing has been conducted at a plant in Queensland.

Investigations into technical and economic aspects of removing bark from eucalypts have been conducted, and reports and published articles have been prepared on this subject (see Abstracts in Newsletter No. 369). Contact is being maintained with engineering companies involved in supplying machinery for wood chip production in view of the importance of this operation in relation to the chip export proposals.

Wood Cutting

Converting the log harvest into consumer products always involves some form of wood-cutting machinery operating in forest, sawmill, factory, plymill, or pulpmill, so that wood-cutting operations are very important to the economics of conversion.

For some time the cutting action itself has been investigated, in order to discover the way in which cutting conditions and wood properties affect cutting forces and product quality. This involves the stress in the wood near the cutting edge, which has been the subject of recent studies. Using a photosensitive lacquer, a fine grid is printed on the side of a work piece and photographed before and during cutting. Coordinates of the grid intersection are measured on a scanning machine that records them on computer cards for calculation of strains and stresses.

The procedure has been applied to the basic veneer-cutting process, with the hope of reducing the difficulties in peeling newly available material from regrowth and plantation forests. Nosebar type, position, and friction characteristics are being investigated.

An extensive study of single-edge cutting in a plane perpendicular to the grain has provided equations and nomograms for calculating cutting forces and power when wood species, moisture content, and cutting conditions are known. These results are now being applied to particular operations such as sawing.

The performance of a sawing machine in terms of throughput, accuracy, kerf losses, and surface quality is also dependent on the lateral stability of the saw blade. This is known to be affected by initial tensions, blade geometry, including number and shape of teeth, mounting conditions, running speed, and temperature gradients, but the relationships have not been well established, especially for large saws.

Examination and rolling equipment has been installed to help refine preparation procedures. Work is being done on circular saws up to 72 in. diam. operating under Australian conditions, and experimental vibration studies have revealed some requirements as to blade preparation, running speed, and packing. It has been shown that heat tensioning increases stiffness and natural frequency in a manner similar to mechanical tensioning, but the extent to which it can replace the latter is not yet known.

Utilization of Mill Residuals

Most sawmills produce considerable quantities of short-length stocks of various grades for which there is no obvious large-scale economic use. Experiments have shown that long lengths of adequate strength can be made by finger jointing and gluing suitable grades of short material.

This treatment has, to date, been used mainly on air-dried or kiln-dried material but work is in progress on finger jointing green material of suitable species using exterior-grade adhesives.

Dried finger-jointed stock is finding ready acceptance in the market for flooring, studs, and other building timbers.

In some cases dried studs cut to length are being marketed with pre-cut nogging lengths as a further approach to utilizing short material. The economic drying of short-length structural-size material presents some problems and a simple drier suited to this task has been designed in the Division.

Some mill residuals are low-quality materials unsuitable for finger jointing. They consist of edgings, dockings, and offcuts, together with material culled or graded from the sawn output. Increasing availability of this and other small-size raw material such as thinnings has made the study of properties of panels made from wood particles more desirable, and assessment of properties in relation to manufacturing methods and adhesives is being undertaken.

DONATIONS

The Division gratefully acknowledges the following recent donations:

	$
Bowater-Scott Aust. Pty. Ltd., Vic. ..	100
Bowen and Pomeroy Pty. Ltd., Vic...	50
Furness Ltd., Clarence Gardens, S.A.	50
W.A. Chip and Pulp Co. Pty. Ltd., W.A.	2000

Materials

Hawker Siddeley Building Supplies, W.A.
Sawn karri for experimental purposes approx. value 180

CORRIGENDUM

Please note that in Forest Products Technical Note No. 1, Gluing Techniques for Timber Engineering Structures,

Revised Edition 1962, p.15
" " 1967, p.16

the formula for torque *should read:*

$$FL = \frac{WD}{2}\left(\frac{\pi f D + K}{\pi D - f K}\right)$$

Printed by CSIRO, Melbourne

CSIRO

Forest Products Newsletter

DIVISION OF FOREST PRODUCTS, CSIRO, P.O. BOX 310, SOUTH MELBOURNE, VICTORIA 3205

REGISTERED IN AUSTRALIA FOR TRANSMISSION BY POST AS A PERIODICAL

NUMBER 376 SEPTEMBER 1970

1970##376

Coppice-grown *Eucalyptus viminalis* as Source of Chip Material

With the increasing consumption of wood fibre for the production of paper, paperboard, fibreboard, and particleboard, more serious attention is being paid throughout the world to the growing of fibre as a short-rotation crop. There is rising interest in the planting of quick-growing tree species, the application of fertilizer and irrigation techniques, the utilization of parts of the tree other than the merchantable bole, and the increased use of waste and residue material. Investigations are already under way in the U.S.A. into the possibility of coppice-regenerated sycamore being managed on a rotation as short as 2–3 years, stems only an inch or two in diameter being harvested by mechanical means.

Under appropriate conditions eucalypts are capable of rapid growth and can produce exceptional yields. Many species are able to regenerate by coppicing and the increment of coppice shoots is higher than that of trees grown from sowing or planting. Whilst growth stresses and seasoning difficulties can be accentuated in fast-growing plantation eucalypts, these defects are not disadvantageous if the material is to be utilized as chips.

The Division of Forest Products is particularly interested in this problem, and during 1969 commenced an investigation into the possibilities of using a coppice-grown eucalypt as a source of chip material. *Eucalyptus viminalis* was chosen for study because it has a wide distribution in south-eastern Australia, coppices readily, and exhibits marked genetic variation. The wood is pale in colour, not subject to marked kino formation, and is of moderate density. When pulped by the kraft process the young material yields a chemical pulp which is comparable in quality to that of young *E. regnans*.

Experimental material was collected from fortuitous coppice-regenerated *E. viminalis* in Victoria, the coppice shoots varying in age from 2 to 27 years, the number of shoots from a given stump varying from 1 to 11. An assessment was carried out of the anatomical, physical, and certain chemical properties of the material. In utilizing small material the removal of bark can be a costly factor. It would, therefore, be an advantage if the whole log could be used, and this is potentially possible with young smooth-barked eucalypts. Consequently the investigation included a detailed examination of the bark and its effects on the end product.

The possibility of pulping the entire tree, i.e. stem, branches, twigs, and leaves, was also examined. With regard to leaves, since they have a deleterious effect on the pulp properties and comprise less than 10% of the above-ground dry matter yield, they should not be included, but should be stripped so that no more than about 5% remain, depending on quality required and the economics of stripping. Twigs present sufficient difficulties to indicate that they also should be excluded, and this may be combined with leaf removal since neither portion of the tree contributes greatly to the product. It was found that young bark could be a useful addition to the raw material, although certain undesirable features of the bark, particularly of the older stems, indicated that the rotation age should be limited to avoid excessive bark content.

The results of this study have indicated that coppice-regenerated *E. viminalis* can provide a useful source of chip material for utilization as pulp and paper and fibreboard. After removal of leaves and twigs the remainder of the above-ground material can be utilized. A consideration of all factors indicates that a rotation age of 6–8 years would be the most satisfactory, which is the age chosen for the coppice rotation of certain eucalypt species used for pulping in Brazil. At this age harvesting by existing machinery presents no problem.

For the maximum benefit to be gained from this approach, further investigations covering such matters as optimum tree spacing, site preparation, and desirable number of rotations from one root system are needed.

Full details of the project were published in Division of Forest Products Technological Paper No. 58.

Revised Standard Names for Australian Timbers

A revised edition of a standard reference work for the Australian timber user, Australian Standard O2, Nomenclature of Australian Timbers, has been announced by the Standards Association of Australia.

The revision of the Standard was undertaken by a small committee operating under the Standards Association's Timber Industry Standards Committee, comprising representatives from the Division of Forest Products, Commonwealth Forestry and Timber Bureau, and Forestry Departments in Queensland, New South Wales, and Victoria, with the cooperation of botanists from other State Forest Services, national herbaria, and timber trade organizations.

This standard establishes standard trade common names for more than 750 Australian timbers, and provides botanical names and synonyms, the authors of such names, an indication of the States where the timbers are grown, and local names that have been, or are, also used for many of the timbers. It includes a comprehensive alphabetical index of every name, whether trade, botanical, or local name, and details of authors. Names changed from those in the former edition are listed in an appendix.

The nomenclature now includes rain-forest species, species of importance to the woodchip industry, and small trees and shrubs of interest to wood technologists, research workers, hobbyists, and makers of souvenirs. Coniferous species (i.e. the softwoods of international trade) are given an identifying letter, as are exotic species (i.e. those introduced into Australia).

Copies of AS O2 may be obtained from the various offices of the Standards Association of Australia for $4 each.

DONATIONS

The Division gratefully acknowledges the following recent donations:

	$
A. A. Swallow Pty. Ltd., Sth. Melb.	200.00
Tenaru Pty. Ltd., North Sydney ..	100.00
Radiata Pine Association of Australia, Adelaide	2000.00

Materials

Victorian Sawmillers' Association Hardwood flooring and scantling for experimental purposes approx.	110.00
J. Wright and Sons (Aust.) Pty. Ltd., West Footscray, Vic. Oregon flitches for experimental purposes .. .. approx.	10.00

Victorian Forests Commission
10 trees of mountain ash and radiata pine, 20 ft × 12 in. diam.
15 trees messmate stringybark and mountain grey gum, 10 ft × 6 in. diam.

NEW TIMBER ENGINEERING STANDARDS

Plywood and Scantling

Reflecting the increasing structural use of radiata pine in Australia is the recent issue of two standards for products intended for load-bearing applications. One is AS O85, Pinus Structural Plywood, which also encompasses other *Pinus* species similar to radiata pine, while the other is AS O123, Finger Jointed and/or Laminated Radiata Pine Scantlings. For both these standards the Division was closely involved in providing supporting technical data and in the drafting activities of the Standards Association Committees.

Plywood has always been recognized as an important structural material with many desirable characteristics. However, its use in this field has been restricted in Australia due in part to the lack of a suitable set of grading rules. Basic stresses necessary for design purposes may be recommended only for materials produced to some acceptable minimum standard.

To supply the background information necessary to prepare the standard a testing programme was undertaken in the Division's engineering laboratory. This established the influence of factors such as depth of peeler checks, density, and knot size on the strength and stiffness of plywood. The results have now been incorporated in the standard, in the form of a table of basic stresses and a corresponding description of the permissible grades of veneers. Sections on plywood manufacture and quality control are also included in AS O85. A similar industry standard for hardwood plywood is in use, and it is expected that this will eventually be the basis for an Australian standard.

The type of scantling referred to in AS O123 is material up to 4 in. wide fabricated from radiata pine by means of either finger-jointing or face-gluing. In this standard, guidelines are laid down for the preparation of the material prior to gluing, suitable types of glue, and methods of fabrication, and a detailed description is given of a quality control system including the necessary testing techniques. The grade of timber is not given but cross-reference is made to AS O78, Visually Graded Radiata Pine for Structural Purposes, where provision is made for six visual grades.

This standard should create considerable interest as it comes at a time when there is a growing trend towards the use of dry framing timber and a keen recognition of the economic advantages of finger-jointing.

STANDARD FOR TYPES OF TIMBER SURFACES

A new Australian standard which will be of interest to designers, manufacturers, and purchasers in all sections of industry requiring to specify the surface finish of timber has been issued under the reference AS O119, Types of Timber Surfaces.

The standard gives descriptions of categories of bare timber surfaces, broadly known as sawn surfaces, dressed surfaces, and abraded surfaces. Its aim is to provide descriptions related to function and appearance, and to reduce to the minimum reliance upon subjective evaluation or the human element when assessing surfaces.

The standard provides for specification of finish of surface by type-numbering sawn surfaces 1 to 5 for finishes ranging from "coarse" to "smooth", dressed surfaces 1 to 5 for finishes from "dimensional dressing" to "very smooth", and abraded surfaces 1 to 3 for finishes from "medium" to "very smooth". The grading requirements for each type of surface are given in detail and are also summarized in an appendix. Some suggested applications of the various types of surfaces are tabulated in a commentary.

Copies of AS O119 may be obtained from the offices of the Standards Association for $1 each.

ABSTRACTS

The Economics of Finger-jointing by B. T. Hawkins. *Aust. Timb. J.* **36**(5), 1970. *(D.F.P. Reprint No. 843.)*

The cost of finger-jointing depends on the type of machine, the rate at which the machine is used, the amount of preparation needed on the material, the size of material, and the type and amount of ancillary equipment used with the machine. Recently a study has been made at two finger-jointing installations using the same basic type of machine, but operating on different-size material at different rates and with different ancillary equipment and material preparation. This report gives details of the costs per joint for the various combinations of factors seen during the study.

Technical Assessment of Eucalypt Pulps in the Papermaking Economy by H. G. Higgins. *Appita* **23**(6), 1970. *(D.F.P. Reprint No. 837.)*

Developments in the production of pulp from plantation-grown eucalypts in various countries and in the export of wood chips from Australia call for an assessment of the potentialities of the genus *Eucalyptus* as part of the world papermaking economy.

For Australian eucalypts, wood basic density, which ranges from 0·3 to 1·0 g/cc, and extractives content are considered to be the main determinants of their pulping and papermaking properties. Breaking length and burst factor decline steeply as wood density rises from 0·3 to 0·65 g/cc but much more gently at higher densities; paper density declines (bulk rises) over the wood density range from 0·3 to 0·65 g/cc, but is then fairly constant. This behaviour can be largely correlated with that predicted from a simple model involving the effect of cell wall thickness on the number of fibres in a sheet of constant basis weight, and on the extent to which the fibre collapses during the papermaking process. The economic potentialities and limitations of thick-walled fibres are considered on the basis of these and other criteria.

The use of eucalypts in Australia for packaging materials, fine papers, and newsprint is very briefly reviewed, and reference is made to possibilities for improving eucalypt pulps by fibre blending and modified pulping procedures.

Trial of a Ring Debarker on W.A. Eucalypts by W. D. Woodhead and J. A. Oldham. *Aust. Timb. J.* **36**(1), 1970. (*D.F.P. Reprint No. 827.*)

A trial debarking of thirty-two 18-ft logs of marri, karri, and jarrah was carried out with a 35-in. Brunette ring debarker. Log mid-diameters ranged from 9 to 19 in. and the sample included logs of poor form. Bark removal, especially of the outer charred bark, was almost complete on the marri and karri. The machine processed all sizes at a feed speed of 100 ft/min. Indications are that for marri and karri debarking rates of approximately 40 tons of 9-in.-diam. logs to 200 tons of 19-in. logs could be achieved per hour, at a cost of 45 and 10 cents per ton respectively. Fibrous jarrah bark was not removed satisfactorily by the machine and some modifications to the machine would be necessary before the operations could be a practical commercial proposition with this species.

Marri and karri bark were hogged satisfactorily in a knife hog but jarrah bark became clogged.

Chipping for Pulp Production by W. M. McKenzie. *Aust. Timb. J.* **36**(4), 1970. (*D.F.P. Reprint No. 834.*)

After setting out the objects and requirements of chipping for pulp manufacture, the basic cutting action, characteristics, advantages, and disadvantages of five types of chipper are discussed. Methods of choosing a suitable size of chipper and estimating its power requirement are given.

Printed by CSIRO, Melbourne

CSIRO
Forest Products Newsletter
DIVISION OF FOREST PRODUCTS, CSIRO, P.O. BOX 310, SOUTH MELBOURNE, VICTORIA 3205
REGISTERED IN AUSTRALIA FOR TRANSMISSION BY POST AS A PERIODICAL

NUMBER 377 OCTOBER—NOVEMBER 1970

1970##377

Current Practices in Seasoning of Western Australian Jarrah

By J. F. G. Mackay, Timber Conversion Section

FOLLOWING REPORTS of increasing concern in the timber industry in Western Australia with respect to the utilization of jarrah for joinery stock, an inspection of a broad cross-section of timber mills and yards (12 in all) and joinery shops was undertaken during April 1970 by two officers of the seasoning section. The main purpose was to obtain personal impressions of the form and magnitude of current seasoning problems, draw any conclusions from initial observations, and make immediate suggestions to individual firms concerned, prior to drawing up a research programme to study in depth each facet that might become apparent.

A detailed report on findings, current and proposed research, and a cost analysis will soon be published by the Division for distribution to parties concerned in Western Australia, but some main points considered to be relevant to seasoning methods of other hardwood species have been extracted for this article.

The incidence of internal checking, particularly in 3-in. joinery stock, and of surface checking in 2- and 3-in. stock is widespread but varies in both intensity and yard location.

Internal checking is the more isolated of the defects; it was moderate to severe in only five yards but reported to be prevalent to varying extents in a number of joinery shops. From on-site observations it appeared to be associated with collapse, and specimens brought back to the Division showed clear characteristics of this both microscopically and in response to a standard reconditioning treatment. Other than this, end checks were common, arising from over-rapid drying of exposed ends but extending no more than a few inches along the length of the board.

Surface checking is by far the more serious defect, particularly where the highest possible grade of joinery, i.e. clear finish grade, is being sought. Reliable indications of the severity of this problem could be found only where stock had been cut and/or stripped out in the past few months. These checks do close up as drying proceeds, so timber that might appear to be select quality at the mill may be badly surface checked, but not visibly so, by the end of an air-drying period.

This is probably a major factor contributing to the situation existing where the rate of rejection occurring in joinery shops is significantly higher than that expected or predicted at the mill. Such checking was found to be due to over-rapid drying occurring, depending on climatic conditions, during the first few hours or days off the green chain. If no surface protection to boards was applied during this time, then the influence of hot drying winds was to set up moisture gradients of such magnitude as to cause surface cracks. These are said to be more severe in 3- than in 2-in. material and also seem to occur more readily in boards cut from smaller logs.

Because of the Forests Department's policy of clear felling to a green line in die-back and reafforestation areas, certain mills are now receiving a greatly increased proportion of small logs. While no one yard receives exclusively small logs, apparently in many cases little selection is carried out as to which are to be used for joinery stock. It is felt that if joinery material were given a priority above sleepers and crossings, the conversion of only the largest and most mature logs to joinery stock could significantly reduce subsequent seasoning degrade. This point is well borne out by the few mills that were cutting in virgin bush, selecting large logs for 3-in. stock, and subsequently reporting little degrade.

In some yards there is a policy of not cutting thick material in summer, others cut but do not strip out in summer. Instead, they store the boards either block-stacked, block-stacked with salt granules interspersed between each layer, or block-stacked with an overall wrapping. These yards report less degrade than those that cut and/or strip out during summer months.

The use of surface-protecting agents, viz. microcrystalline wax, brushed or sprayed on as a single coat on upper and outer exposed surfaces of boards, is claimed to have reduced rapid initial drying and consequent degrade. As it dries the wax forms a protective skin over the timber surface, ensuring that rapid drying does not lead to severe moisture gradients and high tension stresses that could lead to face checking. A major project is now under way to evaluate the effectiveness of this method and to set down firm guide lines for its most beneficial and economical uses.

Three instances, one of which was experimental only, of drying joinery sizes under cover in sheds were examined. There was no uniformity of construction or use about these sheds but in all cases substantially decreased drying times for enclosed stacks were reported, and where timber had been initially protected there was little degrade. For example, in one yard stacks of green 1-in. boards were placed around others of 2- and 3-in. material and the whole thing roofed with stack covers; the resultant lowered air temperature inside was considered to be the reason for the significantly reduced level of excessive drying and degrade obtained in previous years. However, stripping out of this material was done in winter, and stripping and drying comparable stock in the open air in summer has yet to be tested.

In general, joinery material such as heads and stiles is required to be free of surface checks on two sides and one face, but certain components such as mullions, transom rails, and sashes must be check-free on both faces. Hence a high quality must be achieved, particularly as there appears to be little distinction made at the plants between paint and clear finish grade joinery. Principal factors leading to high rejection rate at some plants are extreme surface checking, which often does not become apparent until machining, and internal checking in 3-in. stock which requires rebating. After machining, such slight surface checking then becomes noticeable, particularly following application of a protective oil. On a building site this coating is often not sufficient to prevent old checks re-opening if there is inadequate shelter from weather conditions. Thus previously slight checks can become quite pronounced in finished joinery which is left exposed. Thus, grading of joinery timber for this defect after completion of seasoning is not the total answer.

General conclusions and recommendations made refer mainly to surface protection of joinery stock straight off the green chain. When surface protection agents are not used, maximum effort should be put into the storage of boards prior to stripping, both under cover and away from drying winds. Covered block-stacks could be the simplest method in this case. In summer at least, all subsequent stripping should be done under cover to reduce severe initial drying. Unless some such form of early protection can be provided, cutting should be avoided during severe drying conditions.

BREAKTHROUGH IN DRYING SOFTWOODS

By F. J. Christensen, Timber Conversion Section

VERY PROMISING RESULTS have been obtained from an extensive series of experiments aimed at reducing drying distortion in *framing* timbers cut from early thinnings of plantation softwoods.

Previous reference to this work was made in Newsletter No. 368, and the present results are the outcome of proposals referred to in that article. The Division of Forest Products, the Queensland Department of Forestry, and the Queensland Pine Association were closely and actively associated on this venture, which was made feasible by the cooperation of the Department's staff and the use of their experimental kiln-drying facilities at Rocklea.

To recapitulate briefly, there is a definite tendency for 1½-in. and thicker timber sawn from plantation softwoods, particularly early thinnings, to develop greater twist and spring during drying than is acceptable or permitted for specific structural grades defined in Australian standard AS O107 (1969). For material cut near the pith twist is generally a more serious problem than spring, while the reverse is usually true for material cut from the "wings", especially when quarter-sawn. A reduction in both these forms of distortion to at least the specified levels will result in a general upgrading of product quality from essentially low-grade "case" logs. It will also help to meet the steadily growing demand for dried and dimensioned framing timbers.

In the present study, some 15,000 super ft of 3- by 2-in. and 4- by 1½-in. slash pine (*Pinus elliottii*) and 3000 super ft of hoop pine (*Araucaria cunninghamii*), supplied by the Queensland Pine Association, were dried in 12 separate runs in which the following factors were examined: dry and wet bulb temperatures; air velocity and reversal rates; sticker thickness and spacing; stack width, weighting, restraint and support. Measurements and tests made included basic density; pith configuration and percentage late wood; drying data; methods of assessing dry moisture content; fan and heating energy consumption; twist, spring, and bow; mechanical strength; and dried timber stability.

As the final run was not completed until late last month, all of the considerable volume of data collected have not yet been processed. However, with this reservation in mind, it can be tentatively concluded that some 85–90% of pith-included material dried under optimum conditions will meet standard grade requirements of AS O107 in respect of twist, spring, and bow without special machining. It is felt that this figure could be raised to 95% or so with some straightening before dressing to final size.

Material was deliberately over-dried and then brought back to an average moisture content (m.c.) of 10–12% by means of a high humidity or steaming treatment, and then cooled while still restrained. In this way, all material is initially dried to at least the minimum equilibrium moisture content (e.m.c.) it is ever likely to reach in service. It has been demonstrated from distortion measurements made on some 1500 specimens 6 and 12 weeks after drying, that a slight reduction in twist can be expected as the dried material returns to normal equilibrium values. It has also been shown by "cycling" material between 5 and 17% e.m.c. (the extremes for most of Australia) that "set" induced by drying under restraint is permanent. However, it should be made clear that such material has not been dimensionally stabilized, i.e. it will still move in response to changes in ambient moisture content and the distortion which occurs will depend on the wood structure. Such movement will be less in material dried at high temperature because of its decreased hygroscopicity. The principal effect of drying under restraint is thus to increase the proportion of straight and usable material.

Whilst this investigation has been confined to hoop and slash pines, it is felt that the techniques developed to limit drying distortion to acceptable limits are applicable to other plantation softwoods. These species are becoming available in increasing quantities throughout Australia, and are expected to provide approximately half of Australia's timber requirements in 20 years. It is anticipated that large-scale confirmatory tests with radiata pine will be carried out early next year, making use of the commercial kiln-drying facilities offered by two firms in the Mt. Gambier area. Meanwhile, efforts will be concentrated on getting the results of the present investigation to the Australian industry as soon as possible.

Appropriate stress grades for slash pine, particularly with included pith, still need to be determined. Mechanical strength tests have already been made at Rocklea on about 20% of the material dried, and further tests will be made at the Division on a large sample of similar material. It is expected that this information will facilitate the allotting of stress grades to visually graded material for structural use.

PERSONAL

Mr. Norman B. Lynch retired from the Division of Forest Products on September 23 after almost 26 years' service. Mr. Lynch, who retired as a Technical Officer, is a recognized craftsman in wood, both as a cabinet maker and an expert on wood finishing problems. His advice has often been sought by various large companies experiencing difficulties with wood and plywood finishes, and he has published articles on wood finishing in popular journals and provided the answers for a readers' enquiry service.

Some of his best known works as a cabinet maker were the inlaid table presented by the Commonwealth Government to the United States of America for inclusion in the Roosevelt Memorial; the table with the inlaid map of New Guinea containing 19 native timbers, together with the presentation box for a pictorial album, which were presented by the New Guinea Administration to Her Majesty the Queen; and the basic cutting and machining of the plywood pieces forming the triptych mural designed by Robert Ingpen for the Clunies Ross Memorial Mural in the foyer of the National Science Centre in Melbourne. His inlaid boxes have been presented to many overseas visitors as well as local celebrities, and are very much prized.

In retirement, Mr. Lynch will continue to act as a consultant on finishing problems.

Continuous Laminating

THE DIVISION is conducting performance trials on a continuous laminating machine of local design and manufacture. The machine which has been lent by Philips Electrical Industries is designed to produce sections up to 30 in. wide and 5 in. deep. Curing of the glue lines is carried out by a radio frequency heating unit of 50 kW capacity.

Machines of a similar type have been used in Europe for some years, primarily to manufacture large-size sections for joinery and re-manufacturing purposes.

It is envisaged that the machine, which incorporates a provision for putting small amounts of camber into the laminates, will be used to produce beams, window joinery, and other products. The use of this type of machine will enable short lengths of small-section timber, presently of low value, to be upgraded by direct conversion into high-value products.

Initial trials of the machine are aimed at evaluating the effect of variables such as timber species, type and spread rate of adhesive, and characteristics of the laminae including moisture content and surface quality.

DONATIONS

The Division gratefully acknowledges the following recent donations:

	$
Macdee Sawmills Pty. Ltd., Alexandra, Vic.	50.00
F. A. Trotter, Murwillumbah, N.S.W.	3.00
Materials	
G. N. Raymond Timber Pty. Ltd., Dandenong, Vic. Tasmanian hardwood for experimental purposes .. approx.	7.50
Victorian Sawmillers' Association Hardwood flooring for experimental purposes .. approx.	100.00

Printed by CSIRO, Melbourne

CSIRO

Forest Products Newsletter

DIVISION OF FOREST PRODUCTS, CSIRO, P.O. BOX 310, SOUTH MELBOURNE, VICTORIA 3205

REGISTERED IN AUSTRALIA FOR TRANSMISSION BY POST AS A PERIODICAL

NUMBER 378 DECEMBER 1970

1970##378

Biodeterioration in Wood Chips

By H. Greaves, Preservation Section

General

Commercial wood-chip storage was introduced in the early 1950s as a means of alleviating some of the problems encountered by the pulp and paper industry in the storage of their vast reserves of raw material. The advantages gained over stockpiling in the log form are mainly mechanical or chemical in nature; wood chips are easier to transport, easier to handle, require less manpower, and occupy less space than logs; the extractive content of the wood generally decreases in chip piles, a significant advantage, particularly in kraft pulping.

The problem of biodeterioration of the wood is similar for both logs and chip piles; however, the extent of damage caused by microorganisms is so variable and is influenced by so many factors that it is difficult to determine which method of storage is best. Biodeterioration occurs as two major effects: loss of wood substance due to decay-producing microorganisms, and discoloration brought about either directly by pigmented microorganisms such as blue-stain fungi or indirectly by the interactions of microbial metabolic products with the wood cell contents.

Within a wood pile of average size (600–1000 cu m), various zone effects can be expected which are likely to contribute to the extent of biodeterioration. Figure 1 illustrates these different zones; it was compiled from the literature available about chip piles in Europe and North America and, of course, may not be accurate for any one pile. For instance, the shape of the pile and degree of compacting of the chips as well as the surface on which the pile is built are all factors that affect zonations; temperatures as high as 82°C have been recorded at the centre of chip piles, while moisture contents of more than 200% can occur. The outer zones are affected by the environment but for the most part conditions in the inner pile vary little with climate.

The Situation in Australia

The first commercial chip pile in Australia was established in the early 1960s at Port Huon, Tas. The chips consist of mixed eucalypt woods and have a turnover rate of about two months. Biodeterioration does not appear to be a problem in this pile, and only small amounts of discoloration occur. Both softwood (*Pinus radiata*) and hardwood (mixed eucalypt species) chip piles have been built at Maryvale in south-east Victoria, and have been operative for about two years. Again no severe biodeterioration problems have been encountered. General Paper Mills at Brooklyn (West Melbourne) store mixed eucalypt wood as chips, and over the past three years have experienced discoloration difficulties. They have recently begun chipping *Pinus radiata*, and microbial discoloration is fairly common. Large pockets of fungal attack also occur in the pine-chip pile, but apparently do not affect the economics of the operations. The most recent chip pile to be built in Australia commenced

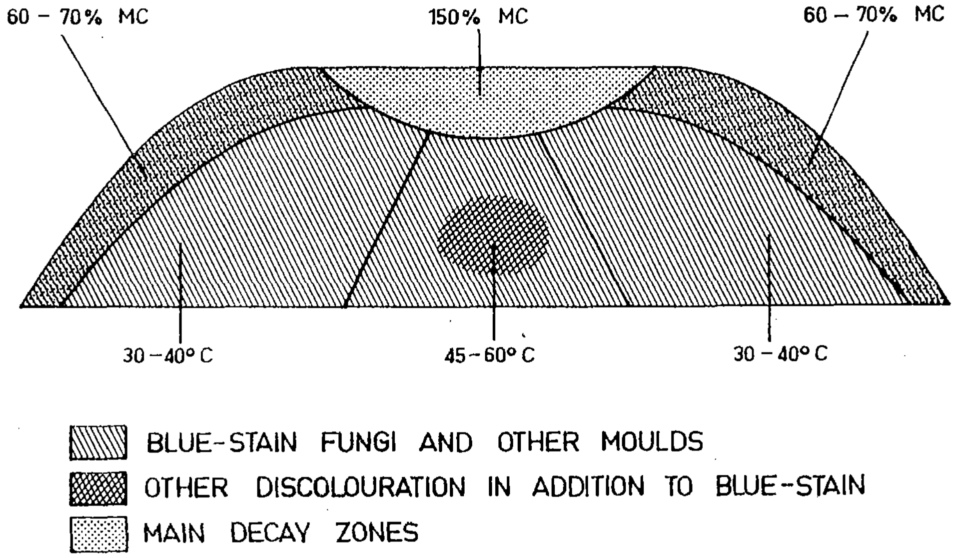


Fig. 1.—Generalized diagram of the major zones of influence in an average chip pile.

last year at Eden, on the N.S.W. coast. Mixed eucalypt woods are being used. Microbiological deterioration in the pile is being investigated by the Division of Wood Technology in Sydney.

Current Research at the Division

The Division is currently involved in a feasibility study of the export to Japan of wood chips from the vast timber resources of Papua and New Guinea. Experimental chip piles have been established over the past 12 months at Madang and Vanimo, and material has so far been obtained from a four-month-old pile at Madang that was constructed as a cone, approx. 40 ft diameter at the base by approx. 25 ft high. Two shipments of chips, located in the pile as shown in Figure 2, have been received and estimates of the extent of discoloration, quantitative measurements of the microbial population size, and determinations of the microflora have been made. In addition, pulping qualities are also being investigated. This article is intended to deal only with the microbiological aspects of the study.

The first shipment consisted of samples treated with four preservatives: three trichlorphenol formulations, and sodium pentachlorophenate. The last proved to be by far the most effective in preventing microbial discoloration and inhibiting decay. Fungi were notably susceptible to this preservative, although bacteria were not as readily con-

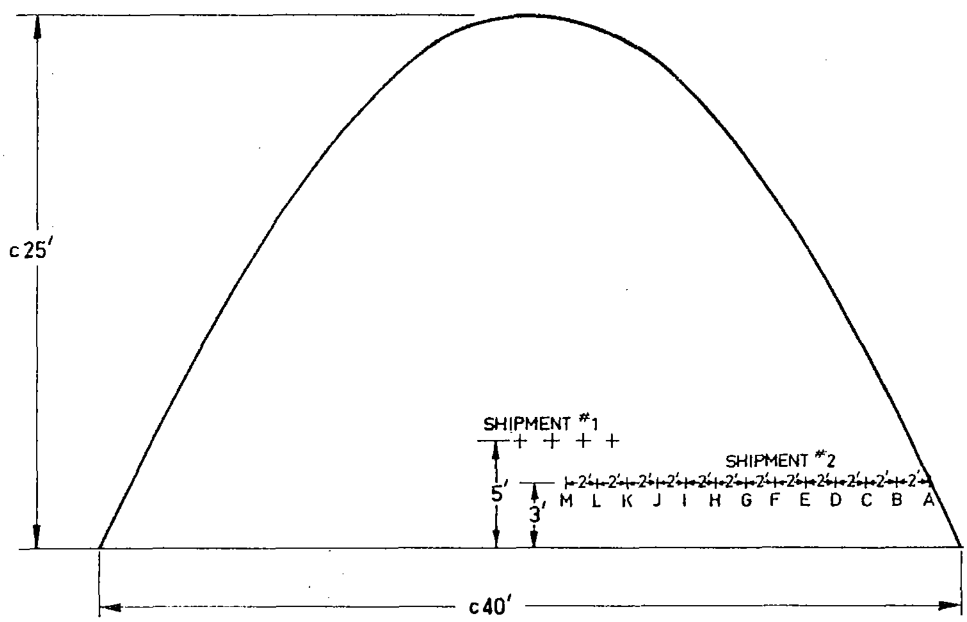


Fig. 2.—Experimental chip pile from New Guinea showing sampling positions.

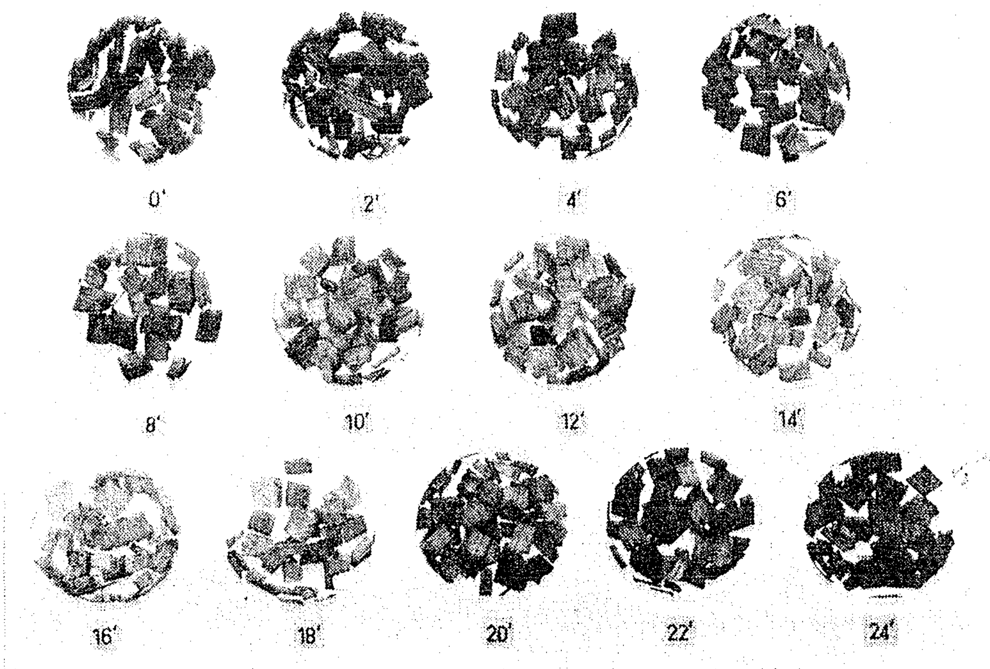


Fig. 3.—Discoloration in chips taken at 2-ft intervals throughout the Madang pile.

trolled. It was interesting to see that the preservative was less effective on thermotolerant microorganisms.

In the second shipment, samples of untreated chips were taken from the pile at 2-ft intervals from surface to centre. The results indicated that the outer-zone effect for decay, as depicted in Figure 1, was very much deeper than expected. Soft rot and bacterial pitting of wood cell walls occurred to a depth of 16 ft. Microbial discoloration was marked throughout the pile, but was more intense in the outer zones and again at the centre than in the mid zones. Figure 3 shows this gradation in chip discoloration thoughout the pile.

Activity peaks, in terms of population size, suggest that the zones of least microbial activity lie between 4 and 6 ft (positions C and D in Figure 2), while the higher-activity regions are found about 16–18 ft from the pile's surface (positions I and J). The diversity of the population, however, seems to decrease at these depths, possibly due to dominance by a small number of microorganisms capable of growing at the temperatures, moisture contents, and conditions of aeration that prevail in these zones. The microflora is in fact most diverse at about 10 ft (position F).

Some 90 different microorganisms have been isolated from the shipments. Bacteria represent the most common form of microbial activity, while species of *Penicillium* make up a large percentage of the fungi. Other common species of fungi isolated include *Fusarium* spp., *Trichoderma* spp., *Humicola grisea*, *Pithomyces* spp., *Chaetomium thermophile*, and *Torula* spp. Actinomycetes are most frequent in the mid zones of the pile, where they appear to exert some antagonistic influence on the fungi. Cellulolytic activity is scattered throughout the pile, but there is a surprisingly close association of cellulolytic ability with thermotolerance.

Further work is planned in assessing the biodeterioration hazard of wood chips in New Guinea, and no doubt many more investigations will have to be undertaken in the field of chip storage at this stage of Australian involvement.

DONATIONS

The Division gratefully acknowledges the following donations received during the last month.

Stefanelli Bros., Middle Swan, W.A.	$10.00
Kauri Timber Co. Pty. Ltd., Devonport, Tas. Timber for experimental purposes approx. value	$50.00

Victorian Timber Promotion Committee

THE VICTORIAN GOVERNMENT, in cooperation with the Victorian sawmilling industry, is supporting a newly formed Timber Promotion Committee. Members of this Committee were appointed by the Minister for Forests in October 1969, under Regulations prescribed under the Forests Act.

The Committee consists of three representatives each of the Forests Commission of Victoria and the Victorian Sawmillers' Association, with up to three others appointed by the Minister. Mr. A. O. Lawrence, formerly Chairman of the Victorian Forests Commission, is Chairman of the Committee.

The Committee derives its funds from an increase in royalty charges of 2 cents per 100 super ft of logs from State forests and from a Government grant of $25,000 per annum. Revenue in a full year is expected to be of the order of $115,000.

During its first year the Committee decided to appoint an Executive Director, and an engineer, who will continue the technical advisory service previously conducted under the auspices of the Timber Development Association. These two positions are currently held by Mr. Ian Sherwen and Mr. Bob Lamb, both of whom are well known within the Victorian timber industry.

The second year of the Committee's work has commenced with the opening of its own office at 328 Flinders Street, Melbourne (telephone 62 5428), adjacent to the Victorian Sawmillers' Association.

Much of the first year of operation of the Committee has been concerned with preparing its methods of operation in the future and assessing which of the activities of a former joint Forests Commission/VSA committee should be continued. During the year the Committee has provided financial support for education and training courses within the industry, these courses having been operated for some years through the Royal Melbourne Institute of Technology. The Committee decided to continue support of the Timber Development Association of Victoria up to the time that this Association was wound up, and, through the Forests Commission and the Victorian Sawmillers' Association, contributes considerable funds to the present operations of the Timber Development Council of Australia. The Timber Promotion Committee joined the Timber Advisory Council of New South Wales in arranging a specifiers' tour of red gum forests and sawmills in the Echuca–Barmah area over the weekend of May 30, 1970, and a group of 70 undertook this tour. Finally, the work of the Victorian Sawmillers' Association in developing rural buildings was supported, and prototypes of these structures were erected by the Timber Promotion Committee at the 1970 Royal Melbourne Show as a continuing exhibit. Considerable interest has been expressed in these structures and efforts to develop commercial viability are continuing.

The work of the Timber Promotion Committee of Victoria is in its early stages and very much of its present activity has been in continuing work of the past. However, the Committee envisages considerable development and expansion of its field of activity in the future. It sees itself as having the opportunity and the responsibility to spearhead the development of methods of using timber within the Victorian scene, and also of sponsoring the promotion of the application of timber to the new and exciting opportunities to be developed in the '70s and '80s.

Close liaison between the activities of the Division of Forest Products and the Timber Promotion Committee is ensured as the Chief of the Division is a member of the Committee.

Printed by CSIRO, Melbourne