PROCEEDINGS

FIFTEENTH

FOREST PRODUCTS RESEARCH CONFERENCE

HELD AT

THE FOREST PRODUCTS LABORATORY,

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION,

MELBOURNE

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REPRESENTATION

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ITEM 1/1. ASSESSMENT OF AUSTRALIAN FOREST RESOURCES IN RELATION TO FORESTRY DEVELOPMENT*

Summary

Recent estimates of Australia's commercial forest area of approximately 87 million acres and 1 million acres of softwood plantations are recorded, and the inadequacy of inventory data generally at the national level, and at the State Government level for all except dedicated State forests, is noted. The importance of actual and potential future yield estimates, rather than standing volume data, is emphasized.

Estimates of Australia's wood requirements, around 1,200 million cu ft true volume per annum at the year 2000, are noted. The great production potential of eucalypts in selected areas under intensive management, and the trend towards intensive management, accelerated by export wood chip developments, are noted.

Background

For many years past, attempts to carry out a national forest inventory of Australia's forest resources have been frustrated in various ways. In 1971 the position is that although the State and Territory Forest Services have much data about areas, forest types, standing volumes, yields, etc. in their reserved forests, this data has never been examined in depth and collated at the national level. The information available about forests on privately held land is very incomplete at the State level, and negligible at the national level.

It is obvious that a national assessment of Australia' forests, indicating areas, distribution, standing volumes, current and potential future production, forming a coherent and readily intelligible background picture, is an essential prerequisite for planning forestry and forest industry development. The Australian Forestry Council has decided that a National Forestry Development Conference shall be held on 9th-13th April, 1973. The Forest Services and the Forestry and Timber Bureau, whose responsibility it will be to reconcile and collate State information into a national framework, have therefore perhaps 18 months in which to get the job done, and provide such a background picture.

The latest assessment of Australia's native forest area is about 87 million acres of "commercial" eucalypt, rain, and cypress pine forest (as at 30th June, 1965, Table R1 in NAFTA "Report on Australian

*Prepared by C S Cree, Forestry and Timber Bureau, Canberra.

and New Zealand Forest Resources" etc. (1), and 1 million acres of softwood plantations, mainly of exotic species (as at 31st March, 1970).

The Forestry and Timber Bureau Progress Report for 1961/65 (2) records the area of State forest (that is, areas permanently reserved for production forestry) as 29,699,000 acres at 30th June 1965, distributed as follows, (millions of acres):- New South Wales 6.8; Victoria 6.1; Queensland 8.2; South Australia 1.0; Western Australia 4.8; Tasmania 2.4; ACT 0.3; NT 0.1. The same report gives an assessment of growing stock in forests in commercial use at 17,645 million cu ft under bark at that date. As the area of economically exploitable forest is given in the same paper as 37,187,000 acres, this standing volume works out at 473 cu ft per acre. Table 12, page 18, gives an annual net growth total of approximately 428 million cu ft under bark, from which a per acre figure of 11.5 cu ft derives. The Forestry and Timber Bureau Progress Report also records in Tables 2 and 2A the area of "Forest Land" assessed according to an FAO definition, as 599.7 million acres or 31.6% of the total land area of Australia. This figure includes vast areas of mallees, acacia woodland and low scrub, which would be more suitably classified as "woodland". This change has been under discussion with FAO, and is to be made.

Future requirements

A number of estimates of future demand for timber have been made in recent years, both published and unpublished. These estimates differ considerably and for that reason are not quoted here in detail, but together they give a consensus of opinion that total annual round wood requirements in Australia for domestic supplies of sawn wood, processed wood, paper manufacture, etc. would approximate to 1200 million cu ft true volume at the year 2000.

The NAFTA report on Australian and New Zealand Forest Industries, etc. (1) (May 1970) estimates that Australian consumption of forest products in the year 2000 will range from 1076 million cu ft true volume to 1377 million cu ft. The same report gives estimates of potential Australian production at the year 2000 of 1,050 million cu ft per annum, of which 461 million cu ft is estimated production from coniferous plantations. The total includes an unstated quantity of pulp wood for export. Before the recent development of export markets for wood chips, Jacobs (3) estimated that the yield from native forests in the year 2000 would only total 361 million cu ft per annum. If the NAFTA estimate for coniferous plantation production is added to this figure, the total estimates for Australian production in that year, omitting pulpwood exports, becomes 833 million cu ft only. If expected pulpwood (or later, wood pulp) exports are added, the total production estimated on this basis would be of the same order as the estimate in the NAFTA report. The wood chip export production areas are generally remote from, or not well suited for domestic markets. They were not considered by Jacobs in his assessments.

Statistics presently available at the national level do not take us much further than this. The area of softwood plantations, and of State forests are considered reasonably accurate; unreserved forest on public land is much less accurately known; and the area figure for "other" privately owned forest land is not much more than a guess. Adequate data on standing volumes, forest types, distribution of age classes in plantations, is not available at the national level.

National and regional forest inventories

Although a forest inventory on a national basis must be the aim, global national totals of areas, standing volumes and yields are not of much value as a basis for planning. The geographical location of resources and their actual and potential yields within regions or districts, and their relation to and accessibility from established or potential future markets and lines of communication, are much more significant. Also, most Australian forests have long passed the stage when the standing volume of timber was the main criterion on which harvesting decisions had to be based (as they might be in a developing country, or indeed in the newly opened Australian wood chip areas, where an adequate volume of standing timber in a given tract of forest is a prerequisite to initiating harvesting and utilization of the resource). Most of the productive Australian forests have been under some degree of exploitation for round timber or sawlogs or both for a long period, and their permissible annual yield has been assessed in relation to their rate of growth.

The real forest resource is not the static standing volume, but the dynamic forest eco-system, capable of a degree of wood production ranging from a very low figure to almost 500 cu ft per acre, depending on site conditions, species composition and the degree of intensity of forest management applied to it.

Potential of the eucalypts

A characteristic of some species of eucalypt which has given the genus world wide fame and importance is their fast rate of growth. Measurements from eight South African plantations recorded by Streets (4) exemplify the results obtainable there and in other African and South American countries with Eucalyptus grandis/saligna. Streets records mean heights and mean annual increments ranging from 52 ft and 294 cu ft at 4 years of age, through 117 ft and 513 cu ft at age 17, to 177 ft and 356 cu ft at 41 years of age. Within the writer's personal experience, these rates of growth can be matched by E. grandis/saligna plantations in East Africa over a wide range of elevation and site conditions. Brazilian plantations of these species also show rapid growth rates. G Gemignani (5) records that a plantation of E. globulus at Borgo Sabatino in Italy showed a mean annual increment rising from 24.7 m^3 at 4 years old to 32.2 m^3 (450 cu ft) at 6 years old, under intensive management.

The view that eucalypts could not achieve rapid growth rates in Australia because of attack by endemic leaf eating insects is widely held. Jacobs (6) states that because of attack by leaf eating insects growth of eucalypts within Australia is usually much slower than in corresponding climates overseas. He also notes that under certain favourable conditions, some eucalypts achieve remarkable rates of growth within Australia, citing a E. grandis plantation in Pine Creek State Forest near Coffs Harbour, NSW, which grew to more than 40 ft in height in two years from the date of planting.

Other evidence of fast growth rates in Australia is recorded by Webb (7), who reports a mean annual increment of from 266 to 483 cu ft per acre, depending on site, at age 24 in Eucalyptus regnans plantations near Noojee in Victoria, commenting that the mean annual increment was still rising at that age.

Prior, Chandler and Clarke (8) expect high annual increments in E. grandis plantations on intensively prepared sites at Coffs Harbour. Measurements of trial plots recorded to date show mean annual increments up to 391 cu ft per acre at 8 years of age.

High yields from eucalypts are not confined to plantations. A mean annual increment of about 430 cu ft at age 60 has been recorded for a natural even-aged stand of E. regnans near Powelltown, Victoria, by Webb (7). Mean annual increments of the order of 200-250 cu ft per acre have been recorded by the Forestry and Timber Bureau in eucalypt regrowth (mainly E. obliqua), resulting from 1939 fires in southern Tasmania.

The inheritance from the days of the early timber-getters of a system of selection forest management of eucalypt forest deriving from the selective logging, has been at least as important a factor in preventing the achievement of full growth potential of the eucalypt forest as have the leaf eating insects. Eucalypts in general are intolerant of shade, therefore selection forest silviculture enables them only to achieve low growth rates of perhaps 30-70 cu ft per acre per annum. Curtin (9) quotes 72 cu ft as the maximum possible mean annual increment obtainable in blackbutt forest on the New South Wales North Coast under selection management. He estimates that blackbutt plantations on the same sites could achieve double this rate.

Trend to intensive management

Henry (10) discerns a trend in current eucalyptus forestry towards more intensive site preparation and management, combined with shorter rotations, and forecasts a swing to hardwood plantations away from natural regeneration in native forests. The large and growing demand for pulpwood by Australian pulp and paper companies is leading to the clear felling of a progressively greater area of eucalypt forest, to be regenerated as even-aged crops (as in the Florentine Valley forests managed by Australian Newsprint Mills).

The probability of shorter rotations in the new crops is very great - it is most unlikely that trees will ever again be grown to the immense size of some of those in the old growth forests. The rising demand for pulpwood is the immediate cause of this trend to clear felling, coupled with intensive management, but this is likely also to lead to more rapid production of acceptable eucalypt saw logs (probably considerably smaller than many old growth logs) - perhaps on a 40 year rotation.

The effect of wood chip exports

A new factor which is already significantly extending the area of eucalypt forest clear-felled, and therefore converted in a few year's time to a new even-aged forest crop, are the wood chip projects, producing wood chips for export to Japan.

According to Gardner (11) two of the Tasmanian wood chip projects will together involve the regeneration of 25-30,000 acres of eucalypt forest annually. If all four projects operating or approved (three in Tasmania, one in New South Wales) develop as expected, it may be necessary to clear fell and regenerate over 50,000 acres annually.

If all the projects under consideration come to fruition, the area of high production forest regrowth will be very greatly and rapidly expanded.

Conclusion

Sufficient has been said to indicate that the task of assessing Australia's forest resources is not one of enumerating standing volumes, but rather of assessing, and locating, yields from existing and planned softwood plantations, and from the native forests as at present managed; and adding to this the high yields potentially available from selected areas of eucalypt forest converted to intensive management. This process can only go forward on the assumption that a greater forestry research effort will be devoted to intensive eucalypt forest management and plantation silviculture than in the past, as was indeed called for in the opening address to the 21st Appita General Conference in 1967. (12).

For reasons of space, it is not possible to consider here the possibly profound effects which technological changes will have on future forest production, and on uses of forest products. There are plenty of prophets, ranging from Young (13) advocating utilization of the whole tree, to Dawkins (14) who sees all non-aesthetic, large scale industrial uses of wood, in the industrial areas of the world, being taken over by synthetic plastics and derivatives of the Al Fe Si Ca minerals within the next half century. Forest products research workers may be able to give some indication of changes in prospect.

Projections of present trends have led Vakomies (15) to the conclusion that world consumption of industrial wood, at present assessed at 1000 million solid cubic metres per annum, will double within 15 years, after allowing for substitution by products such as plastics.

Unless and until events prove otherwise, we will proceed on the assumption that Vakomies is on the right track.

Acknowledgement

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ITEM 1/2. FOREST RESOURCES (VICTORIA)

Victoria's forest products resources are undergoing significant change due to the development of large areas of two very productive types of forest.

Plantations of exotic conifers, mainly radiata pine, are steadily expanding, and the regrowth forests of mountain ash and alpine ash are rapidly approaching an age where utilization can be considered.

The area of plantations now exceeds 230,000 acres, and is being extended at approximately 16,000 acres per annum.

State plantations comprise slightly less than half the current total area and are increasing by approximately 10,000 acres per year. That rate of planting will increase.

Output from the State plantations will be greatly increased by this development. Whereas the output is currently 6.7 million cu ft, commitments for the near future now stand at 8.4 million cu ft, and potential output will increase to 19 million by 1980 and 39 million by 1990.

The yield from private and industrial plantations by 1990 will probably be almost as great as that from State plantations, after a threefold increase on current output.

Pulpwood comprises less than one-third of current output but it will amount to two-thirds of the potential output in 1980 and more than half in 1990.

Production in the regrowth forests of mountain ash and alpine ash could balance a decline in the yield from mature and overmature ash forests. Output from regrowth forests could rise to approximately 30 million cu ft per annum by 1985 and then level off; 10 million cu ft of this volume will be of sawlog size and quality, and pulpwood yields will rise from 2 million cu ft to 20 million cu ft.

Extending over an area of about 300,000 acres the regrowth forests, being mainly located in the Central Highlands, will be more accessible and valuable than current sources of ash timber, but in the early years the log sizes will be small compared with current outputs.

Some ash forests which regenerated before 1939 will produce sawlogs from trees of 26 inches average diameter breast high, but sawlog trees in the main resource will be 20 inches in diameter on average, ranging from 17 to 30 inches. After 1975 the average size of sawlog trees available for harvesting will be in the range of 22 to 36 inches diameter.

The impact of the output from these two types of forest will be considerable. Within 15 to 20 years the relatively young, relatively small timbers of the plantation conifers and regrowth ash forests will comprise 60 per cent of the total Victorian timber output compared with 15 per cent at present.

The mainstay of hardwood production to date, the extensive mixed species forests of the lower foothills of the main Dividing Range, will make a somewhat smaller contribution to wood output in the future as sustained yield management replaces liquidation of virgin mature and overmature stands and as certain areas of this forest type are set aside for purposes other than the production of timber.

ITEM 1/2. FOREST RESOURCES (NSW)*

An accurate assessment of the commercial forest resources in New South Wales now and in the future, must be a job of magnitude, clouded unavoidably by the uncertainty of changes in the pattern of timber usages and in the species and log qualities acceptable for such usages, changes in the concepts of multiple usage and the accent to be placed on environmental factors, including pollution and erosion, and legislative changes that over the long term could have a profound effect on the tenures of large areas, now contributing timber for industry.

The Commission has undertaken two inventories of timber volumes in New South Wales one in 1952 and another in 1963 and we are now working on a more sophisticated estimate for the Forest Development Conference to be held in 1973.

Forest statistics

Areas of NSW	198,000,000	acres
(Estimated total forested area at present	32,403,000	"
(Percentage	16.3%	

Secured forest areas

Area of State forest (April 1971)	7,192,904	"
" " timber reserve (April 1971)	1,029,320	"
" in process of dedication as State forest (April 1971)	383,656	"
" of vacant crown lands and certain reserves carrying timber (estimate)	1,500,000	"
Total	10,105,000	"

* Prepared by P T Cooke, Forestry Commission of NSW

Forest areas unsecured or not under legal control

Crown areas of forested lands held as leases etc. (estimate)	9,228,000 acres
Areas of forested lands held commercially by private wood growing interests which includes about 40,000 acres of Pinus species and about 5,500 acres of poplars - the rest being mostly hardwoods (estimate)	120,000 "
Areas of forest lands as private property (estimate)	9,580,000 "
Total	18,928,000 "

Secured forested areas on which timber harvesting is not currently permitted

Catchment areas (Sydney to Newcastle)	670,000 "
National Parks under N P & W L S	2,700,000 "
Total	3,370,000 "

FOREST REGIONS

These "indigenous" forested areas fall in 5 major regions and it is appropriate to also list below the now large and expanding areas of "man-made" softwood plantations of almost wholly "exotic" species:-

(i) Hardwood forests of the north coast

This region extends up the coast from the Hawkesbury to the Queensland border. Currently, it produces 60% of the State's total cut of all species and 80% of the hardwood yield. The principal forest types are blackbutt, blue gum-tallowwood, grey gum-white mahogany-grey ironbark and flooded gum with spotted gum prominant in areas of lower rainfall.

(ii) Hardwood forests of the south coast

The main forest type is spotted gum. Near the Victorian border large areas of coast ash occur, currently the scene of major pulpwood exports to Japan. In some of the better sites yellow stringybark and blackbutt occur in limited quantities.

(iii) Hardwood forests of the Highlands

These forests contain the light ash type eucalypts such as alpine ash at the higher elevations, brown barrel and messmate stringybark. Numerous other species including New England blackbutt, mountain grey gum, mountain gum and tallowwood occur in various locations.

(iv) Brushwood forests of the coastal regions

These forests have been extensively cleared in the past for farming (examples are the eastern Dorrigo and the area formerly known as the "Big Scrub" on the Richmond River). Some 4000,000 acres remain in the more inaccessible and steeper forest areas. The brushwood forests contain a rich variety of species, the more valuable being hoop pine, valuable species are extremely limited.

(v) Forests of the drier interior

The Great Dividing Range which runs parallel to the New South Wales coast for its full length falls off to the west in a series of comparatively gentle slopes which merge with the Western Plains. The greater part of this area has been cleared for wheat and sheep farming but some 2.5 million acres of forest remain. The principal forest species is white cypress pine mixed with various ironbarks and box species. Distinct from the cypress pine area are some 250,000 acres of red gum forests which occur along the flood plains of the principal inland rivers.

(vi) Softwood plantations

The major species used in the exotic softwood plantation programme is Pinus radiata. Planting is at present concentrated in the Central Tablelands (Bathurst), Southern Tablelands (Tumut), the Southern Monaro (Bombala) and the Southern New England Tableland. By 1970 the established plantation area was 191,437 acres which includes 3,791 acres of indigenous hoop and bunya pine plantations established on the far North Coast.

Currently there are 92.000 acres and 66,000 acres in Tumut and Bathurst zones respectively and nearly 90% of all exotic plantations are in P. radiata.

It is believed that the bulk of the commercially worthwhile timber country under the Crown is already State Forest, or in process of dedication. Nevertheless, there are still some substantial areas of Crown Lands and Leaseholds suitable for dedication on which investigations are proceeding and the Commission does acquire some privately held lands needed for specific purposes, particularly for pine plantations.

MANAGEMENT CONSIDERATIONS

All of the "secured forest areas" do not carry prime forest and about half is likely to be managed for commercial timber production on an "extensive" rather than an "intensive" basis.

Volume assessments and/or yields and management plans are a continuous job requirement and so far have been done for:-

Coastal hardwood and brushwood	2,197,000	acres
Red gum	218,000	"
Alpine ash	32,000	"
Cypress pine on State forests	1,104,000	"
" " " leaseholds	185,000	"
Part only of Eden area for pulp, currently	176,000	"
	3,912,000	"

In addition there is the 191,471 acres of softwood plantations for which yields have been calculated on the basis of their continued expansion at the proposed rates shown in Table 1 and it is hoped to reach 25,000 acres established per year from the mid 1970's.

TIMBER CUT IN NSW

From these "forested" lands of the State the cuts for various periods have been:-

Current cut for year 1969/70

(Volumes in millions su ft Hoppus)

	Sawlogs								
	Hard-wood	Brush-wood	Hoop pine	Cypress pine	Exotic	Total	Poles piles	Other timber	Grand total
Crown	301	38	4	37	59	439	70	88	596
Private	208	3	1	18	1	231	14	71	317
State	509	42	5	55	60	670	84	159	913

It will be noted that nearly 75% of the gross timber cut in NSW at present is in sawlogs.

By comparison cuts in the past have been:-

			Grand total including all timbers
1937/38	Total crown and private sawlogs	- 271 million s. ft	595) million
1950/51	" "	- 533 " "	779) super
1960/61	" "	- 632 " "	915) feet

If we were to analyse more detailed figures than I have listed above, it would be seen that over the past 20 years, the total Crown cut of sawlogs has increased by 55% while the cut of private logs has decreased by 8%. It seems likely in the future that more and more of the burden of log supplies for industry will fall on the Crown.

TRENDS IN TIMBER USAGES

While the main consumption of the forest product in NSW has been and still is for milling to produce sawn timber we may be expected to follow the world trends (Unasylva vol. 20, 1966) of:-

> "The growth in demand for manufactured goods has a particularly important bearing on the use of wood - which has become less a product for use in the round and more a raw product for industry".

To forecast what our future requirements may be and whether we are likely to have the resources to meet them, it is fashionable in forestry today to think of the "future" as the year 2000 AD. By this time the Australian population is expected to have nearly doubled and at the same time we are expected to become more affluent and thus in line with world trends, consume a greater amount of wood products per head than we do today.

In considering individual products, I regret that the figures quoted are not as up-to-date as I would wish and we might hope that the Standing Committee of the Australian Forestry Council may press through its Research Working Groups for closer and continuous review of trends of usage and likely future demands on the Australian scene, as a guide to what long term Forest Policy should be.

Sawn timber

It is thought likely that sawlogs for milling are likely to remain by far the largest single product from our forest for the foreseeable future.

The NSW current consumption per head is about 145 s. ft sawn and hewn which was lower than any other State.

The Australian average is about 152 s. ft and this is lower than the USA average of over 200 s. ft sawn.

There are controversial views on whether the Australian figure will rise to say 200 s. ft with increased affluence by the year 2000 AD or remain at about the present figure, or drop. It is not difficult to expect less consumption of products such as railway sleepers in the future.

In forecasting future sawlog requirements the figure of 140 s. ft and 200 s. ft sawn per year has been used in a table later in this paper to highlight the significant difference in log consumption involved.

Products from pulp

One thinks here of newsprint and other papers for printing, kraft wrapping papers, tissues, paper and fibre board containers as the multiple products into which pulp is reconstituted.

The Australian consumption is currently about 260 lb/capita/annum which is much lower than the comparable American figure of 410 lb.

However, by the year 2000 AD it is expected that Australia will have caught up with and surpassed the present American **per** capita consumption.

It appears on world trends that it is in this field where the log is broken down and then reconstituted into some particular product, that the greatest increases in the consumption of wood will occur.

Other products

Increases in consumption of the lesser important products of veneer, masonite, particle board are expected too. However, it is difficult to foresee that any increase in the demands for poles, piles, posts etc. will take place.

TOTAL ESTIMATED DEMAND IN YEAR 2000 AD

The overall anticipated future demand for wood from the forest at a particular time in the future must be the product of the increased population and any changed consumption per head.

By the year 2000 AD it is expected that the Australian population will be about 22 million of whom about one-third, say 7 million, will be in NSW.

Using the forecasts of population and consumption per head under various categories, demand in 2000 AD can be estimated at:

Product	Future consumption per capita	Future roundwood or log equivalent (millions s. ft hoppus)
Sawn and hewn timber	200 s. ft 140 s. ft	2204 1545
Ply and veneer	40 sq. ft	89
Newsprint	100 lb.)	318)
Printing and writing paper	65 lb.)	251)
Paperboard (corrugated boards, cartons etc.)	230 lb.)470)lb.	432) Total paper pulp 1,296
Other paper	75 lb.)	295)
Hardboard	60 sq. ft	115
Poles and piles		89 s. ft hoppus

Estimates of future consumption may be grouped into two main categories, the first requiring generally better class and longer rotation logs for sawing etc., while the second as cordwood for chipping, pulping etc. which may be from smaller or shorter rotation logs or from logs unwanted for sawing.

Consumption in 2000 AD
Total round timber or log equivalent

	Sawn timber consumption per capita	
	140 s. ft	200 s. ft
Logs for sawing, veneer, poles, piles	1,723 million s. ft	2,382 million s. ft
Timber for cordwood (pulp, flake and hardboard etc.)	1,311 million s. ft	1,311 million s. ft
Total	3,034 million s. ft	3,693 million s. ft

The table also highlights the need for better estimates of future sawn timber consumption if we wish to estimate total consumption more accurately.

FUTURE AVAILABILITY OF LOCAL TIMBERS

The expanded Softwood Plantation Programme under the Commonwealth Softwood Agreement got under way very satisfactorily in NSW in 1966.

The pattern of plantation expansion has been to concentrate initially on the Forestry Districts of Tumut and Bathurst where considerable areas of older plantations, dating back to the 1920's already existed and so to build up in a relatively short time, a sufficient availability of Pinus to attract integrated wood-using industries.

It is not until the 1980's that a significantly greater wood volume will become available at these centres, mainly as pulpwood class thinnings resulting from the substantially increased annual plantings from 1966 onwards.

In the indigenous hardwood forests, silvicultural treatment for natural regeneration of logged areas will continue, but in some cases the emphasis is changing towards artificial regeneration and planting with jiffy pot stock.

This particularly applies to the forest types not easy to regenerate naturally (such as some moist hardwood and brushwood areas).

It is proposed to give preference, with such money as may be available for artificial regeneration works, to a limited number of regions, one of which is Coff's Harbour where APM already have substantial areas planted with flooded gum (E. grandis) and some blackbutt (E.pilularis).

Having regard to the expanded softwood plantation programme and investigations in progress on native forests, the most up-to-date estimates of annual yields of sawlogs and pulpwood in New South Wales to the year 2000 AD are as below.

It is necessary to stress, however, that these forecasts assume the continuance of the softwood plantation programme as planned and that sufficient funds will be available too for the regeneration and treatment of our indigenous forests.

Availability - Estimated annual yield of timber in NSW
(millions of s. ft hoppus)

Year and commodity	Softwood plantations	Indigenous forests	Total
1970 Sawlog	66	665	731
Pulpwood	68	696	764
1980 Sawlog	139	645	784
Pulpwood	136	696	832
1990 Sawlog	191	645	836
Pulpwood	430	696	1126
2000 Sawlog	752	635	1387
Pulpwood	489	696	1185

This table highlights the significance of the part that softwood plantations will play in the future in the supply of forest products in New South Wales. By 1985 there should be some 5000,000 acres of these plantations established in the State and all of these will be contributing to the wood supply by the year 2000 AD.

By comparing the above table on "Availability" with the previous table showing "Consumption", it may be seen, there will probably still be a gap of over 462 million s. ft log equivalent, between what is expected to be required and what should be available and that NSW will have to continue to import much as it does today.

SELECTING TREE CROPS FOR FUTURE MARKETS

Forestry deals in the main with essentially long term timber crops on generally a quarter to half century rotations and sometimes longer.

Over such long periods changes in patterns of wood usage are inevitable, and centralised Forest Authorities should keep trends of industry under review.

When the agriculturist reviews future markets and decides that his stock and products need changing, the processes are relatively short term and more simple than for the forester, whose main markets are usually in the way distant future.

Even with the best of guide-lines on trends of world usage supported by the advice of persons such as might attend a conference as we have here today, the assessment of long term future requirements on the types of woods Foresters should grow, can be expected to contain elements of uncertainty.

I think it proper therefore, at this stage, that we should aim to produce in the main, wood with broad general purpose market adaptability, rather than a wider range of species with specialised usages.

In any case, it would be often less a matter of selecting species with special qualities than using species (either indigenous or exotic) which will produce an increment which will show a profitable return on the land available to the forester.

However, foresters are very conscientious of the need to grow the best crop they can for future requirements and in NSW we are undertaking tree improvement work in the following fields:-

Species trials

In our plantation programme in NSW we believe that we have tried out over the years either in pilot or commercial plantings every potentially useful softwood species that we have been able to get and we will continue to build up knowledge in this field of investigation.

Pre-eminent over a wide range of NSW is, of course, Pinus radiata, outstanding to the degree that on present knowledge I personally find it hard to accept that we should be undertaking more than experimental plantings of other species on sites where P. radiata will grow successfully, until such sites have been virtually used up.

Provenance trials

There are, however, a number of species which occur naturally over a wide range distribution in their own countries which have shown sufficient promise under NSW conditions for us to undertake provenance trials for the guidance of future generations of foresters.

The species concerned include the indigenous blackbutt (E. pilularis) and the exotics P. elliottii, caribaea, taeda, ponderosa and Douglas fir and provenances of seed have been or are being obtained.

The main interests here have been on growth rates and tree form, with little interest practicable in the wood quality of provenances at this stage.

Tree improvement

Tree improvement programmes have been undertaken in NSW with several species being used in routine planting programme. The major programme is with P. radiata and to a lesser extent with P. taeda; work with P. elliottii is virtually only an extension of the advanced QFD programme; and investigatory programmes are under way with E. grandis and E. pilularis.

The P. radiata programme is based on existing plantations in NSW; material from other States and NZ has been obtained but is currently kept separate in clone banks. Initial emphasis has been on obtaining trees of superior growth rate and form, and with timber properties meeting certain standards - above average basic density and fibre length, and a low incidence of spiral grain. Further wood testing is intended on the progeny. Spiral grain has so far been the main wood factor in eliminating selected trees from use in the orchard programme.

So far all NSW selections have been pooled for orchard establishment, though the majority of selected trees are from Tumut-Batlow. However, in future, orchards will be "regionalised" to some extent, even though the need for this has not yet been demonstrated.

The P. taeda programme is being followed in two directions. Firstly is a standard selection - seed orchard - progeny trial project, using selections from the Queensland plantations (because there are virtually no acceptable trees in NSW plantations). At the same time improved seed from some 70 US sources (seed orchard; seed production area; open-pollinated elite tree; controlled cross-pollinated) has been obtained, and stock from this is being planted to establish a form of seed production area-cum-provenance trial, with heavy roguing envisaged as the plants develop. In both cases the aim is to produce seed producing a fast-growing, well-formed tree with at least acceptable timber properties.

For the E. grandis programme, plantations on the central North Coast have been searched and 45 superior stems selected. In selection, considerable weight has been given to natural branch shed. The selections are finally to be increased to give 100 above average trees, and seed from these will be pooled and the subsequent stock used to establish 1 acre of seed orchard per year, the acre stand being felled after 10 years for seed collection and being replanted with selections from within the orchard. In the meantime, work on the grafting of E. grandis is continuing, and studies on breeding mechanisms, the inheritance of branch-shed characters, and frost-hardy E. grandis hybrids will be undertaken. Similar work will subsequently be commenced with E. pilularis when techniques are improved for E. grandis.

Tree breeding

We have not commenced any work in NSW to breed trees to suit particular purposes or conditions.

INFORMATION SOUGHT AND COMMENT

In our tree crop improvement work, we do like to be kept informed by workers in industrial research what wood characteristics we should be looking for.

At the same time the foresters need to keep under review the character of the wood they are growing or reproducing and whether within a species it may vary much according to locality. In particular with Eucalypts we should know to what degree the fast grown regrowth timber differs from that from the virgin stand.

In NSW we are undertaking such reviews through our Division of Wood Technology and the results when complete should have considerable silvicultural and industrial importance.

ITEM 1/2. FOREST RESOURCES (Q'LD)

SAWN TIMBER FROM NATURAL FORESTS

Hardwoods

In the area of hardwood milling activity the volumes available in the log sizes on which the industry has depended to date will diminish and there is an urgent need to be able to utilize to best advantage the smaller type of log which can be produced more economically and will thus become available in increasing proportion.

Within Queensland relatively small pockets of mature hardwoods still exist and are being tapped progressively with improving access, particularly in the central western and far northern parts of the State; but while they are important reserves they are relatively small in the overall State picture.

Apart from immediate problems of extraction and conversion, the utilization of small logs in some cases will involve a significantly changed pattern of utilization as for example with brush box and its traditional flooring market to which many of the logs will not be suited. Similarly log length and/or large dimension material will become increasingly difficult to produce from log supplies available.

Cypress pine

There are still large untapped reserves of cypress in the State which are currently beyond the range of economic operations but, as with hardwoods, improving access and growing demand is generating increasing interest in the fringes of these areas.

Knowledge of our cypress pine resource has expanded rapidly in recent years as a side benefit of the State Government's current policy of freeholding Crown lands and volumes now known to be available are much greater than previously believed.

This species now presents one of the best possibilities of bridging the supply/demand gap which will arise and it must enter to a growing extent the marketing fields now largely occupied by hardwood.

Rain forest species

The ability of industry to utilize a wider range of rain forest species is essential if the most economic use of our rain forest areas is to be possible. Volumes available in the southern part of the State would not be large but could still contribute significantly to filling the expected hardwood deficit, particularly in the framing market if problems of sawing and seasoning can be overcome. In northern areas of course this use, apart from local demand, would be limited by distance from market, but progressive thinking should allow the use in veneering of a wider range of species.

SAWN PLANTATION TIMBERS

<u>Hoop pine</u>

There is little scope for increased yield from hoop pine plantations over the next 5 year period and increases even immediately beyond that period will not be large. Increasing age of plantations and greater diversion of lower quality material to other uses will however result in a higher quality of saw log including some pruned material.

<u>Exotics</u>

While plantings of these species have increased substantially, much of the increase is already committed to industry both as pulp and saw logs. Some relatively large additional quantities will however be marketed in the near future in slash, loblolly and caribaea in the North Coast and Rockhampton areas.

The increased sawn output in these species will result in a rapid increase in their sawn availability over the next few years to replace diminishing supplies of both natural hoop and hardwoods in some markets.

OTHER MARKETS

Chips

Five feasibility studies are at present being carried out in Queensland in the Brisbane, Gympie/Maryborough, Ingham, Cairns and Weipa areas.

Sleepers

Normal demand has been increased periodically by demand of heavy sleepers for coal lines. Acceptance of a wider range of species has assisted in meeting demand and has considerably increased reserves of this material. However, local acceptance does not yet extend to treated sleepers nor to all species listed in the Standard but it is anticipated that requirements will continue to be met in the immediate future.

Mining timbers

An acute local problem which is arising in the coal mining areas of Central Queensland and is expected to increase as the proportion of underground mining grows.

Utilization of species not previously accepted and sawing from some very defective logs may ease the problem but in some areas it may adversely affect the life expectancy of some hardwood mills for saw logs, particularly in view of the extensive freeholding of Crown lands which occurring in the area.

ITEM 1/2. FOREST RESOURCES (SA)

A. AREAS: Gross acres

(1) Productive or potential

(a) Plantations

State forest reserves	
Planted	200,000 ac.
Plantable	23,000 ac.
Waterworks reserves	
Planted	3,000 ac.
Plantable	1,000 ac.
Local Government reserves	200 ac.
	227,200 ac.

•/fwd/.

	b/fwd. 227,200 ac.
Private company lands	
Planted	Ca. 53,000 ac.
Plantable	Ca. 10,000 ac.
Private woodlots	
Planted	Ca. 4,000 ac.
	294,200 ac.

(b) Natural forest* areas

State forest reserves	67,000 ac.
Other public lands	612,000 ac.
Private lands	1,169,000 ac.
	1,848,000 ac.

(2) Protective, under forest*

State forest reserves	3,000 ac.
Other public reserves	73,000 ac.
	76,000 ac.

B. PLANTATIONS: Net acres, softwoods**

Standing; including 1970 plantings

State forest reserves	177,700 ac.
Waterworks reserves	2,700 ac.
Local government reserves	200 ac.
Private company lands	Ca. 45,000 ac.
Private woodlots	Ca. 4,000 ac.
	229,600 ac.

*FAO definition as modified by Forest Resources Panel of Forest and Wood-based Industries Development Conference.

**Approximately 92% Pinus radiata, 8% Pinus pinaster. Hardwood plantation area negligible.

C. CURRENT AND FUTURE YIELD*: Softwood only

(1) State forest reserves

Region	Current cut		Expected yield					
	1969-70		1980		1990		2000	
	P	L	P	L	P	L	P	L
South-east	6.1	13.1	11.0	14.0	11.5	14.0	11.5	14.5
Other	0.3	2.1	0.7	2.3	0.9	2.5	0.8	3.0
Total	6.4	15.2	11.7	16.3	12.4	16.5	12.3	17.5

P = Pulpwood, Particle board logs, Preservation material.

L = Sawlogs, ply logs, 8" s.e. and over.

(2) Private plantation areas

Current cut, 1969-70

Pulp etc: Ca. 2.5 m. cubic ft**

Logs: Ca. 6 m. " " **

Future cut

Not known

(3) Hardwood yields

Current: Ca. 0.4 m cubic ft/year

Future: Not known

*Millions of cubic ft/annum

**Includes volume from Victoria feeding to the Mt Gambier region.

ITEM 1/2. FOREST RESOURCES (TAS.)

The most recent statement of Tasmania's forest resources was one prepared for FAO titled "Forest Inventory 1970". Relevant data from this is given below:-

1. Forest area of hardwoods and softwoods (1000 acres)

(a) Publicly owned			5,753
	(i) State forest	2,709	
	(ii) Other Crown forest	3,044	
(b) Privately owned			2,039
	(i) Forest industries	235	
	(ii) Farm forests	1,804	
		Total	7,792

2. Gross stand volume of hardwood forests (millions of cubic feet)

(a) Publicly owned	3,987.4		
(b) Privately owned	1,413.2		
	Total		5,401

3. Merchantable stand volume of hardwood forests (millions super feet H)

(a) Publicly owned			33,823
	(i) Sawlog	7,516	
	(ii) Pulpwood	26,307	
(b) Privately owned			11,987
	(i) Sawlog	1,998	
	(ii) Pulpwood	9,989	
		Total	45,810

4. Gross stand volume of softwood forests (millions of cubic feet)

(i)	7,700 acres carrying 3,500 + cu ft/ac.	26.95
(ii)	4,400 acres carrying 2,000 - 3,500 cu ft/ac.	11.88
(iii)	44,500 acres carrying under 2,000 cu ft/ac.	28.75
	Total	67.58

5. Merchantable stand volume of softwood forests (millions of cubic feet)

Pulpwood and sawlog	30-35

Due to the preponderance of younger age classes a high percentage of this material would be of pulpwood specification at present but will be grown on for a full sawlog rotation.

ITEM 1/2. FOREST RESOURCES (WA)

Present situation (December 1970)

Area of State forest	4.5×10^6 acres
Annual yield of hardwood sawlogs	40×10^6 cubic feet
Area of Forests Department plantations	71,500 acres
Yield from F D plantations, round logs	2.9×10^6 cubic feet
Population	One million
Per capita consumption	45 cubic feet

Future demand and supply

Demand		Unit	1970	1980	1990	2000	2010
Population at 2.6% increase		millions	1	1.3	1.7	2.2	2.8
Per capita consumption		cubic feet	45	45	45	45	45
Total consumption		millions of cubic feet	45	58.5	76.5	99	126
Supply							
Hardwood:	sawlogs	millions of cubic feet	43	40	40	41.5	43
	Marri chips	"	-	15	15	15	15
Softwood:	Over 9") TDL)	"	1	1	13	21	36
"	Less than) 9" TDL)	"	2	5	9	10	12
Total supply		"	46	61	77	87.5	105
Excess of production		"	+1	+2.5	+0.5	-11.5	-20

Per capita consumption has been as high as 65 cubic feet but the Australian average of 45 cubic feet (Jacobs, 1969) seems more appropriate to the long term.

Population increase is expected, because of flow from mining development, to be greater than the Australian average of 1.87% including immigration (Jacobs, 1969).

Future supply of hardwood sawlogs will be reduced slightly below present yield as some slight overcutting is terminated. Improved silviculture should give a small increase towards the end of the century. Supply of softwood logs will increase as a result of an annual planting programme of 6 to 8000 acres. By the year 2010 the plantation area should be about 300,000 acres.

ITEM 1/2. FOREST RESOURCES (NT)

A. Natural forests

Forests of the Northern Territory are found within a strip extending inland for a distance of between 10 and 150 miles from the northern coastline.

Estimated area carrying forest or woodland within this belt equals 25 million acres or 7.2% of NT land surface.

Total forest area complying with FAO definition (wooded area of greater than 20% canopy density) equals 10.4 million acres or 3% of N T land surface.

There are two main forest types:

Monsoon forest types, and

Tropical eucalypt forest, containing in areas, cypress pine.

Monsoon forest is very variable in composition and structure, ranging from true rainforest (pockets generally less than 500 acres in extent) to pure paperbark (Melaleuca spp.), sometimes covering hundreds of square miles. Because of limited area, true rainforest is not a commercial resource. Because of its extent paperbark will become an increasingly important resource for the NT sawmilling industry.

The eucalypt forest is by far the most important forest type in terms of utilizable volume. The three most commonly sawn species are:-

a) Northern cypress pine (Callitris intratropica)

b) Darwin stringybark (E. tetradonta)

c) Melville Island bloodwood (E. nesophila)

Cypress pine shows best development in areas with natural fire protection. It can occur in pure stands of up to 20 acres but generally occurs scattered through the eucalypt forest.

Darwin stringybark is widespread and in several areas occurs in extensive pure stands, e.g. Gove Peninsula.

Melville Island bloodwood is restricted to Melville and Bathurst Islands and Cobourg Peninsula. It is an important sawlog resource in these areas.

Utilization to date has mainly been restricted to sawlogs with a small volume being used by the treated post industry. This is expected to increase.

Current log intake is 2½ million super feet per annum.

Species composition is on the average 50% cypress pine, 40% eucalypt and 10% paperbark.

Log intake is expected to increase to 10 million super feet per annum within 5 years.

Large areas have potential for woodchip development. Division of Forest Products, CSIRO, have conducted pulping trials on the more important species. Results have been satisfactory.

B. Plantation establishment

A total of 4140 acres has been established to date. About 90% of this consists of northern cypress pine. The approved establishment rate is 1000 acres per annum.

There are three exotic species which show promise. These are: Pinus caribaea, Khaya senegalensis and Athocephalus cadamba. Plantation trials are currently being undertaken with these species.

C. Forest reservation and protection

At present there are:

119,000 acres of forest reserve

900,000 acres of land with forest potential being sought for permanent reservation

5 million acres of good forest land within aboriginal reserves. This has been protected from indiscriminate exploitation for the last 40 years because of legal controls upon the entry of Europeans. Action is being taken to ensure that these areas are preserved as productive forest land.

Discussion

There was general discussion on problems associated with the changing supply situation. It was felt that in many areas industry cannot be specific enough to spell out to finality what it will require in the future. It is necessary therefore for the forester to make an interpretation, and there is no point in industry saying in 20 or 30 years "we do not want this or that species". Industry can only provide a very broad indication of its needs and the research bodies should assist the forester where possible in interpreting these.

The problem faced by the forester in relation to "conservationists" and their not inconsiderable sway on forest policy was raised. This in turn brought the suggestion that the development of a soundly based land use policy would be of considerable benefit to the whole community, and would enable the more profitable use of land.

The question of regeneration on forested private land, particularly in Tasmania, was also discussed. There is considerable public concern that where a large volume of timber will be removed from such land, e.g. for chips, there should be some requirement concerning reforestation. It could be that some form of control is needed over private land which could be denuded in this way.

ITEM 1/3. METHODS OF FORECASTING FUTURE DEMANDS (NSW)*

The forecasts on which planning for this nation's future timber requirements is based all appear to estimate a per capita consumption of timber and paper pulp at selected dates, to convert these to a log equivalent, and by applying this figure to the estimated population at the selected dates, to derive a total volume of forest products (roundwood) estimated to be required. This has been further extended by dividing the total volume by the estimated mean annual increment per acre to derive a total area of forests to meet the demand.

In arguing the level of per capita consumption it has been contended that the usage of sawn timber has shown a steady decline and the figure which appears to have found favour is 140 su. ft per head per annum at the year 2000 and a slightly higher figure for the intervening periods. There are some who claim that such a figure is too optimistic and some lower one is more appropriate.

The long term predictions seem to have adopted the lower levels of estimated populations, and again some have argued that these figures are too high, in spite of the necessity for demographers to continually revise upwards their estimates.

Finally it is assumed that the level of imports will at least remain at the present rate.

This approach sets a disaster course. It will build up a volume of timber some time in the future which will probably be unsaleable because timber shortages before that time will have forced changes favouring alternative materials and methods thereby reducing the demand for timber.

Let us first look at the per capita consumption. On the basis of the timber availability in any one year divided by the country's population of that year, the per capita consumption rose from approximately 109 su. ft in 1935 to a peak of 166 in 1950 and has shown a steady decline to 134 in 1967. Smoothing out the peaks and hollows the trend appears to be from about 100 in 1935 to 142 in 1957 to 135 in 1967. These figures however, ignore the increasing percentage of the population in the under 20 age groups, groups in which the usage of timber is minimal.

If it be assumed that a person does not use timber until age 25, another figure can be obtained, that given by dividing the timber availability by the population 25 years prior to the year in question. This figure varies from 171 in 1935 to a peak of 219 in 1961 and falls to 204 in 1967. Again smoothing the peaks out the trend appears to be from 144

*Prepared by E B Huddleston

in 1935 rising continuously to 209 in 1967. Thus for future predictions a figure of 210 su. ft applied to a population 25 years prior to the year of estimate would appear reasonable.

On this basis, and applying the yield and cutting estimates supplied by management to our radiata pine plantations already established and planned, assuming that the indigenous forests will continue to produce at the present rate, and that imports will be available at the same volume as at present, the New South Wales position does not appear happy.

The estimate made in this way indicates a deficiency of 229 million su. ft in 1970 rising to 340 million in 1982, maintaining about this level to 1994 and falling to 65 million by the year 2000.

If one now supposes that shortage of timber reduces its market at least by the amount of the shortage and adjusts the predictions accordingly, the indications are that on volumes as above there will be a surplus for which a market cannot be found by the year 2000.

This is not the whole story. A careful look at housing programmes and predictions and a study of the size of logs likely to be available leads to the conclusion that in the years of critical shortage the scantlings will fall short of the proportion of total volume required, resulting in a volume of unsaleable boards because there is insufficient scantling to which to fix them.

If these predictions are true, and I believe they are, we should be looking at alternatives. Poplars grown on a 15 to 20 year rotation and cut primarily for scantling could have been the answer. It may not be too late now to start such a planting programme.

On present indications pulpwood does not appear to be critical, unless of course we continue to expand our export of chips and/or pulp. However, much of the available pulpwood may prove unusable because of its location in relation to the centres of pulpwood use.

ITEM 1/4. ROLE OF WOOD CHARACTERISTICS IN ELITE TREE SELECTION (NSW)

Examination of the wood quality of <u>Pinus radiata</u> and <u>P. taeda</u> has been made in connection with the Commission's tree improvement programme. Seventy six trees of <u>P. radiata</u> from the southern tablelands and nineteen trees of <u>P. taeda</u> from the north coast of New South Wales and southern Queensland were selected on the basis of form and vigour and were sampled from bark-to-bark.

The selection of wood characteristics was determined principally by the likelihood that the timber from the forests would be preferentially used in the solid form rather than as pulp or particles. Following guidelines established by the Division of Forest Products the measurements of the various wood properties were made on a ring basis. The measurement techniques were similarly based on those established by DFP.

With P. radiata, spiral grain, basic density, percent latewood, tracheid length and ring width were measured. With P. taeda spiral grain, basic density, percent latewood, approximate resin content and ring number of heartwood boundary were determined.

Inspection of the results obtained for P. radiata indicated that spiral grain was the wood characteristic most likely to influence wood quality and therefore should be given priority. A grain deflection of 7° was accepted as the criterion and the 76 trees screened. About half of the trees were rejected on this one feature. Inspection of the remaining trees indicated that to produce any real increase in either basic density or tracheid length would require further severe culling and this would reduce the number of plus trees to an unacceptable number for the seed orchard establishment. No further rejections of plus trees were therefore made.

Inspection of the results for P. taeda indicated that spiral grain was not as well developed as in P. radiata and if 7° was to be accepted as the criterion only 3 trees would be rejected. Inspection of the results also revealed a much larger degree of variation of basic density with age than in P. radiata for example 0.36 g cm^{-3} in ring 2 to 0.56 g cm^{-3} in ring 25 (means of 19 trees of P. taeda) as against 0.35 g cm^{-3} in ring 2 to 0.46 g cm^{-3} in ring 25 (means of 60 trees of P. radiata).

While the selections for P. taeda are not yet complete it is suggested that extreme variation in density is undesirable and selections for this characteristic will eliminate a further 2 trees. The trees in question have density variations of 0.31 - 0.59 and 0.32 - 0.60 g cm^{-3} respectively. This reduces the number of plus trees to 14. Further rejections on the basis of wood quality would appear to be impracticable for reasons stated above.

Selection on the basis of wood quality has been to exclude undesirable trees. While removal of the undesirable trees from the gene bank could be expected to improve the respective characteristics, limitations imposed by the relatively small number of plus tree selections and the lack of high correlation between such characteristics as spiral grain, basic density and tracheid length seem to prevent the theoretical gains in these properties being achieved in New South Wales.

ITEM 1/5. THE IMPORTANCE OF WOOD QUALITY EVALUATION IN FOREST TREE IMPROVEMENT (Q'LD)*

"It would appear obvious that improving wood qualities should be an integral part of any tree improvement programme" since "wood is..... ...... the usual end product sought". This statement opened a paper by Drs Bruce Zobel and R C Kellison at the recent IUFRO Congress. They then proceeded to discuss why the concept should be so controversial as to allow the exclusion of wood from some improvement programmes and to document benefits or limitations of improving wood genetically.

Most at this meeting are by now so familiar with the arguments and evidence presented in the past that previous ground will not be recovered in inviting discussion on this subject. However, the following items may be of interest:

(1) No one ever seems to question the potential for improvement in volume and form through selection and silvicultural and genetic manipulation, despite an array of evidence for the heritability of important wood characteristics at least as imposing as that for volume and form parameters. This may be because wood quality improvement workers readily concede the primary objective must be more recoverable wood, while others may not be quite as ready to concede the necessity to ensure that wood quality must not be adversely affected in the process or that there is an untapped potential for compounded wood weight and value improvement through selection for wood properties.

Another paper at the 1971 IUFRO Congress on the basis of ortet-clone relationships (and between clone/total variance ratios), ascribed a "rather limited value" to the examination of wood from trees selected for breeding.

In this study, none of the wood characteristics studied gave poorer relationships or ratios than the growth parameter, ring width. The results were, in fact, quite encouraging all round, providing quite useful estimates of <u>relative</u> gross heritability.

(2) Concerning the often expressed possible adverse effect of selection for vigour on wood quality, there are indications from slash pine progeny and hoop pine provenance trials that selection for vigour tends to be accompanied by some depreciation in certain wood characteristics such as spiral grain and fibre wall structure, but, in general, not in

*Prepared by W J Smith

others such as basic density, percentage latewood and fibre length. More vigorous families have been found to have lower density wood than those less vigorous, but the mean basic density of the improved stock did not differ from that of slower-grown routine stock, giving realised gains of up to 18.5% or 5.3 tons/acre at 14 years.

(3) Wood quality improvement can be more effectively done without detriment to improvement in volume production by second-stage selection from within the progenies of parents pre-selected for vigour, form and branching features. This has been demonstrated by the high heritability of wood features in general and of stem straightness in such populations, compared with a considerably reduced potential for further volume improvement. It has been found that almost the full range of variation in wood properties in the original base population remains in the progenies.

Gains of 300 - 500 lb/100 cu. ft of wood have been claimed for moderately intensive selection for basic density (Zobel and Kellison).

(4) Between provenance differences in wood properties could be more effectively exploited than at present. Differences of up to seven tons of dry wood per acre have been reported for loblolly pine (Zobel and Kellison). Whether this is at constant stocking and volume was not stated. Differences of up to 19 tons/acre have been found between 25 years old hoop pine provenances at constant stocking but much of this was due to volume differences. However, density differences alone, even in this uniform species, have accounted for increases of up to 3½ tons per acre or 7%.

(5) Genetics and silviculture must play complementary roles to secure maximum compounded returns and more knowledge is needed on the influence of ecological factors on wood properties and tree growth.

Basic density and percentage latewood in slash, Benguet and hoop pines have shown some general tendency towards increased basic density and percentage latewood as latitude and elevation decreases. However, factors having a more important influence on these wood characteristics in Pinus caribaea at least seem to be growth rate (negative) and temperature, precipitation, potential evapotranspiration, accumulated potential water loss, evaporation and sunshine hours (all positive).

The importance of investigating growth rate/wood property/ecological factor relationships has been highlighted by recent comparisons of the relative volume and wood weight per acre productivity potential of Caribbean, Benguet and slash pines throughout this State. The interacting infłence of edaphic factors on these relationships is obviously important, but has not yet been studied. Work in this area is needed, as also is further work on the effect of silvicultural practices on wood quality.

ITEM 1/6. ARE GROWTH STRESSES GENETICALLY CONTROLLED?*

Evidence of genetic control of growth stresses

1. Uniformity of growth stresses round the tree appear to be correlated with roundness and straightness, but the average stress level varies greatly from tree to tree and has shown no correlation with straightness, age, growth rate or environment.

2. Eucalyptus generally has greater stress levels than any other timber producing genus.

3. Some eucalypts appear to have higher stress levels than others, e.g. Eucalyptus nitens higher than E. regnans. A species may show generally higher levels in one region than in another.

The next question is:-

How economically important are growth stresses? To what extent can their amelioration make a better product and reduce costs of production?

1. Cause end splitting

2. Cause spring during sawing

3. Cause spring subsequent to sawing.

(a) Sawn timber - Even if use of solid wood is diminishing, it will still have a place after, say, 2 rotations, and in establishing stands for solid timber production, growth stresses should be considered.

(b) Veneer logs - Veneer production will also remain important and since this is effected by end splitting and drying problems, establishment of stands for veneer production should take growth stresses into account.

*Prepared by W M McKenzie

Prospects

1. Storage for six months has resulted in a 15-20% stress relaxation, with little further reduction at 11 months. It is not know how the stress varies over a long term, but it might be expected to show an exponential type of decay with diminishing returns from storage.

2. Average stress level does not appear as yet to have any survival or cultural advantage, so that it appears feasible to select trees with a stress level such as to give little trouble in conversion, and breed from these.

3. There appear to be connections between growth stresses and structure, shrinkage, density and modulus of elasticity, so that a simple method of stress measurement might be a useful means of monitoring wood quality.

4. Logs might be graded on appearance related to growth stresses, for various purposes in integrated stand utilization.

Discussion - Items 1/3 - 1/6

BRYANT: It seems that we could be neglecting the potential of the forest. Some forests are heavily overcut for wood chips whereas these areas could also increase the amount of milled timber available for scantling at the same time.

PARROTT: Forest economics are a most important consideration. Saw logs are worth more than pulp logs but we do not get the most efficient use of a log by sawing. New Zealand practice indicates that more money can be made by converting the log to pulp than by sawing it into timber. This would mean of course that in houses wood would need to be replaced by some substitute so that forestry could confine itself to the most profitable areas.

BRABIN: I feel we should find out why the per capita figure consumption of wood in this country is lower than that of similarly developed countries.

HUDDLESTON: It is predicted that in the years 1975-1990 there will be a shortage of timber. Because of that some of its traditional markets will be lost and thereafter there will be a continuing decrease in per capita consumption of wood.

KAUMAN: When shortages arise it does not necessarily follow that future markets are prejudiced. Also I feel we should look more closely to coppice growth as a source of timber. We must remember that the supplies of timber from South East Asia may not be bright in a few years time.

BRYANT: Further work could be done on tree breeding particularly to gain uniformity in the species.

DOWDEN: Just as agricultural research is still trying to improve their raw material, foresters also should attempt to improve their material by tree breeding.

HUDDLESTON: I cannot see any improvement in the timber quality in the near future but it will become available in the next century. An example of what we can expect is the way the rubber production has been increased by some 700% in Malaysia by a tree breeding programme.

BALODIS: Some attention should be given to the breeding of New Guinea species. Eucalyptus deglupta is a fast growing large tree which can be grown from cuttings. It does have a very wide density range so that there is an opportunity here for selection for high density and high growth rates.

HILLIS: Recent work in the United States has indicated that it is cheaper to change fibre properties during tree breeding programmes than to institute modifications of the pulping procedure. Some forests are being planted for special purposes as required by certain pulp mills.

EDGERLY: I would advise against too narrow a limitation in regard to properties. The main criteria is to grow wood as cheaply as possible. At the present time there are large areas of land which would give a better return by growing of forest than by grazing cattle and sheep.

SMART: Uniformity, yield and production are the most desirable features for all forest projects. "Last year" seed stock is just not good enough and further attention must be given to the provision of continually improving seed.

PARROTT: Further attention should be given to learning to grow from cuttings. Dothistroma can be controlled by spraying but now it is found that one can propagate cuttings of certain pine trees which are resistant to this disease almost as cheaply as praying.

BROWN: We will make effective progress if the objectives are kept as simple as possible. We need straight and vigorous trees and when one begins to add additional objectives then the difficulty in satisfying all objectives increases greatly.

In addition the desirability of that extra objective may be changed by the time the tree is ready for harvesting.

LEWIS: Greater gains have been achieved in breeding slash pine than in any other species. After 30 years of tree breeding work we cannot get the gains that have been experienced in Queensland.

SMITH: There is no real reason why Pinus radiata cannot be improved further. We cannot wait for industry to decide what properties it needs. The foresters themselves must do this if industry cannot or will not. Everyone appears to be happy to have improvements in uniformity and growth. Some workers have shown that on a 2-stage rotation of 28 years the tree breeding costs were 0.5% of the total. Gains of 300% in yield are obtainable without detriment to wood quality by selection and optimum siting of species, provenances and families.

There was general discussion on the subject of growth stresses, and it was felt that whilst longitudinal stresses had the greater apparent effect on the incidence of defects in sawing, radial stresses were considered to be equally important. Mr Page indicated that there was little apparent relationship between growth stresses and the way a tree grows, but that anatomical features and genetical factors exerted considerable influence.

It was agreed that more work is needed in relation to development of growth stresses and their effect on utilization.

ITEM 2/1. HARVESTING - A REVIEW OF RESEARCH AND DEVELOPMENT ACTIVITIES*

Over the past two years the work of the Logging Research Section has been largely directed towards those operations where major expansions are anticipated, i.e., with the development and evaluation of harvesting techniques applicable to plantation thinnings and pulpwood operations in our native forests.

The barking of fibrous barked eucalypts. A study of hand barking made in conjunction with the Division of Forest Products, indicated that the main requirement was for a means of reducing the cost of barking wood of less than eighteen inches in diameter; the barking of the larger logs by hand proving to be no more expensive than hydraulic barking. However, increasing wage costs will influence this break-even point and large scale operations will favour a higher level of labour productivity.

*Prepared by C M Kerruish, Forestry and Timber Bureau, Canberra

The cost of barking by hydraulic debarker has been obtained from an investigation of two Tasmanian installations. These costs also proved sensitive to log size; with logs of fifteen inches in diameter 11 cents per ton.

A debarker of the rosserhead type has been constructed and an evaluation of its performance is about to commence. It is anticipated that this unit will cope with diameters of from six to thirty-six inches.

However, the basic problem is that of debarking the smaller dimension material in large scale operations, and as the rosser head machines are slow, the higher line speeds of the ring type debarker suggest that further developmental work with this type is warranted.

Limited trials with a harvesting machine in plantation grown eucalypts have indicated that under plantation conditions very effective barking can be achieved by the stripping action of the limbing head, fitted with suitable knives to replace those used for limbing. Such a technique was equally effective on both Eucalyptus regnans and E. obliqua. Further work is necessary to establish the effectiveness of this technique under adverse barking conditions.

Splitting. Various methods of splitting eucalypts are currently being examined, including manual methods and mobile and stationary splitting machines. Preliminary results suggest that under certain conditions, splitting is a less costly means of breaking down large logs, than sawing. Work on this subject is continuing.

Forest transport. Investigations of skidding operations were undertaken in the Southern regrowth and old-growth forests of Tasmania, to determine the variation in skidding costs per unit distance for a range of slopes, using various types of crawler tractors and a skidder. The cost data obtained was used in calculations to determine the optimum spacing of forest roads.

In a study of several types of wheeled forwarders being used in plantations, a correlation between stand variables and performance was established to enable the performance of various machine types to be predicted. The low cost of moving wood by this means of forest transport was established. Where the machines can be fully utilized, the superior performance of the larger forwarders was demonstrated.

Cost at roadside with 200 yd lead distance:

For 45 hp forwarder = \$0.80 per ton

For 105 hp forwarder = \$0.60 per ton

The widespread occurrence of small log quotas in Australian native forests together with a wide variation of log sizes in these forests, compel hardwood loggers to use machinery which can cope with the heaviest logs. These machines are costly and the logger can afford only one machine, which must be versatile and be able to doze roads, landings and snig tracks, and snig and load logs.

The Logging Research Section has developed a versatile track-laying logging machine from a standard front end loader by fitting a special dozer blade with log clamps to the loading arms and an integral arch to the winch. This machine has demonstrated its adequacy in the amount of earth-moving required in logging, and its ability to improve production because of its superiority in log loading when compared with the conventional crawler tractor fitted with bulldoze blade and winch. It can load logs 3 times as fast as loading by blade and can increase daily output by 20-40 per cent, depending on the number of trucks it has to load.

Cutter studies. A comprehensive time study of 42 cutters in late thinnings has established the influence of such variables as tree volume, volumes per acre and logging method, permitting a prognosis of cutter production to be made. Of particular interest is the wide variations in productivity between the cutters, with the best men having an output three times higher than the worst.

A similar study was completed in South Australia involving both sawlogs and pulpwood. The results highlight the low productivity associated with the cutting of 4' pulpwood.

The development of pulpwood harvesting methods in plantations. Recent silvicultural research into the influence of row thinning, as opposed to selective thinning suggests that volume production is not adversely affected by the former practice. This technique has been explored by designing, constructing and evaluating a harvester with the cooperation of Australian Paper Manufacturers Ltd. and the Windsor Engineering Pty. Ltd. This machine has demonstrated the feasibility of fully mechanising the harvesting of first thinnings on slopes of up to 15°, provided site preparation is adequate. Costs of producing wood in tree length bundles of about 60 cu. ft are approximately 75% of that of the manual cut-and-pile method, although some further processing may be necessary, depending on mill installations.

The machine has also been tried on an experimental basis in plantation-grown eucalypts. The need for high shear pressure because of increased wood density was apparent, but the results obtained indicated that it may be feasible to produce barked and bunched tree lengths for about $2.50 per ton.

Two selective thinning techniques were tried on a limited operational basis; it was shown that a technique involving the cutting and stacking of pulpwood in random lengths (between 12 and 18 ft) increased cutter productivity 90% above that of the current 4 ft wood operation. Of particular interest was the higher merchantable volume recovered per acre.

Partial limbing of both pulp wood and sawlogs has been shown to be capable of achieving a significant increase in cutter output. Such a technique, whixh involves felling the tree and using the chain saw to top and roughly limb the stem, is considered to be particularly applicable to plantations close to the mill with short lines of communication between forest and mill. The commercial acceptance of this technique awaits the development of a limbing mechanism that can operate ahead of a debarker at the mill.

Logging damage. The introduction of more mechanised means of harvesting can result in a higher level of damage to the remaining stems. An investigation in the Tumut district established that the damage level following the introduction of a long length logging technique to first thinnings was initially very high (16.5%). However, this declined to 7.8% of the remaining stems being damaged, as those concerned with the operation became familiar with the technique. On the basis of the species' known response to mechanical injury, it is estimated that the maximum loss of volume over the rotation would be less than 0.4%, if 10% of the remaining trees were damaged.

Future requirements. In general terms, effective work in the harvesting area will require a wider approach to the problem. All forest operations must be considered as most are inter-related, e.g. harvesting is influenced by establishment practice; haulage costs by plantation design, etc.

The need for a methodology covering forest operations and work study is evident. The definition of techniques, machines and units of measure is needed, to permit an accurate and uniform recording of productivity. This will assist in the compilation of more basic data on the performance of men and machines in the forest to aid in planning all forest operations.

On a project basis, it is considered that the following matters require further investigation:-

The problem of harvesting a higher proportion of the native forest, and the development of techniques capable of handling the extremely variable dimensions and quality of that resource.

The evaluation of harvesting techniques applicable to early thinnings and short rotation crops with respect to the influence of stand variables on harvesting costs, and the development of mechanical techniques applicable to both selective and non-selective harvesting.

The evaluation of the influence of logging method on the value of the products recovered from the forest. For example, do certain methods which may be chosen because of the low harvesting costs, limit the number and value of the products which can be recovered from the stand?

The evaluation of the long distance transport of logs; the effect of spacing, standard and slope of roads; axle configurations and design of prime movers; with the view to achieving an efficient transport system.

ITEM 2/2. HARVESTING - SOME PROBLEMS OF FOREST UTILIZATION

The Forester has often had problems in obtaining the ideal utilization of his bush. With few exceptions there has always been a gap of varying size between the silviculturalists' ideal and the achievable reality and in NSW this gap is of sufficient magnitude as to cause much concern in certain areas.

Two specific situations are mentioned to illustrate this point:-

(a) On the NSW North Coast there has been a change in emphasis in forest management policy. Rather than spread somewhat thinly the Commission's silvicultural resources more or less evenly throughout the whole range of forests, species types, economic zones etc., the present policy is to establish hardwood plantations principally of blackbutt and flooded gum.

The rate of establishment will be generally in the range 1,000 to 3,000 acres per annum and clearing such areas will require the destruction or utilization of significant volumes of cellulose: Which is it to be?

(b) Cypress pine has regenerated in many areas of NSW in dense stands which tend to stagnate or at best grow very slowly unless heavily thinned.

Since 1946 much of the thinning has been done commercially but the Commission has recently decided to assist the cypress pine sawmilling industry, which is in a decidedly unhealthy state, by raising the compulsory minimum log size to 7" c.d.u.b. (i.e. approximately 20.5" c.g.u.b.). The volume of logs below 7" c.d.u.b. previously taken by millers in Baradine District for example represented about 14% of the total cut. Here is more cellulose for the using or wasting.

How can one harvest and use these forest products economically? Are there ways in which the forester and wood technologist can jointly make presently unpopular material more appetizing?

Discussion - Items 2/1 and 2/2

There was agreement on the need for cooperation amongst the research bodies on this topic, and there was discussion on various aspects of barking.

WOODHEAD reported briefly on trials carried out in cooperation with SA Woods and Forests Department and Bunning Bros. in Western Australia. Various types of logs from WA were put through the ring barker at Mt Gambier. The results were not entirely satisfactory, but he felt that the machine could be adapted for the purpose, but this solution would be costly. He also suggested that the scraping principle appeared to have promise for forest debarking.

WATSON indicated that the debarking of eucalypts is a problem in other countries as well, even where labour costs are relatively low, and research in this area would be of wide interest.

BRYANT said that disposal of bark is a big problem in any large scale debarking operation and it was essential to find some avenue of utilization. He indicated that, for example, the bark of *Eucalyptus sieberi* contains polyphenols and fibre, and the potential value of such by-products could be the subject of cooperative investigation by F & T B and F P L.

COWAN asked that F & T B supply them with whatever reports they have to act as a guide, as work study in all harvesting fields was particularly difficult.

On the question of evaluation of harvesting techniques, Mr Edgerley said that a study was made by ACT Forests to measure the benefit of mechanical harvesting. The use of the harvester increased the value of the remaining stand by an average of $30. He requested that consideration be given of the widest implications of new harvesting methods.

HUDDLESTON suggested that a sufficient quantity of material concentrated in any one place could create its own market. He further suggested that restoration of shipping facilities to allow for barge traffic on the NSW coast could also facilitate utilization.

There was some discussion on the siting of plantations in relation to markets, but the feeling was that this hinges on better land use planning.

BRYANT indicated that NSW had decided not to extend flooded gum plantations as the trees are proving too faulty for sawing, COOK added that they preferred to plant blackbutt but it is harder to establish than flooded gum. Work on tree improvement on flooded gum was currently in progress.

KERRUISH in summing up said that it was obvious that more collaboration is essential in the area between the activities of the forester and the sawmiller. This has been totally inadequate in the past, and in other countries, particularly Scandinavia, a big research effort was put into forest operation. He also agreed that there should be more discussion on debarking with a view to closer cooperation.

ITEM 3/1. WOOD CHIPS FOR EXPORT*

Japanese demand for chips

The Japanese pulp and paper industry is undergoing a difficult period just at the present time, with a slack market and some temporary cut-backs in production, but the longer-term picture is one of rapid expansion, and it appears that there will be a large market for imported wood chips for many years to come. For example, in the ten years up to 1969, the paperboard industry more than trebled. In 1969 paper and board production reached 11.3 million tons (an increase of 13.6% over 1968), and pulp production reached 7.7 million tons (an increase of 12%). Particularly large increases were recorded for printing paper (21%) and container board (19%). The use of hardwood as pulpwood has increased from zero in 1950 to 58% in 1969, and chips have been replacing logs as the raw material delivered at the pulp mill, the chips having reached 71% in 1969.

It was estimated in 1970 that paper and board production would undergo a nearly three-fold increase, from 12.2 to 35.4 million tons from 1970 to 1990, accompanied by a corresponding rise in pulpwood consumption from 29.7 to 86.7 million cubic metres. It was anticipated that

*Prepared by H G Higgins

domestic pulpwood production would rise from 20.9 to 31.2 million cubic metres over the same period. Forests already cover 68% of Japan. The pulpwood deficit in 1969 was met by imports of wood and pulp; the pulpwood imports (92% in the form of chips) represented 17% of the total pulpwood consumption and this was expected to rise to nearly 60% by 1990.

Sources of chips for Japan, other than Australia and New Guinea

At present Japan is importing chips from the west coast of the United States and from Alaska, Malaysia, New Zealand and Australia. The American exports commenced in 1965 and the main species are Douglas fir, hemlock and spruce. It is said that no very large increases in chip exports can be expected from this region. The countries of south-east Asia which have large resources of tropical forests, e.g. the Philippines, Indonesia (particularly Kalimantan and West Irian) and Malaysia are potential exporters of wood chips to Japan. The Japanese mills have had some experience in pulping a few tropical species, particularly lauan, which is available as chips from sawmill and plywood mill waste. Rubberwood is also being chipped in considerable quantities at Port Swettenham in Malaysia. Mangroves constitute another large resource.

The coniferous forests of the northern part of the Soviet Union might be thought of as a source of chips for export to Japan, but it appears that there are a number of difficulties, including the wood requirements of the USSR for internal industrial growth, the remoteness of many forests from centres of population with consequent long transport hauls, the fact that many of the northern ports are shallow and ice-free for only four months of the year, and the difference in economic structure between the two countries.

In New Zealand wood chips are being exported through the port of Nelson, the agreement providing for the supply of 200,000 tons of chips per annum for seven years from 1969. The wood species include a number of conifers and beech (<u>Nothofagus</u>); areas to be clear felled will be replanted mainly with radiata pine. The chipping plant, with hydraulic debarker, is about 10 miles from the wharf area.

Reports have appeared in relation to the possibility of Japan importing eucalypt wood chips from South Africa, through Durban, and from Brazil. India and some Pacific islands have also been suggested as possible chip suppliers.

Pulpwood available in Australia for chip export

The pulpwood resources of Australia have been only partly utilized by existing pulp mills, the first of which was established only 33 years ago. At present, excluding hardboard production, eucalypts are pulped in six Australian mills, four in Tasmania and two in Victoria, and by six processes: kraft, neutral sulphite, soda, cold soda, groundwood and chemigroundwood. In Victoria, eucalypts suitable for chipping and pulping, from the stringybark, gum and peppermint groups are available in East Gippsland in quantities suitable for chip export, and the major impediment appears to be the lack of adequate ports. In New South Wales, which at present has not a single pulp mill, 74 million cu. ft per annum is available, some of which is committed to chip export, hardboard production and a paper company's forest programme, but a large quantity of which is not being used and is not committed. The establishment of new wood chip or pulp industries, particularly on the North Coast, could have considerable economic benefits to the sawmilling industry. Tasmania is already reaching an advanced stage of development in chipping and pulping enterprises. The softwood economy of South Australia is providing an integrated forest products industry, including two pulp mills. In Queensland the present production of chemimechanical pulp from slash pine represents only a small usage of the softwood resources which are becoming available in the south-east of the State; pulpwood will be available from plantation thinnings of slash, loblolly, Caribean and hoop pine. Considerable quantities of eucalypts of intermediate and high density occur respectively in the south and central coastal regions, and in the far north. Semi-tropical rain forests are also found in the northern coastal regions. Queensland is served by many good ports and the feasibility of chip export would seem to depend principally on the amounts of wood available in particular areas. Western Australia has no chipping or pulping industry, but attention is being given to the possible export of chips, principally marri, through the port of Bunbury. In the Northern Territory, large amounts of high density eucalypts are available, and considerable attention is being paid to the possibility of incorporating pulp from these species in furnishes for various end uses, and to the properties of blends of pulps from high and low density species.

Chip export projects in Australia

Projects under way in Australia at present include the following:-

Location	Company	Commencement	Period (years)
Eden, NSW	Harris-Daishowa	1970	20
Triabunna, Tasmania	Tasmanian Pulp and Forest Holdings	1971	15-18

cont'd./

Location	Company	Commencement	Period (years)
Long Reach, Tasmania	Associated Pulp and Paper Mills	1972	11
Long Reach, Tasmania	Northern Woodchips	1972	15

It is planned that each of these enterprises will supply 600,000 to 700,000 green long tons of chips per year after an initial period and in some instances the amounts could be considerably higher. Each project will provide employment for several hundred people. In at least three of the statements issued reference is made to the fact that a new pulp mill is envisaged, within periods of from 7 - 15 years. The Triabunna project is thought to be based on the supply of 66% old wood and 34% regrowth at an average basic density in the vicinity of 34 lb/cu ft. The Northern Woodchips project is to be supplied from sawmill residue and privately owned forest lands.

The pulp and paper industry in Japan

The Japanese pulp and paper industry shows a number of technical features which are relevant to the international wood chip trade. These include:-

(a) Diversity of materials, processes and products in the same mill

(b) Decline in sulphite pulp production from over 40% to about 10% over past 20 years

(c) Rise in production of bleached kraft pulp from almost nothing to nearly 30% over the same period

(d) Increase in use of hardwoods, and experience of the industry in hardwood pulping and use of hardwood pulping and use of hardwood pulps

(e) Use of 100% hardwood furnishes and light beating associated with this procedure

(f) Increase in production of printing papers

(g) About 80% of printing by off-set process, where surface picking of particular significance

(h) Importance placed on printability, pick resistance and ink gloss

(i) Extensive research on use of synthetic materials for papermaking

(j) Critical level of air and water pollution in many areas

(k) High level of research and technical activity

The types of pulp into which imported hardwood chips might be converted in Japan are as follows:-

Bleached kraft (sulphate)

Unbleached kraft

Neutral sulphite

Cold soda

Possibly dissolving pulp

For various reasons it is not likely that these woods would be used extensively for sulphite pulp, groundwood or refiner groundwood.

Paper products in which they would be most likely to be used in substantial quantities include:-

Printing papers

Writing papers

Liner boards

corrugating medium

Wrapping papers

Possibly tissues

The requirements for these products differ widely and a particular resource may well be eminently suitable for a particular end use, and be of limited value for another.

The structure of chip export enterprises

Chipping and associated activities in the exporting country can be organized in various ways, involving differing degrees of local equity, loan capital, etc. In the case of a locally-based company purchasing wood from State forests, agreement must be reached with the forest authorities on the one hand regarding royalties and other matters connected with the supply of wood, and with the purchasing company, on the other, regarding chip quality and price, either on an FOB basis at the port of shipment, if the chips are to be sold there (which is the more usual arrangement) or on a CIF basis if the chipping company delivers the chips to the buyer's port. The royalty will depend on a number of factors, such as the degree of roading and other development which is to be undertaken by the forest authority. As in the case of timber for sawmilling it is often expressed in cents per 100 su. ft, whereas the FOB price will usually be expressed in dollars per BDU (bone dry unit, equivalent to 2400 lb of oven-dry wood). The royalty R in cents/100 su. ft true volume is equivalent to \$(2.88R/D) per BDU or \$(46.08R/d) per BDU, where the average basic density of the wood in lb/cu ft is D, and in kg/cu metre is d.

In addition to State forests, pulpwood may be obtained from private land or from sawmill residues at a negotiated price. The mill waste, including slabs and edgings, is apt to contain less heartwood than the older trees available as pulpwood, and will thus be preferable in respect to pulp yield, chemical requirements, black liquor quality and probably pulp quality. On the other hand this material will usually be inferior to regrowth thinnings.

The main operations in the production of chips for export are:- logging, hauling, debarking, chipping, chip storage and loading, and these, together with royalty and profit, constitute the main components of the cost-plus approach to FOB price. Technical aspects to be taken into account include special problems in removing bark from some species, microbiological deterioration of chip piles, loading techniques, etc. It is necessary, in designing chip mills, for engineers to give close attention to the nature of the raw materials, since methods suitable for softwoods may be inappropriate for eucalypts or tropical hardwoods. The location of the chip mill relative to the port also needs careful consideration in terms of noise, smoke and cost of transport. Among other problems requiring study are the likely ecological effects of the forest operations, particularly where clear felling is envisaged, the location of the chip mill in relation to possible future pulping operations, reafforestation, and of course the nature of the existing or projected port facilities.

Technical factors related to the value of chips

The value of wood chips for pulping depends in the first instance on the following factors:- freight costs, pulp yield, pulp quality, and processing costs. These in turn depend on a number of technical and operational factors, of which the principal ones are:

Freight costs

- Basic density of wood
- Transport distances
- Size of ship

Pulp yield

- Extractives content of wood
- Lignin content of wood

Basic density of wood

Processing variables

Uniformity of chips

Pulp quality

Bleachability

Beating response

Runnability on paper machine

Mechanical properties

Optical properties

Surface properties

Structural properties

Processing costs

Chemical requirements

Heat requirements

Digester productivity

Chemical recovery problems

This approach is mainly in relation to chips to be pulped by chemical processes. It refers also to evaluation of a proposed wood resource in comparison with established resources of known value. The alternative cost-plus approach would be concerned mainly with production costs up to the point of chipping. The value of the wood chips is most sensitive to pulp yield, which must be compared at a constant degree of delignification, usually expressed as kappa number, and to freight costs. The pulp quality is not an absolute property, but is related to the end use. For example pulps which are quite suitable for linerboard manufacture may not be eminently suitable for the production of bleached papers for printing, where surface and optical properties are of high significance. Large vessels which give rise to picking problems in off-set printing, or extractives which resist pulping or bleaching processes, thus causing spots in bleached papers, may well limit the range of usefulness of pulp from a particular species. Such problems can often be overcome technically, but at a cost which may detract seriously from the value of the raw material.

In evaluating a specific forest resource for the production of wood chips for pulping, techniques have been developed for obtaining a composite sample for study, so as to obtain the maximum amount of information for a given expenditure of time and money. A rapid, but less exact, evaluation may be made by a summation of data obtained from individual species, not necessarily from the area under examination.

ITEM 3/2a. PULPING OF NSW EUCALYPTS*

Pulping and papermaking trials have been made on four of the more common eucalypt species growing in south-eastern New South Wales. Four species were examined viz. Eucalyptus cypellocarpa, E. maculata, E. muelleriana and E. sieberi and for each species the material collected consisted of a young regrowth tree, a tree in the medium age group and an old overmature tree. All of the above trees were provided by the Forestry Commission of NSW. In addition to these, three logs of E. cypellocarpa covering covering the same age and dimension range, were supplied from logs collected by the Harris-Daishowa chip project.

Sulphate pulps were prepared from chips made from the regrowth tree of each species and from a composite sample of chips made from the young, medium and old trees of each species, the relative amount of chips from each type of tree being proportional to the cross sectional area of the log.

In all cases it was found that the young wood could be pulped under milder conditions (less alkali) and gave pulps with higher yields and with better strength properties than the chips from the composite sample. All four species showed the same general pulping pattern. There was no evidence that E. cypellocarpa, which is alleged to be a poor pulpwood species, was inferior in pulping and papermaking properties to the other species examined.

Tests were also made on the swelling characteristics of the black liquors from the different cooks. Mill experience has shown that black liquors with good swelling characteristics give no serious problem during the concentration and burning of the kraft black liquor in the recovery plant. For all species the swelling characteristics of the black liquor from the young wood were superior to the old wood black liquors. The black liquors from the composite samples of E. cypellocarpa and E. muelleriana had very poor swelling properties and the regrowth E. cypellocarpa was inferior to the other regrowth species in this property. These findings would give some support to the contention that chip mixtures containing large amounts of E. cypellocarpa give rise to problems in the recovery plant.

*Prepared by A J Watson

ITEM 3/2b. PULPING OF NEW GUINEA SPECIES*

Pulping studies on tropical woods have been carried out for a long period at the Division of Forest Products. New Guinea hardwoods have received particular attention and during recent years tests have been mainly concerned with relatively low density woods from Papua and B ougainville Island. Satisfactory yields of sulphate pulps with strength properties generally similar to pulp from mixed ash type eucalypts were obtained from timbers such as Alstonia scholaris, Sterculia conwentzii, Flindersia amboinensis and Mangifer minor.

However, this work has been very much in the nature of a preliminary survey carried out at a time when no particular commercial utilization of the New Guinea forest areas for pulp production was immediately apparent. Now, with the possibility of the exploitation of a number of forest areas totalling more than 1½ million acres for chip production in the immediate future there is a new emphasis on the potential of mixed tropical hardwoods for pulping. CSIRO, in association with the Department of Forests, TPNG, is investigating the pulping and papermaking properties of the wood resources in the Vanimo Timber Area (VTA).

The VTA covers ca. 600,000 acres and is divided into 6 blocks. All blocks may not prove economically productive, but adjoining forest resources can probably be utilized. Block No. 6, the one closest to the potential harbour site and expected to be logged first contains over 170 hardwood species but the 24 most commonly occurring woods make up 69% of the total volume. These include:- Intsia spp., Pometia spp., Myristica spp., Celtis spp., Terminalia spp., Homalium spp., Palaquium spp., Pimeleodendron spp.; a wide range of girth classes is present (1.5' to 7' GBH) and both hill and lowland rainforest areas occur in the block.

A representative sample has been collected from the Vanimo Timber Area. This involved the cutting of ca. 2400 disks from individual trees and was carried out in conjunction with the Forest Inventory survey by the Department of Forests. The wood representing Block 6 is at present being chipped for the preparation of composite samples for pulping tests. Such tests will take into account the overall wood resource present in the block and also the quality variation expected if certain utilization plans are adopted.

Pilot scale chip storage piles have been studied at Vanimo. Approximately 35 hardwood species from lowland rainforest within 5 miles of the Vanimo township were included in the wood sample used for storage work but

*Prepared by F H Phillips

this would not be considered as fully representative of the whole timber area. Pulping tests have been carried out on unstored control samples and on chips stored at various positions in the pile for periods of 2 and 4 months. Unbleached sulphate pulp from the unstored mixed hardwoods was similar in papermaking properties to pulp from temperate zone eucalypts, although the tropical wood pulps were obtained in lower yield (ca. 2%) and required more beating to develop strength levels than the eucalypt pulps. Bleached sulphate pulp with high brightness and satisfactory strength properties was produced from this mixed tropical hardwood chip sample. However, further tests to evaluate suitability for fine paper production are required especially because the chip pile sample was biased in favour of small young trees.

A preliminary assessment of unbleached sulphate pulps made from chips stored for 2 and 4 months in the pile indicate that the stored wood was readily converted to sulphate pulp using the same conditions as required for unstored wood. Although there was a slight increase in Kappa number, the pulp yield, based on weight of stored wood, showed no change and there was little change in paper strength properties due to storage.

A considerable number of wood species occurring in both the Vanimo and Gogol Timber areas, including those considered to be the most abundant, have been pulped individually by the sulphate process. There was a variation in the yields and Kappa numbers of the pulps from the different woods but generally all pulped satisfactorily. The properties of these unbleached pulps are being evaluated and although strength properties would be considered adequate for a wide range of paper products, further attention is being given to those properties which are important for bleached pulp production and subsequent fine paper products.

ITEM 3/2c. SAMPLING OF TPNG TROPICAL HARDWOOD FORESTS FOR PULP YIELD*

The aim of sampling is to select a sample at the minimum cost which will yield sufficiently accurate estimates of the property under investigation. We applied this principle to the formulation of a sampling plan for the Vanimo Timber Area in the West Sepik District in TPNG. The initial plan was based on the variability of basic density in tropical hardwood forests. A random sample in which every tree on each available plot is sampled was found to be inefficient as regards the minimization of sampling costs. In a random sample most of the wood samples would be taken from small

*Prepared by V Balodis

trees which represent a relatively small volume. To overcome this, the forest was stratified into three girth classes:-

Small trees		1.00 to 2.99 ft girth
Medium	"	3.00 to 4.99 "
Large	"	5.00 ft and larger in girth

The optimum sampling scheme was to sample all small trees in every sixth plot, all medium sized trees in every second plot, and large trees in every available plot. Theoretically, the above sampling scheme will yield a better estimate of basic density for the area from the sampling of 50 trees than a random sample of 100 trees.

Since transport costs are very high in this area, we confined sampling to a single, randomly chosen disc per tree.

ITEM 3/3. WOOD CHIP MATERIAL IN NEW SOUTH WALES - SOME OBSERVATIONS ON BIOLOGICAL DEGRADE*

The wood chip industry is growing rapidly, and will absorb a large share of the timber available from State forests in the next few years. This paper seeks discussion on our future research needs for both hardwood and softwood chips.

From observations on the potential causes of biological degrade of NSW wood chip material there appear to be several avenues requiring attention.

1. Effects of degrade in the tree, and during billet storage

   Degrade present in the log may cause subsequent deterioration in the forest log dump or mill yard; and during storage of the chips. For example we have found that in southern NSW when hardwood logs remain for long periods in the bush after felling there is sometimes abundant production of sporophores of the decay Polyporus portentosus (Berk.) G H Cunn. as well as various Polystictus spp. and Schizophyllum commune Fries. This raises the question as to how important are restrictions of bush or yard storage times in reducing subsequent chip degrade.

*Prepared by D Edwards

2. The ecology of the chip pile

The effects of micro-organisms on chips in storage, and on pulp, and board making qualities has been well documented overseas, and include staining and discolouration, density losses, pile heating, and moisture variations. Dr H Greaves (CSIRO) is studying chip materials from New Guinea and elsewhere and gives an excellent review of the current Australian position*.

I feel that the time is now ripe for a discussion of the work still to be done, and the potential contributions of Conference members.

A study of chip storage methods has also brought to light the need for attention to standards for chip quality, both at the ship's side, and for softwood chips intended for particleboard manufacture. In this latter regard Australia appears different from most overseas countries in its very low consumer tolerance of stain in particleboard.

3. The effect of micro-organisms on pile safety

This is considered important overseas, but tends to be discounted here. I would make a strong plea that we recognize the potential fire danger, and do some exploratory tests in commercial chip piles.

4. The condition of the material when received in Japan

This is an area in which it is absolutely vital that we have clear knowledge if Australia's interests are to be protected. This must be information based on a precise and comprehensive knowledge of both technical facts, and commercial realities.

To sum up, this is a plea for consideration of the type of investigation needed, the degree of effort required in the national interests, and the extent to which the members of this Conference feel they can become involved.

*Forest Products Newsletter No. 378 - December 1970

ITEM 3/4. DETERIORATION IN WOOD CHIP PILES OF TROPICAL RAINFOREST TIMBERS*

Two sites within the Territory of Papua and New Guinea have been selected for trials to assess the extent of biodeterioration in mixed hardwood chip piles over storage periods of 2 to 4 months.

In the first trial at Madang, a conical-shaped pile 40-50' in diameter at the base by 25' high was constructed. Samples of chips were taken from the centre of the pile, and from positions at 2' intervals ranging from the surface to the centre, after 3 months storage. The centre samples consisted of material which had been treated with one of 4 preservatives; 3 tri-chlorophenol compounds with various additives, and sodium pentachlorphenate. The other samples were untreated. The results indicate that sodium pentachlorphenate is an effective preservative in preventing biodeterioration both as discoloration of the chips and as decay. Soft rot and bacterial attack were encountered to depths of 16 ft inside the 40 ft diameter pile, while blue-stain and other microbial discoloration occurred throughout the pile, from surface to centre. Indications of antagonism between thermotolerant actinomycetes and fungi were observed in the mid-zones of the pile, and high microbial counts resulted at all depths sampled. Bacteria were the most frequently isolated group of microorganisms; with Penicillia making up a large percentage of the fungi. Estimates of the extent of biodeterioration in the Madang chip pile give a total discoloration of the pile as 19% (10% biological and 9% chemical), and amount of wood substance loss as 5-7% of the entire pile (by volume).

In the second trial, 2 conical-shaped piles were built further north than Madang at Vanimo, they were roughly the same size as the Madang pile, but did not include preservative-treated chips. One pile was broken down after 2 months storage and the other after 4 months. Samples of chips were examined microbiologically for discolouration and wood substance loss, and were taken from the pile at approximately 7' intervals from surface to centre on a line 5' above the ground. Additional samples were taken at the centre of the piles 10' and 15' above the ground. Temperature measurements were made in the piles during storage, and it was found that the pile centres became hot very rapidly (60-65°C); the mid-zone temperatures were c.55°C and the centre zones c.50°C. A large percentage of the microorganisms isolated from the chips were either thermotolerant or thermophilic. They were also highly cellulolytic. After 2 months storage, decay fungi (soft rot and basidiomycetes) had produced a wood substance loss of 2% of the pile. This figure increased to 7-8% after 4 months. Discolouration of the wood chips occurred in 20-22% (by volume) of the pile at 2 months, but with a further 2 months storage drastically increased to 72%. Decay and discolouration were more marked in the outer 14' of the pile.

*Prepared by H Greaves

Initial conclusions at this stage in our study of chip pile deterioration in the tropics would suggest that for periods up to 2 months, the amount of microbial discolouration and decay is probably not significant. However, with further storage both wood substance loss and discolouration may become serious factors for consideration.

ITEM 3/5. IS THERE A NEED FOR BASIC RESEARCH ON DEBARKING OF"STRINGYBARK" SPECIES?*

Stringybarks are notoriously difficult to debark when "tight" - perhaps half of each year. In some cases large chip projects could use a hydraulic debarker, possibly a "midi" unit of this type, with reduced through-put, would do. However, there is still the problem of handling and disposing of large bark slabs without too much smoke. Debarking may also be desirable for small units, such as sawmills, to permit chipping for pulp, and facilitate sawing.

There has been very little study of the economic benefits of debarking. Perhaps this is where investigation should begin. In addition, the question arises as to how many sawmills are likely to have an outlet for their chips?

It appears that some of the existing rosser-head machines might handle stringybark, if the head is modified as a result of research on its action. The aim would be to remove bark in particle form for convenient handling and spreading, or use in other ways. However, would there be sufficient demand for a $30,000 debarking installation?

ITEM 3/6. DOES THE METHOD OF BILLET PREPARATION INFLUENCE CHIP QUALITY AND COSTS**

Research into various methods of splitting billets for pulp chipping have been suggested, to determine methods suitable for different situations. The need for this research was questioned, as it is considered that splitting generally is less desirable than other methods of billet preparation, such as sawing.

At Eden, for example, many of the problems existing at the chip plant result because it is handling split billets.

*Prepared by W McKenzie

**Prepared by M W Page

Admittedly, splitting equipment is cheap, but the operation is labour intensive. Because of the nature of the material at Eden, splitting is not applicable to lengths over 8 ft. Consequently, loading trucks is expensive and carrying capacities reduced. The irregular shapes of split billets and their 8 ft lengths cause difficulties both in loading and in handling and conveying at the chipping plant. The 8 ft length reduces chipper capacity, also the slivers on the split surfaces result in chip losses.

As against this a sawing plant for billet preparation would be more expensive, but less labour intensive. Loading in the bush and transporting in long lengths would be cheaper, billet handling improved and chipper throughput increased. The losses due to sawdust may not be very much greater than those due to splitting slivers.

ITEM 3/7. SOME ASPECTS OF CHIP MARKETING, STORAGE AND UTILIZATION*

With increasing interest in chips for export from Queensland hardwoods and rain forest species, information is sought and comment invited on certain aspects of chip marketing, storage and utilization.

(a) Species marketing potential

It has been pointed out that the market value of higher density hardwoods may have been underestimated in the past. Low pulp yields reported for such hardwoods may have been misinterpreted by management in negotiations with prospective purchasers. Pulp yields are expressed as percentages of oven-dry weight and the weight of fibre recovered per unit volume of input tends to increase with basic density. Freight costs based on wood volume also decrease as basic density increases and the weight-loading capacity of digesters increases. These give some advantages over apparently higher yielding softwoods which may not be as widely recognized as may be supposed. There are, of course, certain disadvantages in greater chemical consumption and differences in paper properties which have to be considered.

Information is sought on the extent to which species segregation may be deemed necessary in a hardwood chip production operation for the present Japanese market. It would appear, from the rather limited information available to us to date, that most open-forest hardwoods could be marketable. Is this correct? If not, if not, is it known what species or types of wood are unacceptable? Is segregation within acceptable open-forest hardwoods likely to be required and, if so, on what basis?

*Prepared by W J Smith

For rain forest timbers, it is generally considered that the wide range of wood types encountered would require a considerable degree of selectivity in marketing. However, it is suggested that the relatively low volumes of individual species available in a given area make this impracticable. Since a high proportion of the volume available would be in a large number of species ranging from 28-44 lb/cu ft in basic density and the balance should have relatively little influence on the pulp and paper properties of a general mix, pilot trials of broad mixes are under consideration, particularly since they are reported to have been successfully processed elsewhere. In the interim, from work done on individual New Guinea species, can some guidelines be given as to types of rain forest material which may be unsuitable or require segregation in marketing?

(b) Storage, handling and sampling

The sampling and testing procedure has been described as operated at Nelson in New Zealand to check dry wood content, chip size distribution, dust, bark and rotten wood content, and allowances to be made for rainfall and added water in the export of pine and beech chips.

Is a similar system of quantity and quality control at the loading point likely to become the standard basis for chip sales? What other methods are used elsewhere as the basis for payment?

At Nelson, a bulldozer-assisted pneumatic conveyor system is used in stockpiling and loading. What other methods are used elsewhere?

Are any estimates of storage losses from spontaneous heating or other causes available for Australian species and conditions, with indications as to the causes and preventative measures likely to be successful?

(c) Utilization

(i) The question arises as to whether the full potential of wood chips available from our resources is being utilized to maximum advantage in our national economy.

The income from chip sales certainly helps to offset the cost of forest management and to reduce the present extremely high cost of importing forest products. However, the income from the exported raw material is only a very small proportion of the value of the manufactured (and often reimported) product. The present demand for short-fibred pulp should provide management with an excellent bargaining basis in attempting to secure foreign capital investments in Australia to at least process the pulp before export, if not to produce a final product. This would raise the export value, reduce freight costs, and employ local labour. Since pulpwood values seem likely to continue to rise and some more remote forested areas are in no immediate need of treatment, delay in entering the export chip market could possibly be financially advantageous in some cases.

Encouragement to local industry to expand production, even if only to produce pulp for export could also be to the national advantage, possibly leading to inter, and intra, State rather than international movement of chips.

(ii) Pulp production tends to be thought of in some quarters as the ultimate in utilization, whereas, in fact, in chemical pulping, only about one quarter to one-third of the original green wood weight or 40%-50% of its basic weight is recovered for use in most situations.

Lignin losses are high and are believed to be contributing to the increasing world-wide pollution problem. They are also recoverable and, since anti-pollution regulations may require recovery in the future, intensified research into its utilization seems justified.

Reconstituted wood, using processed fibre bonded at least partly by the recovered natural bonding agent, lignin, would lend itself to many applications, in extruded, moulded or flat-pressed form (e.g. constructional mouldings and panels and fruit-packs). This would come largely from material unsuitable for use as sawlogs or round timber.

Chip and fibre utilization can be expected to expand in new avenues for improved particlewood. For example, in Europe, a much smoother, finer-surfaced product with a very dense outer layer manufactured virtually from wood fibres rather than particles is being marketed. The surface texture resembles hardboard but is stated to be less readily influenced by atmospheric changes than the latter. Chip-board extruded mouldings would seem to have good market potential.

Discussion - Items 1 - 7
(Note: The main points of the discussion have been summarized in the following)

Degrade in chip piles: Questions were asked on the effect of storage time on chip colour and quality and on pulp yield and quality. It was felt that it was difficult to be specific as so many variable factors were involved. Storage for up to 3 months in New Guinea caused some darkening of the chips, but ease of pulping and unbleached pulp quality did not appear to be affected. It was not known whether breaking down of the pile, loading into ships and repiling at the other end will increase or reduce the rate of change of chip quality.

Application of some form of preservative treatment might appear to have some advantages, but it was very doubtful if this would be economic. It was agreed that it would be desirable to know the extent of changes that take place in chips from the time of chipping to the time of entering the digester.

Chips handling and sampling. There was discussion concerning various aspects of handling and loading, including effect of sea water on the chips and subsequent pulping operations, and problems associated with sampling shipments to check quality and moisture content. It was mentioned that lack of suitable harbours made it difficult to even consider chip export schemes in certain areas, one in particular being the East Gippsland coastline. No answer could be given as to whether the compacting of chips in holds affected their pulping properties. Experience had shown that collecting a representative sample of chips from a shipment to determine quality and moisture content was an expensive operation, and some attention would be required to streamline and standardize the procedures. It was generally agreed that chip quality was a matter to be arranged between buyer and seller, as wood requirements are governed largely by the pulping process and end use of the pulp.

There was further discussion on problems concerning debarking. There was general agreement on the necessity to develop equipment for the removal of stringybark from eucalypts. This would have application in both sawing and chip production. The possibilities of the rosser head type was mentioned by both F & TB and FPL, but it was thought to be too slow for a chipping operation. The cost of manual debarking was stated to be about 10¢ per 100 su ft of wood. The need for further work in both bark removal and disposal was agreed, and it was decided that discussions should be held between F & TB and FPL to coordinate work on barking and billet preparation and handling.

Further pulping studies. Questions were asked about the pulping and papermaking properties of hardwoods from the NSW and Queensland coastal areas. It was pointed out that while a limited amount of data were available, information was required on species available in considerable quantity and which might be considered for future chipping or pulping projects. Brush box was one species mentioned, which, from its density range might be a satisfactory pulping species. Pulping trials on turpentine by the sulphate process gave poor yields, and the pulp was difficult to bleach.

Rehabilitation of cut over areas. This subject was raised in view of large areas that will be available for replanting or natural regeneration. Specific problems were mentioned relating to tropical areas and the danger of denudation of private land. It was stated that in many cases definite policies had yet to be established, but both regeneration and plantations were under consideration. In many cases removal of the old forest would enable an even aged rapid growth forest to be established, giving increased productivity and easier management.

ITEM 4/1. SAWMILLING*

As reported in the Economic Study Group Report, the Australian sawmilling industry is of importance amongst the major industries within Australia, making an estimated contribution to the economy of about 400 million dollars.

Perhaps of greater importance, the timber industry is a major provider of permanent employment in many rural areas and hence is the stabilizing influence in these communities.

The primary forest products industries employ approximately 42,000 people, almost 70% of whom are engaged in or associated with sawmilling in country areas. Yet to date sawmilling is not fully regarded as either a primary industry or as a decentralized industry, and therefore does not enjoy the taxation and other concessions available to industries that are so classified. However, it does have one factor in common with other large rurally based industries, such as dairy produce, wheat and wool, in that many of those engaged in it have difficulty in obtaining an adequate return on invested funds.

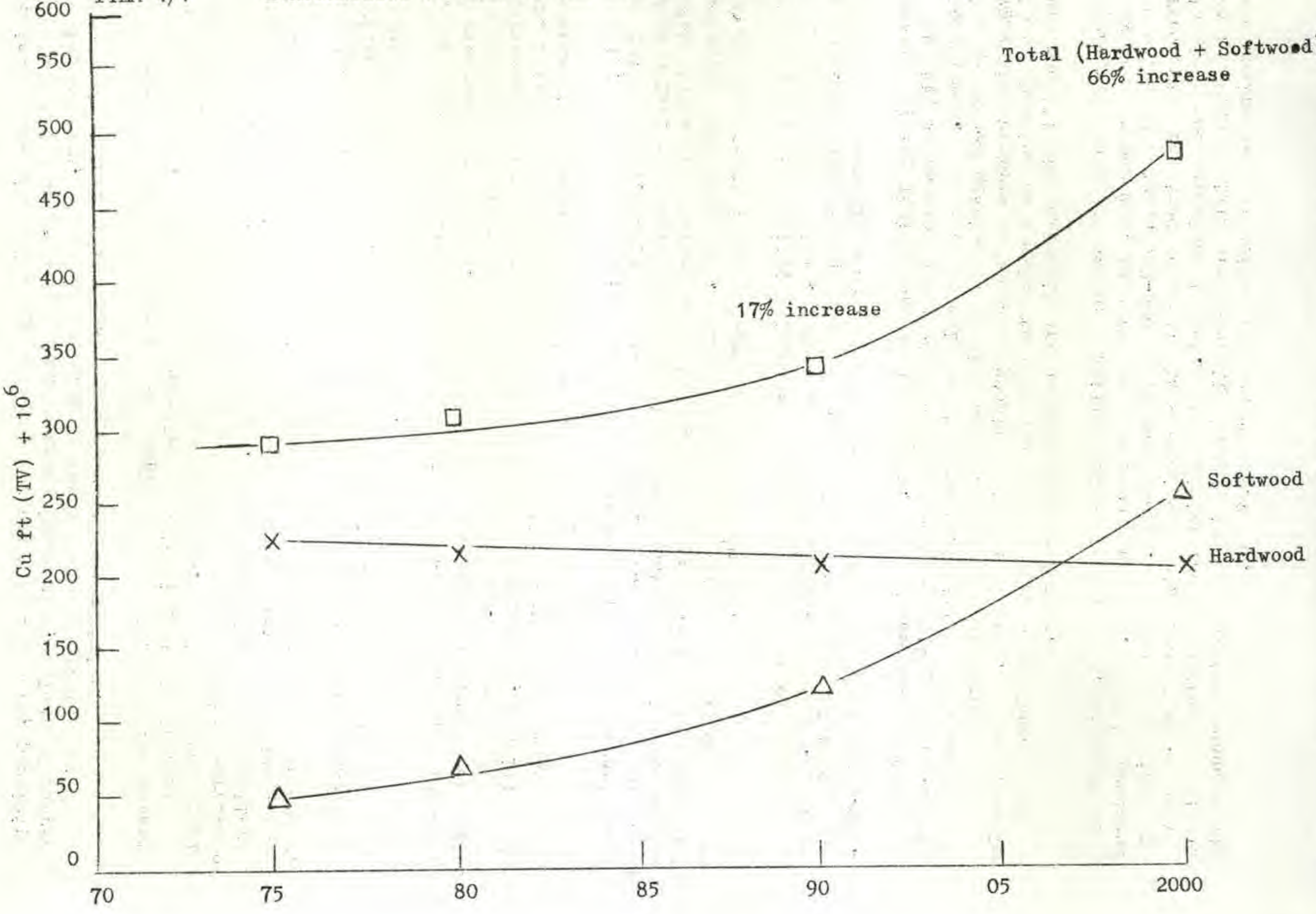
Of those companies which replied to the Economic Study Group questionnaire only 42% obtained a profit on funds invested of 27% or better, prior to tax. And even then a number of these were operating with written-off equipment or under special circumstances of limited competition. As a result, the timber industry does not create the sort of image necessary to attract the investment needed for its development.

The major market for timber is the building industry. This industry is one of Australia's major growth industries. By comparison, the timber industry is static and has been so for the last 18 years. I will not attempt to predict the future demand for timber, but I can assure you that over the last 18 years the per capita consumption of sawn timber has decreased at about the same rate as our population has been increasing, consequently the total consumption has remained static.

But even if it were possible to increase the total market for sawn timber, it must be appreciated that the raw material supply position, as currently understood, is such that it would be some considerable time before the local sawmilling industry could expand to supply an increased need.

*Position paper - prepared by M W Page

ITEM 4/1 AVAILABILITY OF LOGS TO THE SAWMILLING INDUSTRY



Obviously the timber industry cannot, for the next 20 years, participate in the growth rate of other manufacturing industries, unless of course we import logs, and it is doubtful if these could be obtained at a price which would allow sawn timber to remain competitive.

The current interstate pattern for supply of sawn timber to the market is of interest. The major production area in Victoria is in East Gippsland, located 200-300 miles from Melbourne. This distance enables both Tasmania and Mt Gambier, each of which has an exportable surplus of production, to compete on this market. The East Gippsland sawmillers therefore are turning their attention to both Canberra and Sydney, and increasing volumes of Victorian hardwood are being sold in these areas.

A major production area in NSW is the North Coast, located closer to Brisbane than Sydney, and consequently significant volumes of NSW hardwood are marketed in this area.

A substantial proportion of Queensland's production originates from the Maryborough area which, although located some 800 miles from Townsville, is the main supplier of sawn timber to this region. Because of a differential freight rate between North and South travel, sawmillers in the Cairns region have difficulty in competing on the Townsville market with Maryborough sawmillers.

Darwin, where the current annual useage of sawn timber is approximately 6 million su ft, could perhaps be a market. However, because of freight difficulty, the North Queensland industry cannot compete in this region with either the Western Australians, the Malayans or latterly the Territory of Papua and New Guinea. At this stage the North Queenslanders appear to be the losers in this supply and demand picture.

The Australian sawmilling industry has always been characterized by a large number of mills, which, by world standards, are small. From some 2,900 mills in the housing boom period of the middle 'fifties the number has steadily decreased to a present figure of just under 2,000.

Because of the limitations on log supply, most of the new sawmills that will be constructed during the next 20 years will replace existing operations. We have calculated that for such mills a minimum log intake of 6-8 million su ft will be necessary to ensure that the operation returns an adequate profit on invested funds. Consequently it is alarming to realize that at the present time only about 4% of the sawmills in Australia are of this size or larger.

Currently about 80% of our sawmills produce less than 5,000 su ft of sawn timber per day, less than the average house lot. It is produced at rates of between 350-500 su ft per man-day. These small mills are frequently required to handle logs ranging in size from 3 ft - 15 ft in girth and sometimes larger. In addition the log volumes available to individual mills are generally insufficient to justify economically the equipment best suited to each class of log.

In the bulk of these small mills the equipment is antiquated, the work is arduous and often hazardous, and the operation labour intensive. In many cases the proprietors work for lower returns than must be earned by public companies with responsibilities to shareholders.

To some extent Western Australia and the pine areas of Mt Gambier, Dartmoor and NSW are exceptions to this picture. Yet on the average throughout Australia each worker in the sawmilling industry is supported by only $1,400 worth of plant and equipment, compared with a national average for manufacturing industries of approximately $3,700.

The smallest practical combination of modern, high capacity, labour-saving sawmilling equipment which would constitute a complete mill would permit a man-day production of at least 1,000 su ft, but would require a minimum log intake of 4-5 million su ft per year, depending on the end product. Up to June 1969 only about 7% of the mills in Australia were of this size or larger.

However, before I paint too black a canvas, let me hasten to state that the pattern is slowly but surely changing and I believe the change is now gaining momentum. By amalgamations, take-overs and integration the industry is re-grouping into a fewer number of larger mills. For example, during the past year we have either designed or assisted with the design of 13 new mills. In addition we have provided re-designs to overcome production difficulties or increase production in a further 7 mills. Of the 20 mills, 12 were designed for log allocations of at least 6 million su ft per year, and 8 were for at least 10 million.

The pattern of log supply is also changing as the industry becomes increasingly dependent on re-growth forests. As a result the range of log size to be handled is becoming narrower, but the average log size is reducing and in some cases this is affecting recovery.

Currently, there is considerable interest in pony carriages and band saw head rigs. When this combination is provided with facilities for storing and reloading flitches, it is possible for maximum advantage to be taken of the high man-day capacity and the production flexibility of this equipment for log allocations as small as 4-5 million su ft per year.

Increased sawing at the head rig will necessitate reduced saw kerf and two local manufacturers are now producing high strain band rigs for use within very thin saws. A high strain, double cut band rig for use with a pony carriage is currently being installed and should be in operation within a few months. A high strain band resaw is also under construction. As average mill size increases, the use of band saws is also increasing.

The first chipping head rig for use in Australia has now been ordered and it appears likely that a second machine of this type will be ordered in the near future.

In order to combat rising labour costs and to make benching less arduous efforts to develop a 1-man automatic breast bench have been increased. These have been partially successful and machines are now available which, when operated by 2 men, will perform all the duties, and at the same sawing rate, as a 4-man breast bench.

Efforts are also being made to reduce the cost of sorting, and one endeavour is to use the introduction of a metric system to rationalize and reduce the number of sizes produced. Marketing is also being rationalized and the recent amalgamation in the north coast area which gave one company the responsibility for selling 30 million su ft of sawn timber per year appears to be achieving orderly marketing.

Generally, the industry is becoming increasingly aware that it must market products, not sell lumps of green wood.

Discussion

KENNEDY: Can you give us a comparison of merchant cost, milling cost, and log cost?

PAGE: It varies greatly from state to state and even from mill to mill. For Victoria a log on the mill skids would cost between $2 and $4 per 100 su ft hoppus. Milling costs would be not less than $4 per 100 su ft sawn. Selling price about $11 per 100 su ft sawn ex mill. Selling price on site in large quantities about $13 per 100 su ft sawn.

EDGERLEY: Some years ago the hardwood situation was that out of a mill cost of about 120/-, there was only 10/- to 15/- under the direct control of the mill itself. The greater part of the cost was governed by charges by Forest Services, cartage etc. This indicates the difficulty the miller would have in attempting to reduce prices.

KENNEDY: The framing cost for a 14 square house was $435 in hardwood (at $13.50), $590 in oregon, and $447 in the new steel framing system.

An aluminium frame costs about twice that of a steel frame but the aluminium seems to be a better system.

SOUTH: The cost of Pinus framing is similar to that of oregon. Despite the small apparent influence that the miller has on costs, they can be reduced. For example, by reducing accidents, by reducing transport costs, and by integration within the industry.

JONES: On Mr Kennedy's figures we are talking about $100 in a house which would cost at least $12,000. This small difference in price can easily be justified on the virtues that timber has - for example, fixing, and we should be actively promoting these advantages.

BRYANT: The cost of accidents is extremely high in the timber industry. Figures covering a sample of 9700 men show that 92% were injured at a cost of $2,700,000 and a loss of 6% work time. When analyzed this means a loading of 50¢ per 100 su ft on timber.

MCKENZIE: What are our aims, and what are we concerned about - industry profitability, welfare of people, or acting in the best interests of the national economy? They are not necessarily compatible and the relative desirability must be decided.

There was some discussion on labour costs in the industry, which were quoted as 62% of the product cost, which was 17% greater than the national average labour costs. This pointed to the need for improvement in the sawmilling operation and this in turn led to the conclusion that volume production and modern equipment are needed to achieve this. Integration was absolutely necessary.

There was also discussion on the authority necessary to achieve integration of the industry and Tradac and TAC were mentioned as possibilities. The opinion was expressed that the large paper companies are the ones in the best position to do this and had in at least two areas moved into this field.

HINDMARSH: I would query some of the statements on profitability. Where quotas can be bought they are currently selling for about $100,000 for a 1 million su ft quota. You would not pay this money for something that would not return a reasonable amount.

RUMBALL: The presentation of timber leaves much to be desired. Metal framing has a number of attachment points and is predrilled or preformed. For house framing at least the timber industry should be doing more manufacturing on the product before selling it.

KENNEDY: I agree, at present the waste on site with timber frames is between 5 and 10%. Some of this is due to offcutting, some due to pilfering, and precut bundled material could eliminate some of this waste.

PAGE: I think the feeling of the conference is that there is a fairly optimistic outlook for timber, but that we will need to promote it on its merits and we need amalgamations and integration to make the conversion operation economic.

KAUMAN: We need to look realistically at the place of timber in society, treat it as an engineering material to attract capital for the development of the industry and encourage a vigorous market approach.

ITEM 4/2. DEVELOPMENT OF WATER SPRAY STORAGE OF LOGS IN NSW*

Storage of logs under water sprays to prevent degrade has been acknowledged worldwide.

North Coast sawmillers experience long periods of wet weather when access into forest areas is impossible.

An experiment was designed with the cooperation of an interested sawmiller to measure recovery from normally stacked and water sprayed logs.

Experiment was to run for 4-5 months but due to drought conditions water supply failed at 5 weeks.

Photographs and a summary of recovery indicate a distinct saving of up to an average of 8% in timber which would have been larger if water supply had not failed.

Arising from the experiment, interest was shown by several sawmillers. Costs and specifications for equipment to spray stacks were given to them. A typical layout for log spraying was supplied with cost of material only.

Discussion

MCKENZIE: There are several side benefits from water spray storage. In particular, it helps debarking which in turn can improve sawing efficiency and it allows relaxation of growth stresses.

FINIGHAN: The results given by the DWT tests are of the same order as those from the extensive tests carried out by DFP some years ago. This was published in the Forest Products Newsletter and in other places. The work covered a range of protective measures on hardwoods including nominally continuous water sprays. Similar tests on continuous water sprayed softwoods over a period of 9 months indicated a lower incidence of blue stain attack.

*Prepared by G Carraway - Note, this is the summary only of the material tabled at the meeting

COSSTICK: Restrictions on logging in parts of Victoria during the winter make log storage during the drier months essential. Water sprays are essential in preventing excessive degrade during the storage period.

COLWELL: What is the effect of water storage on permeability to preservatives?

DA COSTA: There is little information available, and we are working on this now. It appears that there could be a marked improvement, and this could give rise to a process of "biological incising" prior to treatment.

SMART: Log stocks are tending to become larger and greater losses are being experienced, water sprays could prove to be very useful in Queensland.

KAUMAN: It appears that this work is of great importance and should be continued.

ITEM 4/3. THE PRESENT STATUS OF THE TIMBER GRADING MACHINE (NSW)

For some time the Commission has not been happy with the manufacturers' handling, particularly the servicing, of the timber grading machine. Following complaints from England last year the manufacturer was required to do certain things, and in particular to put the machines in proper order and to provide an adequate servicing facility to keep them in operation and in calibration.

Arising from these requirements a number of discussions were had between Isles Forge & Engineering Pty. Ltd., Plessey Telecommunications Pty. Ltd., and the Commission. These led to Plessey Telecommunications Pty. Ltd., purchasing from Isles Forge & Engineering Pty. Ltd., any rights which the latter company considered itself to have in the grading machine, and in turn entering into an agreement to manufacture, market world wide, and service Computermatic grading machines. The company is not interested in the microstress machine.

Warranty on the older machines has expired. They will be serviced at a cost, but parts etc. are likely to become difficult to obtain.

Plesseys' are setting up to improve the machine and propose to promote it aggressively. Orders, and prospective orders, are in hand.

ITEM 4/3. THE PRESENT STATUS OF THE
TIMBER GRADING MACHINE (Q'LD)

There is still only one timber grading machine located in Queensland and so far it is not being used in production.

However, the owners of the machine are currently seeking acceptance of the use of machine stress graded material for light timber framing from the Brisbane City Council and the Queensland Housing Commission.

Meanwhile static bending testing of material containing defects is being continued by the Department of Forestry in order to improve the Modulus of Rupture - Modulus of Elasticity regression.

B ending tests so far have been limited principally to slash pine thinnings 19 years old. The wide range of values obtained has been a feature of this work to date. From approximately 550 tests, the M of R and M of E values have ranged from around 20,150 psi and 2.02×10^6 psi respectively to around 2,501 psi and 0.58×10^6 psi respectively.

An on-line quality control device has been developed by one firm to ensure that their finger-jointed studs have a stress rating value of no less than 1,200 f. Basically the device consists of rollers at support points and loading point, the combination of span and magnitude of load being designed to apply stressing to the studs at a rate of 1,200 multiplied by a contingency factor for safety and load duration. This factor is appropriately weighted to allow for possible aging of the glue used in the finger joint.

Testing is carried out after the material is dressed, following a 2-day aging period for the glued joints.

It appears however, that market acceptance of machine stress graded timber will be limited until grade branding to requirements of the Light Timber Framing Code is generally adopted and accepted by regulatory authorities. It also seems evident that, particularly in the early stages, a competent independent quality control checking procedure will have to be followed by suppliers to promote market confidence.

ITEM 4/3. THE PRESENT STATUS OF THE
TIMBER GRADING MACHINE (NZ)

The present Forest Service stress grading machine has been used only as a research tool, and will continue to be used for this purpose. The other three machines in New Zealand are owned by private companies. Two of these have virtually never been used, and the third was modified some time ago to operate as a proof loader, primarily on tile battens.

Commercial machine stress grading never got off the ground at the time the machines were purchased because virtually no work had been done on the economics of machine stress grading in New Zealand with New Zealand timbers, and no provision had been made for the acceptance of machine graded timber in the New Zealand Model Building By-Law and related documents.

At the present time the Forest Service is intensively investigating the possible commercial application of machine stress grading at Waipa State Sawmill. The feasibility and economics of production of machine graded radiata and Douglas fir for both light framing and engineering applications are being investigated. Production of machine graded timber for the Australian and UK markets as well as for the home market is a possibility. Results of current investigations should be completed this year.

ITEM 4/4. QUALITY CONTROL SCHEMES IN THE FOREST PRODUCTS INDUSTRIES*

"Quality Control" has become the "in" thing. In the timber industry many claims are being made for quality control schemes, but on examination some of these are nothing more than sales gimmicks, whilst others seek to control the quality of one or two easily measured features of the product, but describe the process in such a way as to leave the impression that the quality of the product as a whole is carefully controlled.

These claims, with their inevitable failures, are doing great harm to the timber industry and something should be done about it.

The basis of any system of quality control is a written description of all the features to be controlled and the degree of departure permitted from each one of them. The system can then be described as one providing a product which meets the requirements of the specification. Nothing more and nothing less.

Even with the best quality control systems, laxity will develop unless there is associated with it a quality assurance inspection. The former lays down the inspection to be carried out, and the tests to be performed at various stages of manufacture, whilst the latter defines the frequency of sampling, the inspection and tests to be carried out on the finished products and the acceptance or rejection of portions of the manufactured batches following those inspections

*Prepared by E B Huddleston

and tests. In the more advanced schemes the frequency of sampling is statistically determined from an analysis of the samples taken to provide assurance of quality to the acceptable level.

These things should be made known to the timber industry and the industry should be encouraged to institute proper quality control schemes. Those who are unable to do so must eventually leave the industry.

ITEM 4/4. QUALITY CONTROL SCHEMES IN THE FOREST PRODUCTS INDUSTRIES (NZ)

Apart from the quality control exercised or implicit in the use of the Standards Association of New Zealand standards mark in the manufacture of some wood products e.g. plywood, other quality control systems currently in use in New Zealand are:-

I. <u>Finger jointing</u>

Before approval is given by the State Advances Corporation to the use in their securities of finger-jointed weatherboards, fascia, joinery etc, by any firm, samples of the joint are required to be tested by the Forest Service (FRI) for integrity and strength of glue joint and also by DSIR for paintability tests.

To the extent that it is able the Forest Service (UDD) undertakes periodic checking of the control exercised at the point of production.

Altogether, this is an informal arrangement and has as its main purpose to provide guides and assistance to firms starting up finger-jointing. It has worked satisfactorily but a formal system is preferred in the long term.

II. <u>Grading of timber for export</u>

(a) <u>Douglas fir</u>

Exporters through the New Zealand Sawmillers Federation have instituted a system of checking the quality of Douglas fir framing exported from New Zealand to ensure:

(i) that there is correct interpretation of the Grading Rules,

(ii) that exporters are in fact applying the Rules.

In addition the Forest Service, in its normal role of inspecting export timber for quarantine purposes, makes a check inspection of shipments for quality and presentation.

(b) Radiata pine

The Forest Service by arrangement with the NZ Sawmillers Federation inspects shipments of radiata pine to Australia with a view to ensuring maintenance of good standards of grading, presentation and branding.

III.. Glue lamination

Through the services of the Timber Research and Development Association (TRADA) the glue laminators are federated with the common object of ensuring that their products are manufactured according to accepted principles which find expression in the Standard Recommendation issued by the Standards Association of NZ. A small group of technically qualified people are employed to carry out periodic checks of glue laminators to ensure that materials (timber and adhesives) and fabrication of gluelam members are according to the Code.

ITEM 4/5. MECHANICAL STRESS GRADING OF LADDER STILES*

Mechanical grading Douglas fir stiles for extension ladders started in 1966 by selecting ladder stock for the Post Master General's Department. Since then electricity authorities of NSW and various County Councils followed up by specifying mechanically graded Douglas fir stiles for their ladders.

The increasing demand for mechanically graded stiles comes as a result of the findings on investigations on broken ladders in the field. The results of these investigations have shown that, the accident could have been prevented if the timber used in the stiles of the broken ladder was selected to our mechanical grading specifications.

The estimated number of Douglas fir ladder stiles processed through our stress grading machine for various ladder manufacturers in NSW since 1966 is of the order of 80,000. Twenty one thousand were

*Prepared by A Anton. Full paper distributed to delegates graded during 1970 and 8,500 from 1st of January 1971 until 15th May 1971. The demand for mechanically graded stiles is increasing rapidly. The reason for this could be attributed to the excellent field results with ladders manufactured with MSG stiles. Specifying authorities appreciate the mechanical grading system with its quality control scheme behind it to warrant the quality of the timber used in their equipment.

In related experiments aimed to develop ladders of superior safety we have studied the effect of reinforcing ladders with extruded fibreglass rod. This technique has been shown to have little effect on the strength of accepted machine graded stiles but does provide an additional safety factor by causing the stile always to break in a tough manner even if damaged to a degree by rough handling.

In general the criteria for accepted wooden stiles to be used in extension ladders can be summed up as follows:-

(i) The timber should have a minimum 1:40 low probability value of modulus of rupture of 7000 psi.

(ii) A specified minimum modulus of elasticity value, for Douglas fir 1.5×10^6 psi, to secure the above "M R" value and to warrant a tough failure when the material is tested to destruction.

The phenomenon that there exists a minimum "E" value for timber above which tough fracture in bending occurs was observed during the initial investigation on MSG of Douglas fir stiles and it has been documented in a preliminary report addressed to the PMG Department on the 7th July 1966.

Discussion - Items 4/3 - 4/5

SMITH: There are 2 grading machines in Queensland at present, a Computermatic not being used and an on-line quality control device being used by a firm to ensure that their finger jointed studs have a stress rating not less than 1200f. They multiply by a contingency factor of 3.4, presumably supplied by DFP. We think this is a high factor but may be due to allowance for aging effects of the UF glue used.

KLOOT: I do not recall recommending such a large factor, but it may contain a sampling factor which will be reduced as a larger amount of material is tested. The factor would not include any allowance for aging of the glue, and we would not agree to UF glue being used for structural purposes, and the fact that this firm is using it must not be implied as having our approval. We endorse Mr Huddleston's comments on quality control. Standard grading rules are one means of quality control and with few exceptions these are not being used as they should be. The machine grading of ladder stiles demonstrates the value of this machine as a research tool.

ANTON: With a proof loading device as mentioned by Mr Smith, care must be taken that the joint or the material is not stressed to a degree which causes damage and so renders it unfit for its intended purpose.

JONES: Quality control has been very highly developed by the Plywood Association and it has been effectively used as a promotional weapon. Quality control by timber grading is fully effective only when used for promotional purposes. The plywood industry is well equipped to assist other parts of the timber industry in developing a quality control system and we offer this assistance to anyone who is in need of it.

WOODHEAD: As the timber industry moves further into the field of finished products, quality control becomes more important, for instance, in the manufacture of laminated beams. The research bodies can assist industry to carry out quality control tests at a reasonable cost and without elaborate equipment.

BOYD: The question of servicing stress grading machines is of utmost importance, and the Australian machine has earned some disrepute because of a lack of proper service. These machines are not the full answer to quality control, and they have been oversold. Visual grading with occasional checks by a spot grader is a most effective and cheaper method. I also suggest that we find out more about the design situation before we go too far with the application of the more sophisticated method we now have for grading, and new knowledge of tensile strength etc. in order not to imbalance unjustifiably the timber using economy.

HUDDLESTON: It is a common misconception that the Light Timber Framing Code requires timber to be grade branded. This is helping to delay adoption of the Code by industry. In claiming quality control of a product, it is necessary to be specific as to the particular features that are controlled otherwise there will be complaints regarding faults not subject to control.

ITEM 4/6. WHAT SHOULD BE DONE TO ASSIST EXISTING AND WOULD-BE BAND SAW OPERATORS?*

In 1969 we made a survey of wide band saws operating throughout Australia and New Guinea. The purpose was first to obtain a record of all band saws operating, and secondly to obtain from

*Prepared by R L Cowling

sawmillers a list of their problems with a view to possible CSIRO assistance or research. The results are to be published, probably in the October 1971 issue of the Australian Timber Journal.

As far as problems for research are concerned, the survey was disappointing in that none were suggested. However, there were others, cracks in the saw blade being the most common, but even this was listed by only seven mills.

Although this suggests that band saw owners do not need much help, if one questions the costs of operating band saws with untrained staff, a different picture emerges.

In the last decade the use of band saws in the hardwood areas has increased enormously, and pressure will continue to bear on sawmillers to group and expand, to produce timber more cheaply and with less waste. The band saw fits into this new approach to sawmilling, but in many hardwood areas it is still under trial.

Most problems came from the hardwood areas, but one of these is common to the whole industry, viz, the difficulty of obtaining a fully competent sawdoctor. Training facilities for sawdoctors are unavailable to many mills and where available are generally inadequate. The best training scheme exists in Mt Gambier where in a large mill a 4 or 5-year apprenticeship training is given under a fully qualified sawdoctor and includes a 3-year course at the Mt Gambier Technical College. Training restricted to softwoods may however prove inadequate for hardwoods, as the problems are often very different.

The sawdoctor is regarded as the key man in sawmills operating band saws and enjoys the highest wage in the industry; yet, the sawdoctor is not required to reach any set standard or to pass any examinations and for all his skill his calling has no recognition as a trade. The Economic Study Group recognized this position when it stated in its report "Recognized standards do not exist within the industry to test and assess operatives' skills. Formal means do not exist to give credit both within and outside the industry to an operative's competence and experience". The report further stated "The implementation of an effective training programme for key personnel is considered to be essential".

To gather further information about the cost of employing untrained sawdoctors and the need for sawdoctor training we conducted a further survey in December 1970. The costs were difficult, if not impossible, to estimate, but the figures given ranged from $3,600 to $10,000 annually, and all respondents agreed that there was a need for training. More than half were agreeable to making a cash contribution to a training scheme.

There can be no doubt, therefore, that training and education for sawdoctors should be provided to assist band saw operators to increase efficiency. Training should of course be extended to other mill personnel, but the key man is the sawdoctor. If this objective is to be achieved it is essential that positive action be taken by industry. We have attempted, through the Timber Development Council of Australia, to organize a meeting to discuss the question, but without success. The answer may be for the industry, in the first instance to organize regional steering committees to consider ways of meeting local training needs. These committees might give consideration to various training possibilities, and consider what assistance might be given by CSIRO, the Department of Labour and National Service, Apprenticeship Commission, Education Department and other bodies.

When considering on-site training, steering committees might give some thought to the employment of a highly qualified itinerant sawdoctor who, besides teaching apprentices, might conduct an educational programme for sawdoctors in general, who have much to learn from the experiences of others.

Another possibility is to provide a correspondence course so that sawdoctors can reach a recognized standard and receive a suitable certificate to prove it.

The involvement of other interested bodies such as the Apprenticeship Commission or the State Education Departments would depend on the recommendations of these committees. It is suggested that the various State sawmillers' associations should coordinate the activities of the steering committees and an effort should be made to obtain interstate uniformity.

The Economic Study Group recommended that the industry should approach the Department of Labour and National Service to work with that Department in a study of training needs. CSIRO also has an interest in the efficient operation of sawmills and hence in education in this area. There are other bodies interested in education and training to which industry might appeal for assistance, and might reasonably expect it. The initiative, however, lies very much with the industry.

ITEM 4/6. WHAT SHOULD BE DONE TO ASSIST EXISTING AND WOULD-BE BAND SAW OPERATORS? (NZ)*

The Head Sawyer is the key man in the successful operation of any sawmill. He operates the headrig, log turner, the log loader and in

*Prepared by R E Parrott

almost all sawmills the log carriage; these are the most critical and probably the most expensive items in the sawmill.

It is the sawyer's function to determine the way every log will be cut, thereby he controls the quantity and quality of the timber the mill will produce.

The judgement and actions of the sawyer dictates what every other production man in the mill must do; a good sawyer is, or should be; qualified to specify how each individual board should be resawn, edged and trimmed. In fact a sawyer's ability and performance in many instances decides the success or failure of a sawmill. His ability to understand and judge quality increases with every increase in log cost, logging cost or decrease in sawlog quality.

It is therefore essential that an existing or would-be sawyer should have had, or should be given, opportunities to attend courses on or have on-the-job training in the following skills;

- (a) Good knowledge of log grades and sawn timber grades as a basis for sawing to maximum recovery and value from a log.
- (b) Quick and accurate operation of the log turner.
- (c) Good knowledge of the carriage he is operating.
- (d) Good knowledge of the operation, capabilities and maintenance of the sawing machinery.
- (e) Basic understanding of the characteristics, use and problems of steam, air, electric and hydraulic power.
- (f) Basic knowledge of bandsaw maintenance and general mill trouble shooting.
- (g) Knowledge of the operation and problems of the secondary machinery involved in the mill operation.

He should be given good lighting and working conditions. An ammeter or carriage feedspeed indicator should be fitted in every sawyer's box indicating maximum bandsaw efficiency and capability, and he should have full knowledge of SAFE sawmill operation. It is advisable to train two or three sawyers so that a change of operator can be made every 2-3 hours. This ensures less strain on the headrig sawyer and results in better output both in quantity and quality.

The Timber Industry Training Centre has a fully operational band mill incorporating log turner, riderless carriage, 60" band headrig, breastbench and line bar band resaw and is conducting courses for bandsaw operators; we would be happy to extend an invitation to train new or upgrade existing band sawyers for the Australian Timber Industry.

We would also be glad to extend our training to include practical experience in saw maintenance, sawmill operation and timber processing for students taking the Timber Industry Administration Course by correspondence through the Royal Melbourne Institute of Technology

Discussion

COWAN: We have found that a properly prepared training programme can get a bandsaw operator up to target production rates in about 3 weeks. We have written this up and a report is available.

WICKETT: Perhaps FPL could assist in this matter by preparing a handbook on the maintenance of saws as a lot of the material is obviously available. Such a handbook is also needed by managers who are required to supervise sawdoctors and operators.

JONES: The problem should first be assessed by FPL staff visiting mills, then the various Timber Promotion bodies could probably assist on a State basis, as they are already appointing training officers.

COOK: There is a need for better contact between TAC and FPL officers.

CREE: Industry contact through the Timber Producer's Panel could be of assistance.

KAUMAN: We maintain very good contact with industry and can provide strong support to the promotional bodies. It would not be desirable for us to have a full range of modern equipment to demonstrate sawing techniques, but we cooperate with industry to carry out research and development work in sawmills.

ITEM 4/7. A NEW INTEREST IN THIN CIRCULAR SAWS*

In Europe and America, there has been a new interest in narrow-kerf sawing, using circular saws, for multiple ripping in primary and secondary conversion.

In laboratories much theoretical and a little experimental work has been done on sawblade stability and the factors affecting it. Sawblade stability is the key to optimizing capacity, kerf width, surface accuracy and surface roughness. Study of stability has led to new concepts in sawblade design examination, preparation and external restraint guides.

*Prepared by W McKenzie

In North America, narrow-kerf saws for pencil slats were achieved by high quality manufacture and preparation, and slotting. A more recent development has been the use of deep exterior or interior slots with carbide cutting edges inserted to cut the way out of binding situations. Both the slots and the side cutters are beneficial.

For multiple ripping and board edging, it appears that circular saws will hold their own, and research aimed at improving stability is justified.

Our work at the FPL is concerned with improving practical shop examination and preparation methods, including levelling and tensioning behaviour of blades when stationary, rotating, dynamically loaded and heated, and finally when sawing, in which rotation dynamic loading, heating and damping are all involved. We are looking for about 20% improvement in the overall costs of operating and manufacturing a particular machine.

Discussion

MCKENZIE: (in answer to questions). The reports from North America refer to a kerf down to $\frac{1}{8}$" and cutting at a depth of 6-8 inches. A comparison of sawing accuracy between band and circular saws depends very largely on the depth of cut. Bandsaws are better performers in deep cuts. With multiple cutting, circular saws have considerable advantages.

PAGE: Relative capital costs must also be considered. A circular rig would cost about $5000, whereas a bandsaw (head rig) would be about $3C,000.

MCKENZIE: If circular sawing machines were developed to maximum efficiency, their cost may be much greater.

ITEM 4/8. CURRENT DEVELOPMENTS IN ABRASIVE PLANING AND COMPARISON WITH CUTTER PLANING*

The concept of abrasive planing has always implied a high capital cost but a lower maintenance cost when compared with cutter planing.

With the continuing rise in labour component cost for all manufacturing processes, what is the current comparison of abrasive planing against cutter planing bearing in mind the following:-

*Prepared by J Smart

(a) Capital cost

(b) Power requirements

(c) Maintenance cost

(d) Quality of finished surface

(e) Different levels of daily throughput.

The question arises when considering the increasing production of dried and dressed framing from hardwoods (eucalypts, brush box, tulip oak, etc.), plantation conifers and cypress pine.

Discussion

MCKENZIE: Abrasive planing is a large production concept and a tremendous amount of energy is required compared with that for the equivalent amount of work done by cutters. We have not worked on this but there are plenty of references.

COKLEY: What are the effects of cutters on the final timber surface, with respect to painting, gluing, etc. We find that blunt cutters do affect the use of paints and finishes.

MCKENZIE: There is an Australian standard on the surface finish of timber, and we have some work almost ready to report. Extractives may be related to cutting conditions such as blunting, which tends to produce glazing.

SMITH: What is the scope for work with static saws.

MCKENZIE: This has been taken about as far as possible in the laboratory overseas, and the idea has severe basic limitations particularly in regard to depth of cut and number of tools required. Machines with circular saws in tandem are being developed.

ITEM 4/9. THE NEED FOR GREATER UNDERSTANDING OF THE EFFECTS OF GIRTH AND OTHER LOG CHARACTERISTICS ON THE ECONOMICS OF CONVERSION AND MARKETING (Q'LD)

For many years the Queensland Department of Forestry has depended on the results of mill studies for its basis of log pricing. In the past, series of mill studies have been carried out at about ten-year intervals on any particular species or group of species.

They are normally carried out in two parts:

(a) Logs at the stump - for measurement and recording of the logs themselves and their visible defect

(b) Logs at the mill - for recording and grading of the sawn output from each log and the timing of each log through the various benches.

The purpose of this type of study is to:

(i) Determine the rate of recovery by grade and rate of production for logs of various girths and species

(ii) Determine, as a result of the sawing study, a satisfactory log grading system or a basis for log allowances and rules for butting in the bush.

Taking into account assessed average costs of erection and equipping of the mill, mill expenses and overheads, depreciation on plant and dividends on capital outlay and working capital, a production cost per man-minute of working time is calculated. From this, combined with green-off-saw value of the sawn product and recovery and production rate derived from the study, the log value at mill door can be calculated for any log or girth group.

Species classes such as hardwoods have been studied as a group in the past. However, the current trend, in hardwoods at least, is to study individual species with which some particular difficulty has been experienced. Because of the increasing trend towards the marketing of seasoned material the scope of studies is also being extended to the seasoned stage, whereas previously only the green-off-saw product was considered for recovery purposes.

As the pattern of log size and type becoming available from the forests is continually changing, it is desirable to continually study the economics of their conversion, not only as a basis of tree marking and log pricing but also to be able to place a realistic value on the forest estate.

ITEM 4/10. RELATIONSHIP BETWEEN TREE FORM AND GRADED RECOVERY PARTICULARLY IN SMALL LOGS (Q'LD)

With integrated logging about to commence from Queensland's soft plantations, it has become desirable that officers in the field who mark stems for removal be given a quick but reasonably reliable method of determining the effect of form on the suitability of a stem for selection for pruning..

Introductory studies have been undertaken with a view to determining the point at which a stem becomes uneconomical to saw because of crookedness. In the case of integrated thinning, this would be the point at which stem value based on recovery and cost of production would yield a calculated residual stumpage lower than the stem's return as pulpwood.

The first approach has been to record the following measurements in the logs as delivered to mill:-

(a) Length of log (L)

(b) Maximum diameter and diameter at right angles measured at both ends, and averaged (D_1 and D_2)

(c) Length over which a particular bend occurs (1)

(d) Maximum deflection from straight of the bend (d). (All deflections in the log greater than $\frac{1}{2}$ inch measured).

(e) Distance at which maximum deflection occurs from the butt of the log (x)

The above measurements of deflection are taken in two planes at right angles to each other the first plane passing through what was estimated to be the worst bend. Deflection is measured on both sides of the log in each plane.

From L, D_1, D_2 and x it is possible to compute log diameter (y) at the point of maximum deflection for each bend.

It can be assumed that, for the log section affected by any bend, Recovery R is proportional to $\frac{ly^2}{d}$.

By calculating this quantity for each bend, summing and taking the mean, a quantitative measure of the effect of crookedness in a stem can be obtained. Analysis has been attempted only on a small sample to date, the stems being of approximately the same size. No relationship between degree of crookedness and actual sawn recovery is evident as yet. However, it is considered likely that a pattern will emerge when distribution of board length is taken into account. Sawing time will also have to be considered in further studies.

If a relationship is determined between degree of crookedness and recovery and rate of production, the next step will be to relate this to a visual assessment of crookedness in the standing tree, (perhaps by a point scoring system supported by illustrating photographs) for use in the field.

This item has been introduced to the conference to invite comment on standards adopted elsewhere and also to seek any information available in reports of similar work which may have come under notice.

Discussion - Items 4/9 and 4/10

MCKENZIE: You indicate that, as the patterns of log supply are changing, much of this work should be repeated. It should be possible to carry out the work so that the pattern can be changed by computer.

SMART: This could answer our problem.

PAGE: We have looked at this in Tasmania, but the important thing is still to find the effect of tree or log characteristics on the conversion process.

HAWKINS: I have seen programmes which could build up a "computer" tree but I do not think they are sufficiently general. Finding the parameters would involve a lot of practical work, but we would be interested in collaborating in such a project.

DOWDEN: I am interested in doing more work in this field in New South Wales, and have seen a computer programme which I think would be suitable. I think that FPL could help to coordinate the work rather than have people working independently.

HUDDLESTON: Logs with kinks are not helping the sawmiller to reduce his costs; they should be processed in the bush to eliminate the kinks.

SMART: I agree that this is important, but plantation logs come in in fixed lengths and are processed through the mill as they come.

VAILE: The whole question of economics surely depends on what we will be selling in the future. We assume there is going to be a timber deficit, but if substitutes take over a big share of the market there may not be. I feel it is dangerous to assume that we will necessarily be tied to the housing market.

PAGE: Scale of operation and integration will help to solve some of these problems. If the housing predictions are true, it is likely that all the timber produced will be used but it will probably represent a smaller percentage of the total building materials used.

ITEM 5/1. TIMBER IN HOUSING*

Over the past decade, consumption of sawn timber in Australia has remained virtually static, however, its pattern of usage has undergone considerable change.

It is difficult to determine accurately how the present output and imports are utilized as reliable statistics are non-existant except in certain defined areas.

Whilst inroads have been made into many of the markets traditionally held by timber, housing still represents the most important individual source of demand for timber and timber products.

Since the settlement of Australia, it is estimated that $3\frac{1}{2}$ million dwellings have been constructed and it is anticipated that the future rate of building will be such that this figure will double by the year 2000.

The static level of consumption of sawn timber (see Graph I), despite a substantial rise in population and increased activity in the construction of dwellings, is generally attributed to the use of alternate building materials and to changes in living patterns (e.g. mode of construction of dwellings).

The degree of penetration of competitive materials in the domestic housing market can be ascertained from Appendix 1 - a concise statement on dwelling timber usage throughout Australia.

Particularly in Sydney and Melbourne, the continuing increase in high density housing as a percentage of total dwellings (see Graph II) has had a marked effect on wood usage as high rise housing development uses very little structural timber.

However, the current flat/house ratio is less alarming when it is realized that a large part of high density flat development is currently in single storey "villa units" erected as a cluster project on a single site - these dwellings mostly employ timber frame construction. The mix of single storey versus multi-storey projects in Victoria is illustrated in Graph III - in NSW there is a far greater swing toward

*Prepared by R Lamb

"walk-up" and high rise flat development in the metropolitan area.

Australia is by no means self sufficient in timber and relies on imports to an extent depicted in Graph I.

Certain States use far more imported timbers than others due to various reasons of supply and demand - a breakdown detailing trends in imported sawn timber since 1964, coupled with usage in the various States, is given in Graph IV.

TRENDS AFFECTING THE USAGE OF WOOD
IN THE DOMESTIC HOUSING MARKET

(a) Concrete slab flooring - Approximately 20% of the super footage of framing timber in a house comprises subfloor framing and, in addition, approximately 1500 super ft of flooring is used - the incidence of slab floors in the various States is detailed in Appendix 1, - the current demand for a low profile architectural concept in housing favours concrete slabs.

(b) Sheet flooring (plywood and particleboard) - gaining acceptance by specifiers in some States.

(c) Metal framing systems - Still in early stages of development and, whilst currently seemingly uneconomic in populated metropolitan areas, they show considerable promise for application in future years.

(d) The drop in the number of timber clad dwellings - Weatherboards have fallen out of favour in most States, however, a resurgence of interest is evident (particularly in NSW, Vic. Q'land and SA) in houses of composite construction which embody external timber claddings as an architectural feature - building statistics do not acknowledge this trend of cladding application.

(e) High rise flat development - previously mentioned.

(f) Panelized construction methods - As yet unacceptable to the mass public and are primarily adopted in remote housing projects - could prove to be an important factor if the attitudes of the buying public could be swayed from their brick/veneer preferences to an economic imaginative panelized system.

(g) Aluminium window joinery - The penetration of metal window joinery varies from State to State (refer Appendix 1) - it is generally felt that timber is steadily gaining in this market and, in fact, holds the major market percentage in some States.

(h) The tendency towards larger homes - In 1960 the average home was considered to be around 10-11 squares; today, in most States, 13 squares is regarded as the norm.

(i) The second home market - As our society becomes more affluent, this market becomes more promising and viable - it currently comprises only about 2% of the overall dwelling commencements.

(j) External timber features - Renewed interest is being experienced in the external use of timber in pergolas, decks and fencing - improvements in timber finishes (viz. natural oil stains) have contributed to the interest in this field.

(k) "Engineered" timber framing - The advent of the light timber framing code has caused certain large builders to investigate closely the economics involved in the rational use of timber for framing (e.g. use of smaller section sizes than traditionally used). This trend will probably become more evident as industry bodies promote the code - the end result, an "engineered" timber frame using less timber than traditionally employed in the past.

APPENDIX 1

THE USE OF TIMBER IN DOMESTIC DWELLINGS
IN AUSTRALIA - 1971

FRAMING (Wall)

NSW	Most walling is timber (95% of all homes). 25% unseasoned hardwoods, 75% imported softwoods.
Vic.	97% of homes are timber framed - of this 87% from unseasoned hardwood, balance radiata pine, kiln dried hardwood and oregon.
Q'land	Over 90% timber framing green sawn hardwood - rest hoop pine, cypress pine and unseasoned rain forest species.

SA Approximately 68% homes solid brick - balance brick veneer - primarily of kiln dried radiata pine and oregon.

WA Solid brick predominates - remote areas use timber frame construction - basically unseasoned hardwood.

TAS. 95% of all construction timber framed (60% b/v, 35% timberclad) - mainly unseasoned hardwood with slow swing to dry hardwood.

FLOORS

NSW Slab penetration only slight - most timber floors are either cypress or radiata pine - hardwoods used in decorative applications.

Vic. About 12% slab penetration - basically kiln dried hardwood strip flooring with pine becoming increasingly popular.

Q'land Slab floors becoming widely used in SE area (up to 20% of new homes - slab penetration in some country areas up to 50%) - kiln dried hardwood normally used (brushbox).

SA Slab penetration less than 10% - floors mainly radiata pine - few hardwood floors in more expensive homes.

WA About 50% new homes have slab floors - timber floors mainly hardwood - very little pine - sheet flooring products used to a minor degree.

TAS Negligible slab penetration - Tasmanian hardwood used in approximately 98% with Tasmanian Myrtle for balance.

STUMPS

NSW Normally brick piers - timber stumps only used in country areas.

Vic. Mainly concrete in metropolitan area - timber in country areas.

Q'land Practically all concrete.

SA Mainly brick piers used.

WA Brick piers in solid brick construction - some timber stumps in the small percentage of b/v construction - concrete stumps not used.

TAS Timber rarely used and then only in country areas.

CLADDING

NSW Mainly used in cheap homes (especially in remote areas) or alternatively in very expensive homes - cypress pine or local hardwoods in the first instance, and treated pine and western red cedar in the latter. Timber cladding is still extensively used on middle-class houses in the Newcastle area.

Vic. Noticeable swing in interest of feature panel concept in middle to high class dwellings.

Q'land Still used extensively - local hardwoods employed with small but increasing amount of CCA pine.

SA Used in few decorative applications only - radiata pine and western red cedar.

WA Almost non-existant - minor amount used on expensive homes in feature panels.

TAS Approximately 35-40% of houses are still weatherboard - Tasmanian hardwoods only.

ROOFING

NSW Trusses comprise about 6%, remainder traditional and flat roof construction - local hardwoods and oregon used.

Vic. About 9% penetration of flat roof construction using oregon, remainder traditionally framed (unseasoned local hardwoods) with small percentage of trussed construction.

Q'land 25% penetration of trusses, balance traditional.

SA	Oregon used extensively in trusses.
WA	Mainly traditionally framed - little penetration of roof trusses.
TAS	Traditional constructional predominates (unseasoned local hardwoods).

FENCING

NSW	Mainly timber - post/rail/paling type.
Vic.	Divisional fences, virtually all timber (unseasoned hardwood).
Q'land	Rarely used.
SA	Mainly galvanized iron.
WA	Corrugated asbestos cement sheet predominates.
TAS	Mainly timber - unseasoned hardwood.

WINDOW JOINERY

Vic.	Timber holds the major portion of the market - species used: western red cedar, local hardwoods, and asian timbers.
SA	Approximately 70% timber - asian, western red cedar primarily used.
WA	Approximately 65% of windows are timber (local hardwoods and asian species).
TAS	80% window are timber - slight swing being experienced toward metal frames.

"FINISH" MOULDINGS (e.g. skirting, architraves, cornices, etc.)

Generally speaking, most internal moulds are timber, - rolled metal fascia is used extensively and steel door frame/architraves are being used in high rise flats to satisfy fire resistance requirements. Extruded plastic moulds are finding limited application in commercial buildings (particularly in office partitioning).

ITEM 5/1a. TRENDS IN HOUSING DESIGN IN WA*

Architectural trends

Housing architecture in WA remains pretty much in the traditional brick cottage style with room and total area getting smaller as costs rise and the finance gap gets harder to bridge.

A Spanish style with arch-supported roof overhangs has been fairly popular for a few years.

A Cape Cod style with a weather board clad upper storey built into a high steep roof is said to be displacing it now. This style can provide a simple enlargement for some existing brick dwellings.

Large high rise blocks of flats for the low income group are becoming increasingly common because they provide a State Housing Commission unit of shelter at a lower cost than individual dwellings. These flats use little timber.

Transportables are much in demand for mining and other outback areas. These are mainly timber framed asbestos clad but steel framed and clad units are increasing in number.

Structural and material trends

Walls - These are traditionally double brick. Over the last five years timber framed private dwellings (brick veneer and asbestos clad) have stayed at about 16% of commencements. One large contractor finds double brick cheaper than veneer and brick partition walls cheaper than timber framed.

Floors - Some $2\frac{1}{2}$ years ago concrete floors had 30% of the market. It is estimated that they now have 50% to 60% and will probably level off at about 75%. A survey of occupants showed no particular preference for concrete or timber and the pressure comes from the builders who find that concrete causes less disruption and inconvenience on their jobs. It is also easier for them to cheat on a concrete job. They quote 3 or 4 times the actual cost for a timber floor because they do not want to be bothered with it. Because of poor quality, the actual cost of a concrete floor is about half the cost of a timber floor. The price of flooring would need to be halved to make timber competitive with a good quality concrete job.

Usage of pinus aquatite plywood flooring has been at 1 million sq ft but it is expected to increase to 10 million over the next 5 years.

*Prepared by H C Wickett

Roofs - Gang nail trusses are not economical in State Housing jobs or private dwellings. When suitable they are going into some industrial roofs but their overall penetration is very small. The underlying reasons do not seem to be available. Exposed beams, solid and usually rough sawn, are becoming popular in domestic and civic architecture. There is a lot of interest in glulam but sales are very slow because of the high price.

Trim - There is a renewed growth of appreciation of quality timber. Decorative panelling in good plywood and even in the old solid timber style is coming into favour but only in high cost homes of course. Low income home builders do have an appreciation of timber and try to incorporate some timber features as far as their building budget allows.

Openings - Taking all new building work, door frames are estimated to be 75% timber and 25% galvanized iron. In high rise flats the proportion is about 50% galvanized iron and in private houses 5% - 10%. Aluminium windows and frames are estimated to be taking about 50% of the market.

Discussion - Items 5/1 and 5/1a

SMITH: Referring to points in Mr Lamb's paper, we have not seen any significant increase in the use of particleboard for flooring. There has been no increase in the use of timber cladding, in fact, it has declined. Aluminium window frames are making more inroads into the timber field, and there is a need for better timber finishes for external use, otherwise timber could lose more markets.

KENNEDY: Statistics which cannot be obtained from Government sources may sometimes be available from private firms, such as Source Market Research.

MARTIN: There are two areas which require attention in the R & D field. These are the cost of timber as a framing material, and its maintenance in exterior applications. Further work is also needed on wood based sheet materials and improvement of the performance of non durable species.

BRYANT: In the case of window framing, treated radiata pine could gain a reasonable market in place of western red cedar.

KENNEDY: Gang nail trusses for house construction have been critized as they do not fit well into the builder's normal operations. They represent a separate activity which must be programmed, hence do not necessarily represent any great saving. It is claimed that a crane is often necessary and in many cases the time saved is insignificant.

WOODHEAD: The shortage of skilled labour and the difficulty of keeping on-site costs down are worrying the industry at the moment.

HUDDLESTON: A comparison was made by me between the costs of supply and erection of gang nail trusses and traditional framing methods for six typical designs. In each case it was more economical to build the roof on the job. In regard to aluminium window framing, the best method of using it may be in combination with wooden frames to provide stiffness. One firm is already doing this in Sydney. We should not lose sight of the considerable amount of timber and plywood used for formwork and temporary construction in high rise buildings. If the industry could market prefinished prehung timber doors and frames, some of the metal doors favoured due to the absence of carpenters on a high rise building might be displaced.

EDGERLEY: Some 90–95% of houses in ACT use gang nail trusses. The houses are designed to use them, and the consequent saving is claimed to be up to $100 per house.

ITEM 5/2. SHOULD BASIC RESEARCH BE DONE ON SURFACE PRESERVATION?*

There is a need for preserving the surface integrity and appearance of wood items used externally, e.g. trim external joinery, external timber features, panels and fences, more economically.

This has been discussed within FPL already, and comment is required.

Paints have been improved and on <u>clear</u> wood of many species, give performance. But this is useless if failure occurs in spots, such as at defects and ends (stops and butt joints). Also success depends on regular and competent application. Back-sawn ash (for instance) is troublesome even when clear.

The problem then becomes to find out what happens at such spots, and what treatment is required to prevent deterioration. It may be that treatment must be deeper than the surface, and done in the factory.

The end result might be to capitalize on the advantages of wood in exterior uses, and maintain or even gain markets.

*Prepared by W McKenzie

ITEM 5/3. FUNGAL INHIBITORS FOR STAIN FINISHES (NSW)

Sydney's recent wet summer has caused a lot of fungal growth in and on timber coating systems. External stain finishes based on linseed oil have been especially affected despite the inclusion of fungicides and the severity of attack seems to be much greater in areas (as on eaves lining) where the surface is protected from direct association with sun and rain.

The greater freedom from attack of the fully exposed surfaces may be due to some polymerization of the oil resulting in a less attractive source of fungal food.

The unfortunate situation exists where exterior stain finishes have reasonable durability (3 or 4 years) against weathering but the fungicides used with them are ineffectual after perhaps a year. Phenyl mercuric succinate and pentachlorphenol are the fungicides commonly used by local manufacturers of stain finishes.

Dr Hoffman and his coworkers at the Division of Building Research, CSIRO, have shown the transient nature of these products in surface coatings. Pentachlorphenol at 3% concentration (the highest currently used in the finishes) was found by them to have no real value in deterring mould growth in external coatings and even 6% would only be effective for little more than a year.

People have been attracted to use timber because of the availability of stain finishes and it would be most unfortunate if this situation is reversed by this fungal problem.

Urgent action is required to:

(a) find an oil base less attractive to fungi, and/or

(b) develop more lasting fungal inhibitors.

In regard to (b) Hoffman and co-worker's have made suggestions in relation to opaque paints that might be extended to stains, such as:

(1) incorporation of some zinc oxide, which increases mould resistance for several years;

(2) use of copper hydroxyquinolinate, which is stable and effective so long as it is exposed to weathering;

(3) addition of N-trichloromethylthiophthalimide, which is stable when protected from weathering.

It is suggested that the timber industry should seek help from the Division of Building Research in tackling this specific problem.

Another point: The transient nature of pentachlorphenol's efficiency, as shown by Hoffman's work, makes one wonder just how effective is this constituent of the 3-minute dip water repellent "preservatives".

ITEM 5/3. FUNGAL INHIBITORS FOR STAIN FINISHES (Q'LAND)

Over the years, the policy of the Queensland Department of Forestry has been to utilize plantation pine extensively in its own new buildings. This has paved the way for improved industry acceptance of the species concerned, particularly for external cladding in timber dwellings.

Clear finishes presently available have an expected exterior service life of no more than 18 months under Queensland conditions. However, there is mounting evidence that under some conditions this service life may be appreciably reduced when applied to slash pine and other exotics. With the Department relying heavily on these species in its planting programme, this potential utilization problem must be overcome.

Two cases of interest have occurred recently. In a coastal situation at the Pomona office less than a month after 70 in. of rain, the clear finished CCA treated chamfer boards were found to have less than 10% moisture content. Extensive breakdown of the finish was nevertheless evident within 8 months of erection. At Passchendaele office further inland, where conditions are generally much drier and cooler, similar boards were found to be at 10 – 14% moisture content and covered with a severe mould associated with finish breakdown. In both cases, knot degradation is causing some concern.

As similar evidence has been found in various sites with clear finished or stained untreated slash pine, these circumstances suggest that:

(i) Clear finished slash pine responds to moisture content change in a very rapid and marked manner.

(ii) Surface moulds grow quite rapidly in the finish applied to slash pine, <u>irrespective</u> of whether the boards have been CCA treated or not.

An inherent problem with slash pine and similar species is the differential moisture and movement characteristics of earlywood and latewood zones, resulting in "ridged grain". This means that if a finish is to be durable, it must have sufficient elasticity, and it must retain this property as it ages. This has been substantiated by overseas work.

Suitable exterior type clear finishes and stains are considered essential to meet public and aesthetic demand for pine cladding or exposed timber generally.

It is hoped to carry out a full study of effects of different clear finishes, paint systems, and species on film durability, with respect to physical breakdown and fungal attack but there is a necessity to coordinate such work by the various organizations before embarking on such a project.

Discussion

MARTIN: Architects and builders are concerned at the very high maintenance costs of external timber joinery treated with stain finishes, and the Public Works Department is now specifying opaque finishes. Since CCA treated pine is now in wide use could a stain be incorporated so that it penetrates the timber.

TAMBLYN: Yes this could be done but surface breakdown could still occur. A better finish rather than impregnation is required, this was decided 15 years ago but it is not within the province of this laboratory to work on finishes. Water repellent preservatives are not the answer either, as there is virtually no penetration in side grain under the circumstances in which they are applied.

SMITH: There is an urgent need for research to prevent spot failure of paints around knots and pitch streaks in pines. There is also need for a better end sealer than paint. Temperature effects are important, especially with resinous non-uniformly textured exotic pines.

BRABIN: Perhaps the Australian Paint Committee could do some research on pigmented stains.

ITEM 5/4. PRODUCTION OF HOUSE STUDS FROM DISTORTION-PRONE JUVENILE CORE RADIATA PINE*

In December 1970 at a meeting convened in Melbourne where members of the Timber Advisory Council of NSW, the Timber Promotion Committee of Victoria, the Radiata Pine Association of Australia and the Division of Forest Products were represented, it was proposed and agreed that a joint project be designed and carried out to evolve seasoning methods which would produce straight studs from the distortion-prone cores of radiata pine logs.

*Prepared by J F G Mackay, Forest Products Laboratory and B L Rumball, Radiata Pine Association

This coordinated research project became the responsibility of us both. Our early ideas were based on the experience of work reported in the United States on stud production from cores of southern pines and on work which had been under way in Queensland on hoop and slash pines, carried out by F Christensen of this laboratory and D Gough of the QFS. Our early results with radiata pine showed us where to develop our techniques specifically for this species.

In detail, the purpose of the project was to determine if the amount of degrade resulting from the rapid high temperature seasoning under restraint of distortion-prone material would enable the economic production of studs meeting the warp specification laid down in AS 078 for No. 1 and No. 2 stud grades.

The experiments were carried out almost entirely at the Lakeside Mill of Softwood Holdings in Mt Gambier. One final run was done at the Woods and Forests Department State Mill. Eight drying runs were carried out to test various factors; material for six of these runs came from the immediate vicinity of Mt Gambier and for two runs from Tumut, NSW.

Each run contained 768 test studs, 8' x 4" x $1\frac{1}{2}$". The size of the packs was such that only about half of the height of the kiln was used, the remainder being filled by a baffle running the whole length of the kiln. The result of this, and the fact that $1\frac{3}{8}$" stickers were used, was that the air velocity reached around 900 fpm. To obtain the studs, logs were centre-ripped using the butt-end pith to position the first cut. An 8' piece capable of yielding a finished $3\frac{7}{8}$" x $1\frac{3}{8}$" stud was obtained by backsawing each half. Pre-sizing in the green state was often found to be necessary to offset the irregularities in sawing quality from our different suppliers.

Two drying temperatures were used; 240° with a 70° WBD as a high temperature schedule and 180° with a 40° WBD as a conventional schedule.

Mechanical restraint consisted of top-loading each test pack with one or two concrete slabs which gave a dead load of 110 and 220 lb/sq ft respectively. The weights remained on the packs for the whole of the drying period, during any final high humidity stress relief period, and during a final 24 hr cooling down period. The principal behind the high temperature drying was to severely over-dry the studs relative to the ambient emc, and then to raise the emc up to 10-12% during the high humidity or reconditioning stress relieving period.

Early results clearly demonstrated that studs cut from cores of logs of different age and tree position twisted on drying to varying extents. In general sapwood twisted more than heartwood and topwood twisted more than buttwood. Our practice was gradually to sift out the log classes which were easily dried straight, and then concentrate on those which presented most difficulty. These turned out to be the butt logs from second and third thinnings, with a butt diameter of 10-12".

The aim of the exercise was to be able to obtain better than 90% of studs meeting 078 grade for twist. In effect this meant twist of not greater than $3\frac{1}{2}°$ in radiata; this incidentally compares with $4\frac{1}{2}°$ for hoop, slash, hemlock and Douglas fir, and $5\frac{1}{2}°$ in the USA.

The objective can be gained by a relatively simple means, namely drying these studs in a conventional low temperature, low air velocity kiln, top loading packs with 220 lb/sq ft and finishing the process with a 4 hr reconditioning treatment. Upwards of 90% of studs so dried will be found to have twist of $3\frac{1}{2}°$ or less. The problem arises, however, when their stability under varying emc conditions is tested. We found that re-cycling between 5 and 19% emc allowed these studs to twist up to an average of 10° and we therefore strongly discourage this method of seasoning.

Rapid drying of studs at the higher temperature mentioned for only 17 hrs, followed by a 4 hr steaming under restraint of 220 lb/sq ft, likewise gives about 90% or better results, and the stability of these studs is vastly greater, variation during the same re-cycling being only from $2\frac{1}{2}°$-$4\frac{1}{2}°$. This then would be our recommended method, but needless to say there are some provisos.

Some may be tempted to carry out the final stress relief operation in the same kiln immediately after drying. This we would not recommend, but would favour transporting the material to a reconditioner. Not only would degrade of the kiln and fittings be accelerated by this treatment, but it is very difficult to obtain the high humidities necessary in a very hot kiln. Even when a wet bulb depression of only 4 or 5° was obtained by this method, the results were considerably poorer than those where a reconditioner was used.

Low air velocities yield poorer results than high ones, even when temperatures are high and the recommended top loading is used. Approximately 10% more studs can be dried straight with an average air velocity of around 900 fpm than with an average of around 400 fpm.

Finally, the strength of the studs. Testing of a representative sample of high temperature dried studs has been in progress in our Engineering Section. Results to date give a clear indication that by the application of a rather simple grading rule, still in final development, a high recovery of 630f grade scantlings is possible. If the remainder of the test programme confirms this, then the end result will be of considerable practical significance. For example, 4" x $1\frac{1}{2}$" studs of 630f at 18" centres may be used for wall heights up to 10' to support tiled roofs. Thus this grade of material could find an immediate use as studs in traditional wall framing.

ITEM 5/5. MOISTURE LEVELS IN RADIATA PINE CONSTRUCTION TIMBER

Because of the high proportion of sapwood likely to be present on radiata pine timber and its proneness to considerable absorbency of moisture it was decided to erect a test structure adjacent to the Commission's Pennant Hills nursery, about 17 miles from Sydney, to see if there are any real dangers of decay when using unpreservatised material.

A range of likely hazard conditions, such as damp clay soil, southerly aspect, sheltered and shady surroundings, absence of eaves overhang and the most absorbent bricks available have been incorporated in the 24' x 12' structure divided above floor level into two rooms, one of which is clad in brick veneer, the other in asbestos cement. The roof is fitted with foil insulation, the walls and ceiling are covered in gypsum board and the flooring and the structural timbers are of radiata pine.

Underfloor ventilation equivalent to about 0.25 sq in./sq ft of floor area was provided in the form of terra cotta vents. The amount of ventilation can be easily restricted by covering some of the vent holes with adhesive tape.

Readings taken in all parts of the structure during a period of 12 months when rainfall totalled 39" indicated a moisture range of 12.5% to 17% in the underfloor timbers and 9.5% to 15% in roof timbers. There was little difference in the moisture content of the framing between the brick veneer and the asbestos cement portions.

Reduction of ventilation to half the above mentioned figure did not cause the moisture content levels to rise to dangerous levels (above 20%) during a month of very wet weather but one quarter of the original ventilation produced a danger level in the same length of time. Further studies on the ventilator area and location are continuing but it is obvious that underfloor ventilation is the essential factor in ensuring the suitability of pine framing.

The structure is also being used to study rate of loss of moisture from green hardwood framing, an important consideration when deciding on builder's maintenance periods. The present period of three months is certainly insufficient for the frame, if at 30-40% moisture content when enclosed, to reach equilibrium and reveal the full extent of plaster cracks.

In another building in a sheltered location at Pennant Hills the durability of unpreservatised radiata pine tiling battens is being examined under both terracotta and concrete tiles laid at a slope of about 21°. Foil sisalation prevents ventilation of the battens from below. After 3½ years the battens appear to be in excellent condition.

ITEM 5/6. DEVELOPMENT IN SEASONING OF FRAMING SIZES (Q'LAND)

Work on the production of dried and dressed framing has focussed mainly on the high temperature drying of material from young plantation grown conifers, notably slash pine and hoop pine.

Extensive trials undertaken jointly with the Division of Forest Products showed the high temperature techniques developed to be a suitable way to obtain a reasonable seasoned recovery from this extremely distortion prone timber.

One sawmilling firm has nearly completed the installation of high temperature drying facilities while another has modified its existing drying facilities in order to increase the heating capacity and the air circulation rate.

High temperature drying work is continuing with research into drying timber cut from older and larger plantation conifers. With these studies, strength testing and stress grading form an integral part.

A constantly rising temperature technique is being investigated in which the dry bulb is increased by 3°F or 4°F every hour while a constant wet bulb of 160°F is maintained. The dry bulb is levelled out at 250°F. Results to date with hoop pine have shown the constantly rising temperature method to give slightly better results, at the expense of slightly more time, than the method whereby super-heated steam is used for heating up with constant conditions of 250°-160°F being maintained thereafter.

The seasoning of brush box in framing sizes is to be investigated soon. Drying in 2" and 1½" thick flitches will be involved and also drying under temperature conditions higher than those currently accepted.

The concept of drying hardwood framing to levels of around 18% mc is of considerable interest. To date this Department has not undertaken studies of this nature, and advice regarding the current status of this type of work elsewhere would be appreciated.

Problems of erosion in high temperature kilns are at present under investigation, the indication being that this is more rapid than in conventional kilns. The effects of high temperature drying on treatability of pine are also being examined. The migration of resin acids to a layer near the surface of the timber tends to prevent penetration of cold waterborne preservatives.

ITEM 5/7. LIGHT TIMBER FRAMING CODE (Q'LAND)

Although no assessment of the acceptability of the Code in Queensland has as yet been possible, from enquiries made and comments received to date, designing, specifying and industrial interests welcome this document with some reservations in certain quarters.

Industrial interests have already moved to implement its recommendations by marketing seasoned framing, precut, treated and dressed to the minimum cross-sectional dimensions specified, with heads and sills supported in a manner acceptable under the Code but not previously permitted by local approving Authorities.

Industry recognizes the advent of the Code as a means not only of affecting economies and gaining consumer confidence in timber products produced and used in accordance with its provisions, but also in achieving rationalization of cross-sectional dimensions in conjunction with approaching metrication in the timber industry.

The T.R.A.D.A.C. of central and southern Queensland has issued an introductory leaflet promoting the Code's application. This is expected to have considerable influence on its implementation in this State.

While the State Housing Authority has not had time adequately to review the Code, it is understood some of their objections include:-

(a) Allowance for studs to be butted to plates without housing.

(b) 2" wide wall braces which do not lend themselves to double nailing.

(c) Strutting in roof framing which could raise building costs.

(d) Rack of tenoning of window-sills to studs.

No objection to the adoption of 1½" thick studs is foreseen.

The limited species schedule, excluding numerous Queensland species, (including several of major importance), is of concern not only to this Department, but also industrial interests marketing plantation pine and rain-forest timbers.

The scheduling in Tables 1 and 2 appears to give an unmerited marketing advantage to radiata pine and imported Douglas fir and hemlock over other Australian grown softwoods and over rain-forest timbers.

Discussion - Item 5/7

HUDDLESTON: In NSW the reception of the Code has been mixed, but in general very favourable by architects and builders who are using it in their designs. Building in NSW is controlled by ordinance 71 of the Local Government Act, which lays down sizes of timber. The Department has said that it will not accept the Code as an alternative to Ord. 71 until the timber industry is prepared to market stress graded timber with the grade marked on it. In the meantime designers can by-pass Ord. 71 by obtaining an engineer's certificate for the design. On the other hand the timber industry is reluctant to grade timber to a stress grade possibly because this would constitute a guarantee, rendering firms liable if the timber did not meet the stress level.

COOK: The TAC in NSW aimed to train graders and introduce grading into the Newcastle area as a pilot operation. At one stage 60% was being graded, but it was eventually dropped due to price competition.

RUMBALL: There has been a good reception of the Code in South Australia, but industry groups must extract it and put out their own bulletins as we have done for radiata pine. The Code presents certain advantages from both producer and user point of view.

THOMSON: TMA (SA) regards the provision of stress graded timber as the first essential function of the industry. Grading courses are planned and we propose to arrange a seminar on the Code to publicize it, also to prepare an extracted version of the Code.

VAILE: Local Government authorities in WA have accepted the Code in principle, but there are some queries regarding construction practices. We have estimated that use of the Code will reduce the cost of the frame for a BV by about 20%. We will also be extracting the Code for the particular use of WA timbers.

LAMB: Approaches have been made to the Vic. UBR Committee indicating that Pamphlet 112, at present the required standard, is now out of print, and suggesting that they accept the Code. Promotion is being commenced but a lot more grading is needed. Extracts are being prepared for distribution.

KLOOT: We have advised the Vic. UBR that the Code supersedes Pamphlet 112 only in respect to Class 1 construction. New Tables for Class II are in course of preparation.

MARTIN: We do not plan to promote the Code until industry personnel are trained in grading. SAA is proposing seminars on the Code and TAC has an instructor to train yard personnel in stress grading.

KENNEDY: Building inspectors have had too many experiences of builders substituting sub-standard items, so they will be looking for brand and grade marks on timber and are not likely to accept the assurance of a yardman that a piece is of a certain grade. This is particularly important in view of the paper on grading of ladder stiles.

ITEM 5/8. VENTILATION OF BUILDINGS*

The underfloor ventilation of buildings is a subject which has been under discussion for many years and does not appear to have been solved yet.

Custom in New South Wales has been to provide two terra cotta vents per room in the foundation walls just below bearer level. It is fair to say that in the great majority of cases this has proved to be satisfactory. In those cases where such provision has been made and trouble has occurred it has been traceable to some departure from normal practice, or to the blocking of the vents by garden growth, or the building of walls up against the vents. Failure to provide openings in the inside leaf of cavity walls directly opposite the ventilators; insufficient openings, or openings incorrectly spaced in internal walls; dead sections caused by inability to place ventilators in sections of the external walls to provide cross circulation; the building up of the soil around the building so that water is ponded under the building; and the sealing of the top of the floor with materials such as plastic tiles have all been fruitful causes of trouble.

In the public review draft of the Light Timber Framing Code provisions applying to the underfloor ventilation of buildings were present. These were objected to in several places and the drafting committee met the objections by elimination of the clauses in question and the insertion of what is now clause 2.3 of the Code which reads:-

*Prepared by E B Huddleston

"Ventilation of sub-floor spaces. No unventilated spaces shall be permitted beneath suspended floors constructed from or supported by timber. Sub-floor ducts, vents, air spaces and, where required, soil vapour barriers shall be provided".

Unfortunately the original provisions which were objected to, found their way, undetected by those who originally objected, into the Code as published in the form of a note to the clause. The note requires a clear opening of $\frac{1}{2}$ sq in. in the external sub-structure walling for each 1 sq ft of exposed under surface of flooring.

Ordinance 71 of the New South Wales Local Government Act has been amended to require ventilation as required by the note.

The amendment, according to information supplied to me by builders and checked by independent cost estimates prepared by myself, makes impossible the use of the terra cotta vents, and puts about $80 onto the cost of the average house. Multiplied by 30,000 per annum and a cost of $240,000 per annum is obtained as the price to the New South Wales home building industry!

In another paper Mr Bootle has shown experimentally that $\frac{1}{4}$ of this amount of ventilation is satisfactory for the structure which he was examining.

Trouble due to faulty ventilation will not be cured by the amended provisions and the Standards Association should be urged to complete the proposed Code for ventilation of buildings as a matter of urgency. It is understood that the Association requires a sponsor to undertake the necessary experimental work. This should not be necessary as information required, if specifically defined by the committee, could be obtained by research in one of the existing organizations.

Discussion

DA COSTA: The major hazard is condensation beneath impervious floor coverings. Increasing use of air conditioning also presents further hazards. More research is needed before there can be any objective assessment at all of the required levels.

TAMBLYN: I agree that a better understanding is needed, but there are so many factors that cannot be covered by a Code that it is necessary to set a high figure to take care of them all. It may, therefore, be more practical to set an arbitrary figure for the combination of the worst circumstances which could arise and not to worry about further research.

RUMBALL: Vapour barriers could provide part of the answer, perhaps more work is needed on them.

ITEM 5/9. METRICATION

Discussion

COKLEY: I would like to draw attention to the problem which metrication will pose to operators of preservation plants. In general these people do not have a high standard of education, and the metric dimensions of timber will be complicated in their case by the necessity to work also in litres and kilograms in connection with solution concentrations. I suggest that this matter should receive the particular attention of committees examining metrication and that some sort of training programme whould be put in hand preferably through the Timber Preservers Association.

WICKETT: Since this matter is in the hands of special committees I feel there is no point in discussing it here.

CROMER: The Metrication Board has 9 Advisory Committees, each of which has Sub-Committees, including Timber Industry & Forestry. In addition there are State Committees, so I feel the subject is being well covered elsewhere.

General discussion - Items 5/1-5/9

BLAKEY: Since the discussion on this important topic has obviously been limited by time, it may be appropriate to consider what extra time can be devoted to it.

KLOOT: I suggest that the use of timber in housing is worthy of a special conference.

HUDDLESTON: I agree.

It was then moved (Huddleston) that a 2-day conference on Timber in H ousing be held later this year and that representation be as for the Forest Products Conference.

Conference unanimously agreed to this motion.

ITEM 6/1. PRESERVATION OF THE ENVIRONMENT*

In 1828 Samuel Taylor Coleridge wrote:-

"The river Rhine, it is well known,
Doth wash your city of Cologne;
But tell me, Nymphs, what power divine
Shall henceforth wash the river Rhine?"

The Poet's concern appears to have gone unheeded and for more than one hundred years after his warning the wastes generated from increasing populations and advances in technology were disposed of in the most convenient and cheapest way. Watercourses and the atmosphere were convenient sinks into which those wastes could be emptied, and were used for this purpose to the full.

It was only when poisonous smogs started to choke the world's major cities and harmful quantities of insecticides started to be discovered in foodstuffs, both less than twenty years ago, that concern was expressed as to the consequences of the practices being followed. As the accelerating effects of this contamination caused the inconvenience to become more and more manifest, public concern mounted and public demands were made that something should be done about it. Country after country introduced legislation to control atmospheric and stream pollution and this has now spread to Australia, with, I believe, New South Wales in the vanguard. Furthermore, the concern over atmospheric and water pollution has now been extended by including: The soiling of the surroundings by spillage from factories and transports; noise; and even the erection of buildings and other installations in such a way that they detract from the aesthetics of the surrounding areas.

The forest products industries have been caught up in this concern, labelled with the general title of "Environmental Pollution", and the restrictions now being imposed by regulations and public complaints are proving an expensive exercise for those industries.

In towns through which timber transports travel it is not unusual to find bark, shavings, sawdust and pieces of sawn timber along the roads to which they had fallen. The noise of heavy transports is regarded as part of the development of the local industries, so sought after by country towns.

Overhead transmission lines were considered as being part of progress and hence were tolerated and eagerly sought. Today these things are considered as polluting the environment. Not only are more and more restrictions being placed on new installations submitted for approval, but new regulations and new requirements are being formulated for

*Prepared by E B Huddleston

existing installations. These are proving costly and in some cases so impossible to meet that relocation of the sawmill or factory seems to be the only solution.

The requirements of Clean Air Acts and similar legislation are proving particularly irksome to the timber industry. Not only do existing waste burners fail to meet the requirements laid down, but at the present time no satisfactory solution is in sight. The best of the "teepee" type burners, with thermostatically controlled air admission, show marked improvement over the older burners but still do not meet those requirements.

It appears that in those cases where waste must be burned, and this is generally necessary in the timber industry, arrangements will have to be made to store the waste generated and to feed it to the burner at a constant rate during the operating period, which could well be continuous over most of the week. This will involve the installation of chippers together with storage and feed mechanisms. At this stage no guarantee can be given that these will be free of breakdown or that they will solve the problem. In any case the large hearts so common in our hardwood mills are not suitable for disposal in this way.

In the meantime several of the timber industries in New South Wales have notices requiring that the nuisance which they create be abated. Action on these notices has been delayed following representations made by the industry associations and having regard to research being undertaken by the Division of Wood Technology. Pressures are building up and with all the good will in the world, those responsible for the enforcement of the regulations cannot hold the axe up much longer and its fall appears inevitable and immenent.

The same regulations have reference to boiler installations. Henceforth much greater care will have to be given to the design of waste fired boilers so that they are of the proper size and dimensions. No longer will the intermittent fired boiler be permitted to operate.

Particles and dust blown from the machines and surroundings of sawmills and factories, or those escaping from cyclone separators, are also the cause for complaints and cause action to be taken. In some cases this has been solved by the installation of high efficiency separators, but in others the problem remains unsolved and the rebuilding or relocation of the sawmill or factory may be necessary.

The pollution of watercourses is another source of worry. The once common practice of discharging sawdust and waste to the nearby convenient creek or river has been frowned upon for a number of years, although still practised in some areas. Now attention is being given to drainage from the plants, and the official eye is travelling away from the watercourses to the town drainage systems which eventually end up in the watercourse. The black liquid which flows from the sawmill yard after rain, the drainage from the reconditioner and particularly from timber preservation plants, are all noticeable, suspect, and unwanted.

The pulp and paper industries are in trouble from both causes. Their boilers and other plant are responsible for atmospheric pollution and their drainage carries chemicals and solids to the waterways. Recently concern was expressed in Sydney at the build-up of mercury salts in Botany Bay, and one well informed (?) public figure stated that the whole of the bed of the bay was covered by a layer of paper pulp at least one foot thick!

Chemicals used in the treatment of timber are very much a cause for concern. Even if adequate precautions can be, and are taken, to ensure that these will not escape by drainage from the plant, or drainage from treated timber, or from the burning of treated timber, in every plant there comes a time when the treatment solution becomes too dirty and must be disposed of. It will no longer be possible to tip this out on the ground and assume that the normal dilution of rain and stream will render it harmless.

In one incident dealt with, a chlorinated hydrocarbon was found in harmful quantities in a river. At first agricultural spraying was suspected but when enquiries revealed that no such spraying had been carried out on the catchment upstream of the affected area other avenues were sought.

One possibility investigated was the chance that the amount of the chemical present could have been carried to the atmosphere by the burning of waste material. By settling on the surrounding land and being flushed to the river by rainfall it was suggested sufficient chemical would be present to cause the concentrations complained of. This did not appear to be an explanation because of the continuance of the trouble independent of rain, but it was a sobering discovery to calculate that this mode of transfer could lead to trouble. Eventually a leak in a storage tank was discovered. This, although sufficient to build up the contamination to an unacceptable level in the river, was so slow as to remain undetected for some considerable period while the investigations were being carried out.

Noise is another cause for complaint. Levels of noise acceptable up to two years ago are now attracting notices to abate the nuisance from local government authorities. Some consultants specialising in this field are reaping a harvest advising local councils. Admittedly their main concern has been aircraft noise, but the successes achieved in this field by having flight paths changed have directed attention to other noises and the circular saw, the planer and the router are now coming under attention.

The preservation of the environment is going to be very much a trouble to the forest industries during the next few years.

ITEM 6/2. POLLUTION PROBLEMS - THE WOOD PRESERVATION AND WOOD PROTECTION INDUSTRIES*

Widespread public interest in pollution control makes it essential that we take a close look at likely sources of pollution arising from the activities of the Wood Preservation and Wood Protection Industries.

In considering pollution in this context we might ask a number of questions to put the matter in its correct perspective. These concern the toxicity of the pollutant, the zone of dispersal, the amount of material, its persistence, the likely effects on the environment, and how to mitigate the problem. It is essential that we do not magnify a situation unreasonably, or confuse local pollution with general pollution.

Some potential sources of pollution are listed in the paper circulated to delegates.

It must be emphasised that we need a considerable amount of information on the extent of these problems. Taken individually they appear localised, but this should be considered in relation to the toxicity of the preservative, the likely effect of any local disaster on the use of preservatives as a whole, and the cumulative effects of pollution, even in local areas, over long periods.

In New South Wales, and other States, the attitudes of the Occupational Health Divisions, of Departments of Labour and Industry, and other Labour supervising organizations, and of local Government Authorities, for example, Council or Shire Health Departments will become increasingly important to the Timber Preservation and Protection Industries.

Pollution which is the cause of obvious discomfort to plant operators, or to other people working with treated wood will inevitably result also in Trade Union pressure either for compensatory wages, or in a refusal to take part in certain operations.

In the United States and in New Zealand the problems of wood preservatives in relation to pollution are now claiming the attention of national committees, and I feel that the members of this Forest Products Conference might well commend to their respective organizations

*Prepared by D W Edwards
Note - This is a summary of the full paper distributed at the Conference

a closer look at pollution problems within the local Timber Preservation and Pest Control Industries.

ITEM 6/2a. WASTE DISPOSAL FROM WOOD PRESERVATION PLANTS AND CHEMICALS*

Certain restrictions have applied to date under local State Health Acts, and City or Shire regulations. However, it has now become desirable to review the problems of the preservation industry relative to waste disposal, especially as regards the impending Legislative control of pollution. This will result in the need for the industry to receive adequate technical assistance to ensure there is no pollution.

There are three main areas of contamination relative to the treatment industry. These are:-

1. Pollution due to escape of preservative solutions due to drainage, leakage or cleaning operations. These include access to work areas, causing toxic dust and fume problems, leakage or drainage to water courses, and storm water drainage.
2. Disposal of sludge etc. during cleaning of plants. This is of <u>major</u> importance in large production units such as CCA cylinders. In certain areas disposal is at "toxic dumps" as prescribed by local Health Authorities. In Queensland to date, firms have been advised to arrange with Local Authorities regarding disposal, but this position is no longer tenable.
3. Disposal of planer shavings, sawdust and sander dust containing preservatives also involves problems.

There are major restrictions on the use of shavings and sawdust, e.g. they are not acceptable for agricultural purposes. The filling of low lying areas is not practicable due to their general proximity to water courses. From a practical aspect all preservatives currently used, boron, fluoride, CCA's, chlorinated hydrocarbons and other organic compounds are long term pollutants. Each individually affects plant or animal life commencing with concentrations of the order of parts per million.

Burning of such treated waste products, particularly those containing fluorides or CCA, provides a major problem. Arsenic salts will volatilize at temperatures attained in furnaces and incinerators. It is considered that a significant quantity of these salts could be

*Prepared by N A H Smith

present in stacks and in areas surrounding incinerators. The question of inhalation of toxic vapours adjacent to open fire burners is also present.

Although this paper was intended to deal primarily with preservatives, similar problems arise with pollution prevention in the plywood industry (plywood adhesives) and effluent from pulp and paper production.

Legislation in relation to pollution control is in preparation in Queensland. However, present control is exercised through local councils or the State Health Department.

It is the considered opinion of this Department that as a forest products group, major investigation into preventing or overcoming these problems should be a function of our activities. Consequently for each State direct liaison with administrative authorities, together with preservative and adhesive suppliers, and timber organizations, is essential. Unless this is done I anticipate that the costs of preventing or eliminating these problems will be excessive and uneconomic.

Discussion - Items 6/1, 6/2 & 6/2a

WEISS: It is possible that this is an area where the water purification research unit at the Division of Applied Chemistry might be interested in doing some work. If the Conference feels that the effluent problem from preservation plants is important, we might be able to look at it.

PARROTT: This is a subject which New Zealand views with particular concern. The Timber Preservation Authority and the Health Department are exercising pressure on preservation plants to improve their hygiene.

There have been instances when, for example, careless washing out of a boron tank has resulted in wiping out all the trout in nearby waters. Local authorities in Christchurch are concerned that underground water in the vicinity of treating plants may have intolerable levels of arsenic. Concrete aprons have now been recommended to be installed around preservation plants and the waste run-off from these has to be drained into sawdust pits. We have also had instances of vegetation being killed off in the vicinity of plants treating with pentachlorphenol.

LIVERSIDGE: The disposal of the sawdust saturated with preservative will in turn present another problem. The burning of wastes containing arsenic was discussed at a conference in Auckland in 1966. The following is a quotation from a paper by R T Douglas, Chief Chemical Inspector, Department of Health, Wellington.

"Arsenious oxide has a fairly low subliming temperature, about 300°F, so we would expect most of it to go off in the flue gases and be deposited with the fly ash and soot. Ash samples we have tested from domestic fires and industrial furnaces do seem to have all run about 0.5% arsenic. As might be expected, the soot and fly ash from other parts of the furnace can be much richer in arsenic, up to 7% in some of our tests. This would be pretty lethal stuff and I can only assume that in the absence of corpses the industry must be taking reasonable precautions in handling and disposing of all this ash. The risk is, however, perhaps getting greater, as more and more of this treated timber is handled. Some of the arsenic must go into the air with the flue gases and here the British Alkali Inspector's air pollution limit of 0.05 grain/cu ft for discharges up to 3000 cfm is relevant. Above 3000 cfm this is reduced to 0.02 gr. A few tests we have made with a CSIRO type of incinerator operating mainly on impregnated timber gave about 0.02 gr as As_2O_3 and were consequently on or close to this limit. It seems this could be a real problem under certain circumstances and the Department of Health will naturally be on the lookout for any possible air pollution hazard. It is something to be taken very seriously into account in the siting of new incinerators".

EDWARDS: Some time ago we circularised the authorities in many overseas countries and asked what precautions they are taking. Sweden takes special precautions for the incineration of arsenic-impregnated wood but no other country then seemed to be doing anything constructive. The preservation industry has probably not been going for long enough in Australia to build up an undesirable level of arsenic around the treatment plants.

TAMBLYN: It is essential that we do not magnify this situation out of proportion. A problem may exist, but experience has shown that since 1910 in Europe, the extensive use of arsenic in preservatives has produced no calamities. Boron has been in use in NSW since 1945 with no major build up. I therefore see no major hazard from wood preservation at present.

TACK: I feel that the problem could be overemphasized and that it is the task of the TPA and its members to take appropriate action to ensure that the situation is kept well in hand. I feel as a member of TPA that we will cooperate fully in taking sensible action, at the same time avoiding "overkill".

ITEM 6/2b. REVIEW OF POLLUTION PROBLEMS IN THE PULP AND PAPER INDUSTRY*

In recent months we have undertaken a survey of the ways in which the Australian pulp and paper industry disposes of its wastes and effluents. This survey has involved visits to most of the Australian mills.

I should begin here by noting that all mills are meeting the legal requirements with respect to effluents but that these requirements vary greatly. In some, detailed standards are set for pH, suspended solids, temperature and five day biological oxygen demand whereas in others only the point of discharge of the effluent is specified.

The nature of the waste materials depends on the operations carried on at the mill. Variables include the raw material, the type of pulping or bleaching process and materials added during the papermaking process. Of these the pulping and bleaching processes are of most importance in relation to effluents.

In Australia the most common raw materials are eucalypt and pine woods, and waste paper with small amounts of straw and flax. Although eucalypt and pine woods differ only slightly in the amount and composition of their major constituents they differ considerably in certain non-structural components (extractives) which have important effects on the properties of spent pulping liquors. Waste paper, which is often used as the major source of fibre on board machines contains a variety of solids including plastics, rubber products, metals and grit which are removed and sent to a tip.

The aqueous effluents from an integrated pulp and paper mill can be divided into suspended solids and solubilised materials. The majority of the suspended solids consists of fibrous materials sometimes with some clay. Fibrous solids though not toxic, are undesirable in natural streams by reason of their oxygen demand during decay and their tendency to reduce visibility in streams. The paper companies do their best to minimise losses of fibres as these represent direct economic losses to them. This is done either in the plant with the use of "savealls" or externally by the use of clarifiers.

The removal or recovery of solubilised materials provides many more difficult problems. These materials usually consist of degradation products of the carbohydrates, lignin and extractives together with inorganic compounds arising from the reacted pulping agents, and they impart a brown or black colour to the effluent. The addition of this colour to receiving waters is undesirable not only from the aesthetic point of view but more importantly from its potential for reducing the photosynthetic processes of life in the waters.

*Prepared by A J Michell

It is convenient to divide the pulp mills according to the amount of wood substance solubilised by the pulping process employed. Loss of substance and chemical energy employed in pulping decreases in the order chemical processes semichemical processes chemimechanical processes mechanical processes.

The chemical processes can be divided further into the strongly alkaline processes used at Burnie and Maryvale and the mildly acid system used at the Apcel mill at Millicent. The two alkaline processes have recovery systems attached. In these systems the liquor is evaporated and burnt and most of the chemicals are recovered by causticisation of the ash with lime. The bisulphite system at Apcel does not have a recovery system attached. The reason for this is that the chemicals used in the bisulphite process are cheaper than those used in the alkaline processes and recovery systems for this type of liquor are less well developed.

Of the six mills in Australia operating semichemical processes only two have recovery systems and these, at Maryvale and Burnie, are integrated with the chemical process recovery systems there. None of the mills operating chemimechanical processes recovers chemicals; however, their usages are only small.

A number of mills bleach their pulp before converting it into paper. In some cases this amounts only to brightening which is done with reagents like hydrogen peroxide or zinc hydrosulphite. In the latter case this provides an acid stream which can be used to neutralize an alkaline stream from a semichemical or chemimechanical process.

In the production of highly bleached pulps treatment with chlorine is often followed by extraction with caustic soda which dissolves the chlorolignins. The effluent from this process, which is used at only two Australian mills has been said to be the most highly coloured emanating from the production of pulp and paper. Four mills produce chlorine on-site by the electrolysis of sodium chloride in flowing mercury cathode plants. Concern was expressed in the newspapers some months ago about the mercury contents of fish caught in Botany Bay, where a similar type of chlorine producing plant operates. However, this plant has a production ten times that of any plant operated by an Australian paper company. Moreover, the companies have now either eliminated their use of the slimicide phenyl mercuric acetate (another source of mercury) or use it only as a method of last resort.

There is also an aerial effluent from the mills. Those burning fossil fuels in their boilers emit sulphur dioxide from their stacks. The proposed use of natural gas by two mills will reduce their emissions. In addition a kraft mill emits small amounts of the highly odourous compounds methyl mercaptan and dimethyl sulphide to which the human nose is very sensitive. Unfortunately, the properties of eucalypt liquors do not allow the one Australian mill using this process to change its method of evaporating the liquors to reduce further the amounts of these gases emitted.

At the moment most of the Australian mills are situated on the sea or on river estuaries so that effluent disposal problems are reduced. One company has announced plans to set up a pulp mill in the Ovens Valley by 1974 but will only be using a mechanical process. However, should a chemical or semichemical pulp mill be set up in the 1980's inland in the Murray-Darling Basin to pulp pines growing in that region problems of effluent treatment would become more acute.

In summary then, the present pollution problems which are peculiar to the pulp and paper industry are largely concerned with the solubilised degradation products of lignin and with odourous emanations from the kraft process. The industry shares with power raising authorities problems associated with the burning of fossil fuels and with the chemical industry the problem of the loss of mercury from chloroalkali plants.

ITEM 6/3. AESTHETICS

When one thinks of the industries whose premises offend the eye, the timber industry must surely be one of the first to come to mind.

Far too many mills indicate their location by the production of voluminous blue smoke, arising from an ever smouldering pile of sawdust often flowing down the bank of an adjacent creek. Closer inspection reveals bleached stacks of rejected boards leaning at all angles and shrouded in weeds, a yard full of potholes and large pipy logs (presenting too daunting a challenge to the milling equipment), gluts scattered throughout the mill yard and adjacent roads, plus a mill building and office quarters topped with rusty iron roofs and enclosed with fungus-covered timber boarding that has never felt paint or stain.

There are still far too many mills for which such a descriptive is apt and which give the industry an image of backwardness and technical incompetence.

The problem of waste disposal is a very real and continuing one, particularly for processors of eucalypt hardwoods and the waste burners will be a necessary part of the equipment for a long while to come. All the more reason to ensure that mills will be sited to ensure that the number of people affected by the resulting atmospheric pollution is minimal.

The increasing tendency for mills to be amalgamated into larger units gives an opportunity to plan again and improve the image of the industry not only to potential customers but also to potential employees, at no prohibitive cost, by incorporating such features:-

(a) a well drained and levelled site,

(b) a log storage yard which is at the back, not the front, of the mill, with a screen of trees and shrubs to hide it from the office and showroom.

(c) a burner unobtrusively located and whose hot and irritant gases may be expected to flow away from the mill for most of the time and not irritate and restrict the output of operatives who make a profit possible.

(d) a mill building thoughtfully designed, adequately equipped, constructed in serviceable materials and well maintained.

(e) a yard that is kept free of weeds, gluts and unsaleable timber which acts as a breeding ground for moulds and decay fungi concurrently with its sapping of the enthusiasm and effectiveness of the workers in the establishment.

(f) an administrative building, sufficiently isolated from the noise and dust of the production process as to provide conditions for efficient mental activity, constructed of timber, attractively painted or stained and maintained in excellent condition.

(g) a tastefully styled, legible but not garish identification of the company and its products.

(h) adequate parking for staff and visitors.

(i) some well placed planting of trees and shrubs, incorporating if possible a patch of the existing flora or examples of the trees commonly milled.

These requirements do not represent extravagance and should be within the reach of most public companies in the sawmilling industry.

ITEM 6/4. NOISE

The processing of wood is one of the noisiest common industrial processes; the problem sounds arise from the high frequency disturbance of the air adjacent to the blade and teeth of the saw and cutter; but the speed of running; the number, dimension and sharpness of the cutting surfaces; the rate of feed; and the nature of the wood are important factors.

The combination of high acoustical energy and buildings of poor insulating value which are inevitably associated in the timber industry create a difficult problem.

Noise levels of 100-110 decibels are commonly produced by planers and moulders. Such levels are considered by medical opinion to be damaging to the hearing faculties. The levels reached are much the same for softwoods and hardwoods, but with the latter they are reached at lower speeds.

Noise levels in excess of 95 decibels for long periods are potentially harmful, while conditions above 90 decibels have been found to impair working efficiency, especially when the operatives have to exercise a considerable degree of judgement. Apart from increasing community pressures against industrial noise there is a growing reaction from workers who can, in a full employment economy, find employment in more pleasant working conditions. Even when the operatives of the offending equipment get used to the noise the office staff of the same employer find it hard to concentrate on mental tasks when housed in adjacent quarters.

The actual loudness of the noise is not the only guide to its degree of annoyance. Other important factors are the time of occurrence (day or night), the contrast with the general noise level of the locality, its nature (intermittent and without pattern, unusual, its pitch) and the season (more windows open in summer).

The best way of tackling the problem is naturally at the source of the noise, through improvements to the machine. The noise level of a piece of machinery is an important factor to be considered when deciding on the selection of a particular make. Dollars saved at this stage may have to be spent elsewhere in noise alleviation.

The use of sound absorptive materials on and around the machine will help. Light sheet metal, as in machine guards, can create air-borne noise, while sawdust extraction equipment needs careful design since it is of lightweight construction and small high speed fans can create a lot of air noise.

Direct noise is often reflected from walls, floor and ceiling and much greater use of absorbent surfaces is required to stop reverberation.

Buildings used for sawing and planing, etc. are difficult to insulate from surrounding premises due to the necessity for large openings for the transport of the timber but at least the openings should not face the sources of greatest complaint. Since the noise level decreases by about 6 decibels as the distance of the source doubles the noisiest equipment should be as far as possible from neighbours and screened from them by other buildings which will absorb the noise. Extremely noisy machinery should be accommodated separately.

Employees not directly concerned with operating offending equipment need separate accommodation, with heavy partition walls and no direct openings between the two sections. Even a few cracks and holes will destroy the efficiency of a solid wall, whose sound insulation value is generally proportional to its mass. Sound barriers must not incorporate openable windows. Double glazing will help to reduce noise only when the space between the panes is considerable. The double glazing appropriate for heat insulation is nowhere near adequate for sound attenuation.

Much more thought about these matters is needed when designing factory and mill layouts and the provision of guidelines to industry is overdue.

ITEM 6/5. ATTEMPTS TO CONTROL AIR POLLUTION FROM TEEPEE BURNERS IN NSW*

Pollution by sawmill teepee burner emission in country towns has led to complaints to the Department of Health.

The Department of Health has threatened to close down several mills unless they can comply with the Clean Air Act in NSW.

To overcome some misunderstanding the Division of Wood Technology arranged a conference to explain to the sawmillers their responsibilities under the Act. This was carried out by officers of Air Pollution Branch of the Department of Health.

Arising from the conference Isles Forge & Engineering Co. offered to carry out developmental work. The Division of Wood Technology and Division of Occupational Health Air Pollution Branch agreed to cooperate in assisting Isles Forge.

The main reason for the developmental work is the belief that the teepee can be efficient if properly controlled and is relatively much cheaper than other types and within range of the average sawmiller.

Two officers of the Division of Wood Technology were trained in stack testing and assisted by the Air Pollution Branch carried out 3 tests, one in Eden and two in Coffs Harbour.

*Prepared by G Cannaway

The results and recommendations arising from the tests are available from the Division of Wood Technology*.

Further work depends on finance being made available either from Isles Forge & Engineering Co. or the timber industry.

ITEM 6/6. DISPOSAL OF SAWMILL WASTE TO MEET REQUIREMENTS OF CLEAN AIR ACTS (Q'LAND)

The increasing public awareness of pollution of the environment in all its forms is focussing greater attention on the need to control the disposal of industrial wastes including that from sawmills. The Clean Air Acts and Regulations in Queensland are administered solely by the State Government, and Local Authorities have no jurisdiction in this matter.

The enactment of the legislation was such as to require conformity with its requirements in the Brisbane-Ipswich area by May 1972 and in the remainder of the State by September 1977 insofar as existing plant is concerned. Any new plant is obliged to meet the requirements upon installation.

Requirements are uniform throughout the State and control the level of emission of any solid impurity into the air. Smoke and gas emission are also controlled. Insofar as boilers are concerned the control should be able to be effected reasonably easily, however disposal of waste is a much more serious problem and at present in Queensland there is no waste incinerator which meets requirements.

The only "Phoenix" burner installed so far is reported to be operating outside requirements due to a combination of species mixture and milling practice.

As far as the Government Authority is concerned, sawmills in cities and provincial towns will have to comply with requirements of the Acts, but mills in isolated locations may perhaps be allowed some period of latitude. If, however, satisfactory control is not yet feasible it may be necessary for the milling industry to seek some dispensation as it is understood, has been done by the sugar milling industry.

However, with equipment now available or becoming available, large expenditure by the industry will be required and this may well be beyond the ability of some of the smaller organizations.

*Full details were distributed at the Conference

ITEM 6/7. THE EFFECT OF ENVIRONMENTAL CONDITIONS ON NORFOLK ISLAND PINES GROWING ON THE SEA SHORES OF SYDNEY

About 10 years ago it was noticed that the Norfolk Island pines growing on the beach front at Bondi were being affected by what appeared to be a disease. There was a continuous thinning of foliage on the south-east exposure commencing at the lower branches and gradually extending up the seaward side of the tree. As the branches died they were removed for safety and this exposed the trees on theinside of them to the south-east and these in turn died in the same way. There are now no pine trees at Bondi.

In 1964 the help of the Forestry Commission was sought and Mr Hartigan has been engaged in investigating the problem, particularly during the last two years.

Norfolk Island pines have been extensively used on beachfronts on the NSW coast and in many cases the trees are more than 80 years old. In some areas odd trees have died, and have been felled and replaced by new trees which have shown satisfactory growth in the place of the dead tree. This is not now possible.

Mr Hartigan has been able to show conclusively that the effect is an environmental one. He is able to raise seedlings in a nursery removed from the ocean front, and when those seedlings have reached a suitable size, to take them to the ocean front still in their pots where, after a short period, they show distress starting on the lower whorls and gradually moving upwards. Seedlings exposed in this way will die in from 4 to 6 weeks, depending on the size of the seedling. If the seedling is removed from the ocean front after it starts to show distress and is taken back to the nursery, it recovers and becomes vigorous in growth.

It is apparent that whatever is causing the trouble is blown in from the sea. Mr Hartigan is currently engaged in an endeavour to find out the causative agent.

The effect of air pollution on plant growth is becoming well documented but this has only happened in the last decade. In spite of earlier cases of trees and vegetation being killed by chemicals, such as that at Mt Lyell in Tasmania, it is only in recent years that the effect of pollution has really come to the fore. It has been estimated that losses to agronomic species in California alone are estimated to exceed one hundred million dollars a year. A recent estimate for the United States as a whole indicates that the losses to agriculture are as high as five hundred million dollars per year. The world-wide importance of the problem is highlighted by a report in "World Wood", vol. 11, No. 13, December, 1970 which states that air pollution is threatening to wipe out the coniferous forests of Northern Bohemia, Czechslovakia.

A recent survey by Mr Hartigan from Southport in Queensland down to Wollongong in NSW, during which he called at all beachfronts accessible by road, showed that the damage is confined to the Newcastle, Sydney and Wollongong metropolitan areas. Only those trees showing exposure to the south-east are affected, and in Manly trees on the ocean front are badly damaged whilst those growing on the Harbour Beach, only a short distance away, are not showing any signs of distress. Obviously whatever is the cause is being blown in from the sea.

Some claims have been made that excessive salt is responsible, but for years the trees which are now sickly grew vigorously in spite of, at times, the salt being deposited so thickly that the foliage appeared to be white.

<u>Discussion</u> - Items 6/2b - 6/7

WEISS: Has the question of microbiological breakdown of sawdust received any attention?

HUDDLESTON: There has been some work, particularly on bark; it appears that the best use of sawdust and bark is as a soil improver.

MCKENZIE: It would seem that the best long term use for such residues is to incorporate them into some form of board or block - even waste from preservative treated wood could be used in this way.

PAGE: The question of air pollution from industrial incinerators is the most urgent problem facing the sawmilling industry. Sawmills established years ago on the outskirts of a town now find they are surrounded by dwellings and other buildings. Requirements of the Clean Air acts could cause many mills to close down. We hope to look at redesign of the suspension type of burner such as the McCashney to allow it to burn hogged fuel.

LIVERSIDGE: Further consideration should be given to the use of mill waste as fuel for steam raising in hearby industrial plants. In areas where clean air problems exist with incineration, the possibility of a number of mills disposing of their wastes in one large efficient incinerator as an alternative to the use of individual incinerators could be considered.

WICKETT: At last the teepee burner has been accepted by the Public Health Department in WA as the only satisfactory way of disposing of sawmill waste in country areas.

HUDDLESTON: The burning of waste as fuel is only a partial solution to the problem as the quantities involved could only be a fraction of the amount available. The question of economics is vital, most fuel users have found that it is cheaper to use oil and dispose of the sawdust.

BRYANT: The question of returning waste material in hogged form to the forest should receive more consideration. There is a great deal of nutritional value in this material and its return to the forest could obviate to some extent the use of costly chemical fertilizers. This could possibly be done by a redesign of log trucks which are at present returning to the forest empty.

WEISS: The emphasis in the past has apparently been on burning, perhaps biological breakdown should be looked at more closely.

CROMER: We are removing enormous quantities of nutrients from our forests, and return of waste is the only way of maintaining soil fertility at a reasonable level, particularly in soils of low natural fertility.

JOHANSON: At a large forestry operation in South Carolina shavings and bark are returned and spread in the forest areas.

BRYANT: Perhaps we should look at this more closely. Undoubtedly problems of spreading the material will arise, but these should not be insoluble.

HINDMARSH: There could also be the question of introducing a lot of highly flammable material to the forest, and whilst I agree in principle, I feel this would render it impractical.

HIGGINS: Perhaps research should be trying harder to solve these problems profitably, not just to reduce potential pollution but to gain a fuller utilization of the raw material. Research is already directed to such problems as how to utilize mechanical pulp more fully, how to develop a good bleaching process for mechanical pulp, and recovery of useful substances from black liquor.

WICKETT: Regarding noise problems, many of the common operations in the timber industry produce very high noise levels, particularly some sawmill operations and chain saws. Under the terms of the Walsh-Healy Act in the USA, no exposure is allowed above 115 decibels which is chain saw level, and the level of some other operations would limit exposure to a few hours at a time. This gives some indication of the magnitude of the problem.

COWAN: We are particularly concerned with the effects of noise and have recently had our first claim for industrial deafness. We have started on a programme of enclosing all moulding machines which produce more than 90 decibels. This must be done fairly cheaply because of the number of machines involved, and we have reduced the cost to about $800 per machine by using a combination of wood and fibreglass.

MCKENZIE: A certain amount is known about reducing noise output from saws, e.g. by slowing the speed as far as it can be done, by modifications to the blade itself such as blade slotting, and by various damping devices.

CROMER: To summarize the papers and discussion, it would appear that there are three major areas where further work is required. Sawmill waste disposal is one of the more serious problems to be faced in the future, but it could be partly solved by more general utilization of wood in the broadest sense. The problems concerning wood preservation wastes may not be so pressing, but will need to be watched. Noise level studies are obviously required in some areas. Disposal of bark is a major problem, and this must be solved if we are to continue to sell wood chips to Japan.

ITEM 7/1a. ECONOMIC ASPECTS OF WOOD PRESERVATION EXTERIOR STRUCTURAL TIMBERS*

The purpose of treating wood with preservatives is to increase its service life and improve its reliability in situations where performance without treatment would be more or less unsatisfactory. This purpose is not fully achieved unless the treatment given so reduces the cost per year of service that use of treated wood becomes economically more attractive than that of untreated wood or other alternative materials. Cost per year of service (or annual charge) is thus the basis for comparison of treated wood with alternative materials unless other factors such as lower fire hazard, better appearance, improved design facility etc. are of over-riding importance. It may be defined as the annual sum required to extinguish an interest bearing debt (e.g. the cost in place) over the expected period of service, together with estimated maintenance charges similarly computed. It is calculated from the well known amortization formula or more easily from tables giving annual charge per unit cost in place per year of service at given interest rates. A variation of this is to calculate present value which is the capital sum which if invested at compound interest would enable the annual charge and maintenance payments to be met as they occur.

It is beyond the scope of this paper to attempt comparisons based on the estimated annual charge for treated wood and alternative

*Prepared by N Tamblyn

materials. This can be done only when all facts in a specific case have been established by the project engineer and when close estimates have been made of cost in place and estimated life for the materials to be compared. Rather it is intended here to look briefly at some of the main factors which affect the successful and therefore economic use of treated wood in exterior structures.

1. Marine structures

If the map of Australia is divided into three zones by drawing lines from about Sydney to Perth and from about Maryborough in Queensland to Carnarvon in Western Australia, it can be said as a generalization that the marine borer hazard is slight-moderate in the southern zone, moderate-severe in the middle zone and severe-very severe in the northern zone.

In the southern zone, untreated piling of durable eucalypts or turpentine has usually given long life and there is little doubt that satisfactory service can be obtained from presently available treated round eucalypt piling, provided the pile head is protected from decay. The cost of treatment is a very small part of the cost in place, and as the sapwood is protected for the full length, the chance of its decay above water is much less than in untreated piling. In this southern zone treated wooden piling is an economically attractive material and if it is displaced in the future it will not be because the marine borer hazard cannot be controlled by preservative treatments now available.

Available preservative treatments are less suitable for the marine superstructure - partly because of the practical difficulty of treating eucalypt heartwood of the desired size and mechanical properties and partly for other reasons including the relatively poor resistance of wooden decking to weathering, wear and fire. By today's standards it is doubtful if a completely wooden superstructure, even if well treated, has much future except in small harbour installations. There is probably more future in the use of composite structures in which treated wood is combined with a concrete deck. These conclusions hold generally in all three zones.

In the intermediate zone, performance of untreated durable piling (turpentine, jarrah etc.) has been rather variable and the treatments for eucalypts, so far available, have not been completely reliable. Whether or not the market for treated piling can be expanded in this zone depends on the development of more reliable treatments against marine borers. Provided the engineer is satisfied that this can be achieved there should be no quibble at high treating costs.

In the northern zone, use of untreated durable piling without mechanical protection against marine borers has generally been unsatisfactory and experience with treated piling has at times been disastrous. The present indications are that very heavy CCA treatment of pine piling is reasonably satisfactory against both crustacean and molluscan borers but that eucalypt piling cannot be adequately protected with either CCA or creosote at the maximum commercial loadings. Even with pine, double treatment with both preservatives is probably desirable and it is only a hope at present, that this double treatment may enable use of eucalypt piles if both preservatives are used at high loadings. If the treatment offered can guarantee 20 years life it will be acceptable according to Queensland harbour engineers who have recently stated their preference for wooden piling particularly in smaller habour works. The cost of double treatment is unlikely to be critical as the alternatives of steel and concrete piling are not cost competitive unless much longer life is required.

The future of wooden piling in the northern zone, and to some extent in the intermediate zone, is a challenge to wood preservation in Australia and it must be admitted that we are still far from reaching a reasonably good solution. If a special marine preservative is devised it may not be economically acceptable to the treating industry because of the capital outlay involved in providing extra storage and in holding large quantities of preservative against occasional orders for marine piling. This difficulty may perhaps be solved by coating piles, after creosote or CCA treatment, with a special marine preservative which will either diffuse deeply into the creosote or diffuse in and then fix by reaction with the CCA components. The Division is planning some work in this field.

Whatever the solution to the marine borer problem it must also be recognized that unless decay is prevented in the untreated heartwood at the pile head it could become a limiting factor in the life of non-durable pine or eucalypt piling, especially in wet or tropical climates. This is not necessarily a difficult problem and might, for example, be solved if a water-shield could be incorporated in the attachment of the cap beams. It does however, need attention concurrently with marine borer protection. The same type of problem exists in the attachment of bracing which represents a possible decay hazard above water, and a marine borer hazard below tidal level.

2. Land piles

Untreated wood kept saturated by driving to a permanent water-table is an excellent material for friction piling and is generally cheaper than other alternatives. However, the water-table is not always conveniently high and in any case experience has shown that it is often dangerous to assume that its height will not change during the life of a building due to drainage or other unforeseen developments in the area. In most cases, therefore, preservative treatment of friction piling should be considered an essential precaution and one which does not appreciably affect the favourable economy of using wood. Additionally, since the pile head is usually cut off after driving, it is considered a desirable safety measure to treat the cut surface with preservative before encasing in concrete.

The setting of minimum standards for treatment of friction piling presents some difficulty as the long term performance of preservatives under a concrete slab is not well known. Also the danger of decay or termite attack is likely to vary greatly with site conditions and with the position of piles relative to the edge of the slab. For these reasons it is considered better to err on the side of over-treatment for all foundation piling.

Although the future market for treated bridge piling is unlikely to be large it does still offer scope for successful development provided there is effective cooperation between the treater and the bridge engineer. This cooperation is necessary because there is no one standard treatment which will economically meet all requirements. Obviously, these requirements vary depending on the life required for the structure, on whether or not marine borer protection is needed for some of the piles, and on the extent to which untreated heartwood must be protected in the fitting of the bracing and cap beams. This latter aspect, already referred to under "Marine Structures" requires close attention. It is not covered in the Australian Standard for treatment of piling which is now being drafted, and in the absence of a code of practice, it is left to the bridge engineer to find his own solution. Until a suitable practice is defined the simplest answer may be to limit timbers for bridge piling (and marine piling) to those with heartwood of high natural durability. Certainly the use of piling timbers in durability groups 3 and 4 requires considerable care at every point where heartwood is exposed if preservative treatments are to realize their full economic potential.

3. Transmission poles

Despite considerable reduction in demand in the last few years (due mainly to undergrounding of PMG lines) treatment of poles is still one of the mainstays of the pressure treating industry in Australia and is likely to remain so at least in the present decade. Pole engineers have generally accepted that use of treated poles is economically desirable except in a few specific cases where long life is not required or where, because of remoteness from a treating plant, a locally available untreated pole is considered to carry a lower annual charge. Treaters have reached the satisfactory position where specifications can be readily and profitably met with modern plants of more than adequate capacity to meet demands. It may therefore appear, at first sight, that pole treatments have reached the stage where technical competence and economic requirements are in balance and that therefore no further research is immediately needed. Unfortunately, this is a superficial judgment as may be illustrated by considering some of the ideals which a treated pole should reach to hold whatever market may exist in the longer term.

(a) Service life and reliability

Since commercial pressure treatments commenced in Australia only about 15 years ago, it is still too early to assess the probability that an average life of 30-35 years will be obtained from creosoted eucalypt poles as originally predicted, or that CCA treatments will give similar performance. At present it can be said that though there is no conclusive evidence to the contrary, there have still been sufficient premature failures to high-light the need for improvement in the reliability of treatment. The two concepts of average service life and of individual pole reliability are somewhat different and though the former is still important it is probably overshadowed today by the need for complete reliability during the first 20 years of service. If this is accepted it becomes essential to focus attention on the causes of premature failure, and, within economic limits, to adjust treating practices accordingly. This approach, if followed methodically, should reveal in a few years what might otherwise take half a century of casual observation. It may, for example, indicate that some species at present treated are more unreliable than others, that some are better treated with one preservative than another, that longer pressure schedules or butt incising are necessary to reduce variations in penetration and retention, that treating specifications should be varied for different areas, or that use of arsenical creosote or additional in situ treatments are justified at costs higher than at present visualized. The effect of such investigation on average life is relatively unimportant and it should not be judged only in terms of annual charge. Rather, its economic value should be judged against the future need for treated wood to meet the standard of reliability of other engineering materials if it is to hold its markets.

(b) Preservatives

Although creosote and CCA are rightly regarded as excellent preservatives in ground contact there seems little doubt that their toxicity and permanence can vary appreciably in different timber species. Unfortunately, performance in the sapwood of some eucalypts in our small specimen field test is proving to be greatly inferior to that in the sapwood of pine especially in the more northern test sites. It seems likely that this reflects a fundamental difference in the physical and chemical interaction of preservatives in pine and hardwood substrates and that its solution may not be readily achieved in warm wet sites. However, there are many factors yet to be examined before a clear picture emerges and before the results can be interpreted in terms of performance of treated poles of different eucalypt species especially in the north where differences between species are likely to show up more rapidly.

With the increasing emphasis today on pollution, another preservative factor which may need early consideration is the disposal of old poles treated with any arsenical preservative. At present there is no restriction on the arsenic level permitted in CCA preservatives with the result that commercial formulations used in Australia for pole treatments at the same salt retention may vary in content of arsenic pentoxide from about 20-35 percent. A typical 40 ft eucalypt pole could thus contain as much as 2-3 lb of arsenic and its disposal by burning may be considered objectionable. At this stage it is fair to say that the formulation of all preservatives will need review in the future to obtain the best compromise consistent with economy and maximum reduction in hazard in use and with ultimate disposal. Complete elimination of arsenic is probably unnecessary but it should be kept in mind as an ideal.

(c) Appearance.

Poles, and their fittings and wires, are generally regarded as unsightly and it is not realistic today to believe that a heavy, misshapen wooden pole treated with a relatively dirty preservative oil will still represent the pattern for tomorrow. The best that can be offered at present to produce a more symmetrical pole is taper-shaving in which the cut is heavier at the top but tapers off gradually so that the butt sapwood is not reduced in thickness. With eucalypts having only a thin sapwood this may expose some heartwood above ground and it is not yet known what restrictions may be necessary with respect to species and climate. Machine shaving is not a costly operation particularly as it reduces preservative consumption and slightly increases treating capacity. However, as it may increase bleeding of preservative oils in hardwood as well as promote heartwood decay it requires careful evaluation.

The rather heavy appearance of Australian power poles compared with those often seen abroad suggests that our safety factors may still be higher than necessary. A slimmer pole would be more attractive and would certainly reduce costs. Although this aspect has been investigated by this Division, in cooperation with pole-using authorities, and the results fully accepted by the PMG's Department, there appears to be room for further review in the case of some power poles.

4. Fence posts

During the last decade the market for treated round fence posts has developed rapidly in southern Australia and it should continue to expand in the future with the main emphasis on production of pine posts. On present indications a life of 30 years or more is a reasonable expectation from well treated pine posts and somewhat more hopefully from round hardwood posts. Unfortunately, because fence posts can be treated profitably in small cheap plants by operators who may be unskilled or irresponsible, and because the buyer is often quite unable to judge the quality of treatment, there is more danger of a sub-standard product than in any other branch of the treating industry. The Division has seen too many examples of poor treatment, and even of failure of posts within a year or so of installation to have any illusions that the present system of supervision by the preservative manufacturer is a rational approach to quality control. It is obvious that an erring treater cannot be controlled against his will by a preservative supplier who must be indulgent or else risk closing his market. The only sensible control is for fence post treating plants to be registered and to be subject to inspection by a legally constituted authority - either a State Department of Forestry or Agriculture. It is suggested that this is a responsibility which has been neglected for too long in States other than New South Wales and Queensland.

Apart from quality control, the main present need in fence post treatments is improved fire-resistance in CCA treatments. This is discussed in a later paper and it is sufficient here to say that the Division's contribution to this should not be regarded as an ideal answer or as the only economically practicable solution. Creosoted posts are still more fire-resistant than those treated with our modified CCA formulation and while this situation obtains, there is need for further work.

In the field of fence post usage there is considerable room for improved fence design. There is scope here for practical research to ensure that treated posts are used to maximum advantage and at the lowest fencing cost.

5. Rail sleepers

In the past, most Australian sleeper requirements have been met readily and cheaply by heavy durable timbers which have given long service without the need for expenditure on seasoning, preservative treatment or haulage over long distances. Although this favourable position is gradually changing the market for preservative treated sleepers of other species may not develop automatically. It is beset by the problem of high treating costs, by difficulty in obtaining good penetration in heavier species, and by the threat from concrete sleepers. However, some market for treated sleepers must develop and the Division has sufficient service tests in all States to set standards of treatment to give proven performance. In this respect the Division has not been prepared to bow to expediency by recommending treatments of doubtful merit, despite pressure at times from commercial interests. For most purposes, our recommendations are for treatment with a permanent preservative oil to a retention of about 5-8 lb/cu ft (on total volume) depending on species and hazard, and to a side grain penetration depth of at least $\frac{1}{2}$ and preferably $\frac{3}{4}$ inch. With heavy refractory species such as brush box this involves incising and Boultonizing and may require pressures higher than 200 psi. With lighter species air drying and high pressure treatment or Boultonizing followed by 200 psi is often sufficient. Such treatment may cost about $1.30 - $1.80 per sleeper and may not be economically attractive in all cases, depending on the availability of untreated sleepers of moderate (but less) durability than those of preferred species. However, we believe that cheaper and inferior treatments to give industry a "leg in" are economically unsound in a very critical market, which all over the world has set high treating standards based on the premise that railways are a long term investment and that the lowest annual charge is therefore more significant than the lowest first cost. We believe that our policy is now paying dividends because Victorian Railways have recently ordered 10,000 sleepers to be treated to our recommendations and Tasmanian Railways are now calling tenders for 80,000 sleepers for the Bell Bay line to be similarly treated. There is no gamble with these sleepers and their assured performance is a sound basis for further market development. Unfortunately we have not been able to prevent a situation developing in one of the iron ore lines in north west Australia where a 50 cent treatment of dubious merit is likely to be accepted for karri sleepers because in this case, first cost and rapid supply have been considered the main factors.

ITEM 7/1b. THE ECONOMICS OF BUILDING TIMBER PRESERVATION*

Summary

The costs of building timber preservation have been discussed from time to time by this Conference. A number of factors suggest that we should now take a fresh and critical look at the use of treated wood in houses.

*Prepared by D W Edwards

The Standards Association will shortly complete a Standard for the Preservation of Building Timbers. Another Standard is in preparation dealing with water repellent preservative treatments for certain building timbers, notably window joinery. Standards have also been completed for both mechanical and soil poison barriers to control termite attack. In recent years there have been changes in the pattern of building timber utilization and large quantities of radiata pine building timbers are being used in most parts of Australia. Building construction methods also are changing and we are likely to see industrialized building techniques more widely used. In addition we have a well established Timber Preservation Industry, and an increasing degree of sophistication in the Pest Control Industry.

It is hoped that this discussion may cover the economic implications of these changes for the Timber Preservation and Pest Control Industries, and the homeowner. In that context I should like to put certain questions before this Conference, namely:

1. Are present building methods sufficient to protect low durability timbers against insects and decay?
2. Is there a sound cost/benefit advantage in requiring mandatory installation of soil poison barriers to control termites at the time a house is constructed?
3. Are we now justified in recommending the complete preservation of all Class 4 durability timbers used in house construction, and in particular radiata pine. In making such a recommendation the grounds might be the potential hazard from the European house borer (<u>Hylotrupes</u>), and possibly attack by anobium, termites, and wood decay?
4. What should be our attitude towards the use of water repellent preservatives for window joinery?
5. Which is the best proposition, singly or in combination for future home building; protection by building methods, protection by soil poison barriers, the use of durable, treated, or water repellent preservative dipped timber, or reliance on <u>in situ</u> treatment if trouble occurs.

The costs of building timber preservation have been discussed from time to time by this Conference. A number of factors suggest that we should now take a fresh and critical look at our attitude towards the use of preservative treated timber used for building construction.

The Standards Association will shortly complete a Standard for the Preservation of Building Timbers. Another Standard is now in preparation which will deal with water repellent preservative treatments for certain building timbers, notably window joinery. Standards have also been completed for mechanical barriers and soil poison barriers to control termite attack in houses. At the same time there have been changes in the pattern of building timber utilization, and we are seeing large quantities of radiata pine building timbers being used in most parts of Australia. Building construction methods also are changing and we are likely to see industrialized building techniques more widely used. In addition we have a well established technically oriented Timber Preservation Industry, and an increasing degree of sophistication in the Pest Control Industry.

It is hoped that this disucssion may examine the economic implications of these alterations in the status of timber preservation and protection.

This is not the place for an exhaustive analysis of the economics of building timber preservation but rather to indicate some areas and costs involved. There are many variations, many ways to the same end. This confuses the home builder and perhaps we can develop here some guidelines for the future.

The trends in building construction in Australia shown in the last issue of the Commonwealth Year Book (1970) for new houses completed in 1968-69 throughout Australia, are pertinent to this discussion. Based on materials used for the outer walls they show a marked trend to brick/brick veneer as follows:-

Wall material	Number completed	Approximate % of total
Brick, brick veneer, concrete and stone	64,696	70
Fibro cement	15,525	17
Wood (weatherboards, etc.)	10,554	12
Other materials	771	1

Queensland has the largest number of timber-sheathed completions, but even there the figure is a sharply plunging one. This was shown graphically in a paper by Scott reported in the Australian Timber Journal (July, 1970).

When we consider the cost of preservative and protective treatments for building timbers, therefore we need to look, in the immediate future, at the brick and brick veneer house. If we do this we might consider the costs of various items of preservative treatment and the likely benefits which could be obtained.

In New South Wales the bulk of the houses in the first CBCS classification above would be built in brick veneer, and would range in size between 11 and 13 squares. In a survey which we did in 1964, we estimated that the amount of building timbers used in a house of 13 squares was approximately as follows: Brick veneer, 6,400 su ft; fibro cement 7,600 su ft, and all timber construction (including weatherboard sheathing) about 13,000 su ft. There have been some variations since then but these figures will serve as a general guide.

In the Sydney area in 1971 such a house would be likely to have a floor of either cypress pine, radiata pine, brushbox or other hardwood, in that order. The scantling might be either hardwood, Douglas fir, or some other softwood. Interior trim might be meranti, radiata pine, or rain forest species. Most window joinery would be of Douglas fir, with tallowwood sills. Different situations will of course occur in other States.

The first important consideration is that some degree of protection is required against termite attack. This can be done by the provision of mechanical barriers according to the appropriate Australian Standard, and subsequently by good maintenance. It can be done more effectively in many cases by the establishment of soil poison barriers around the foundations, according to another Australian Standard. Again some maintenance is required. It can also be done by preservative treatment of all the timbers in the house.

The estimated relative costs of two such treatments on a 13 square house are as follows:

Soil poison barrier plus treatment of small slab areas on fill	\$50 to \$60
Preservative treatment of all timbers within the house to 0.35 lb/cu ft of a copper/chrome/arsenic salt (The extreme case - in practice not all components would be treated, or would need treatment)	\$175.00*

What is required in termite protection is basically freedom from attack for the period of the lender's equity in the house, usually about 45 years. There are no hard and fast rules, nor do I believe any easy calculations which can give us a cost/benefit result for each of these systems, but we can arrange them in the order of likely long term success with a full preservative treatment at the top end of the scale, partial preservative treatments plus a soil poison or mechanical barriers, soil poison barriers and lastly mechanical barriers alone.

*plus seasoning charges

Estimates of the cost of termite eradication treatments in the Sydney Metropolitan area are about $75 to $85 but this is difficult to average realistically since each house is a special problem. The cost of annual inspection for such a house is $12 to $15 and in such cases any building repairs are carried out at the expense of the householder. It will be seen that the inspection will cost on present rates of something like $540 to $675 over a 45 year period. In actual fact the figure may be in excess of this due to inflationary pressures evident in the economy. We must however, beware of simple comparisons of this type and consider for example the earning power of any initial expenditure if invested for say the 45 year equity period.

The next question I should like to raise is the value of water repellent preservative treatments for window joinery such as are being provided for in Australian Standard (now out for Public Critical Review). It is here that we need to take a close look at the respective economics of the use of durable timbers; of non-durable timbers protected by paint, moderately non-durable treated with a water repellent dip, and non-durable timbers given the same or better protection i.e. a WRP dip or pressure treatment with a CCA preservative. The estimated costs in southern Australia are as follows:

Treatment of window joinery with 0.35 lb/ft^3 CCA salt	$2.70 per 100 su ft*
Treatment with a water repellent preservative corresponding to the Draft Standard	$4.00 per 100 su ft

The critical questions here are the conditions under which water repellent treatments might be regarded as an acceptable substitute for either durable or CCA pressure treated window joinery; and whether the anticipated maintenance costs in any area dictates that some form of water repellent preservative treatment should be given to timbers which cannot be pressure impregnated.

We might also consider whether the time is yet ripe to recommend a general purpose highly fixed preservative treatment for timbers such as radiata pine to protect them against the potential hazard of the European house borer, anobium attack, termite attack, and wood decay on the assumption that one or all of these agencies may attack timbers in the house during its life, and that the relative cost of the treatment before erection is likely to be overshadowed by increasing future costs of maintenance treatments. Improved building standards and the pressure of competitive materials such as steel and aluminium, will I think force us to market building timbers fully protected against biological agencies, with a guarantee of a trouble free life

*plus seasoning charges

during the service of the house. This may have a special relevance in brick veneer construction where access to studs is difficult.

To sum up I believe that the members of this Conference should take a critical look at the value of proved preservative treatments for permeable building timbers, at the merits or otherwise, of water repellent preservatives and at the desirability of mandatory termite protection by soil poison barriers.

I think that in future we can place little reliance on advice to build houses to exclude these hazards. I do not believe we have as yet a proper economic evaluation of the desirability or otherwise of the various processes concerned, and I think that all concerned with the good utilization of timber, CSIRO, Forest Services, Timber Advisory Council, the Timber Development Association, the Preservation and other timber industries ought to be looking very closely at the future.

I believe that this future in so far as building timbers are concerned is to present the general public with a material free from problems of decay and insect attack and wherever possible to insist on pretreatment of foundations against termite attack, rather than to concentrate our efforts on protecting such timber by so called good building practices which the experience of the last 30 years has shown to be incapable of uniform enforcement.

ITEM 7/1c. ECONOMIC ASPECTS OF THE PRESERVATIVE TREATMENT OF VENEERS AND PLYWOOD*

At this stage of development of both the plywood and preservative industries, it is desirable that the future of preservation for these products and the economic aspects involved be reviewed. Utilization trends should be examined and the related service hazards determined.

This summary has been prepared after discussion with officers of the Plywood Association, who also supplied certain data used herein.

Historical

Commercially and traditionally, the industry began in Queensland and has been based on veneer production, storage and subsequent manufacture into plywood. Emphasis on manufacture of veneer in separate plants for supply to plywood manufacturers has tended to separate also reasons and methods for preservation.

*Prepared by K Cokley

In 1939 treatment began with the use of "boiling bath" wherein the veneer, separately stripped, was immersed for 20 minutes; this in turn was supplanted (1948) by hand dipping and the process called the "momentary dip". This was mechanised in 1949 with feed speeds of 80 lineal feet/minute but involved 2 men and required a diversion and delay in the flow line of veneers from the bath to the drier.

In 1969, in-line spray systems were approved which reduced labour and delay. No diversion in flow line was necessary. Preservatives used were simple insecticides e.g. boron salts, sodium fluoride and dieldrin. Plywood products were principally low temperature dried, cold-pressed and used for decorative internal products. Special external products were produced in limited volume and were restricted to select species such as Queensland hoop pine. The first plywood racing dinghies were designed in approximately 1948 as a result of the increased output of water-proof plywood.

Over the next 10 years (1948-1957) there were major modernisation changes in the industry: high speed peeling and reeling, high temperature mechanical driers, synthetic resin adhesives became predominant and emphasis was placed on the increasing use of plywood as structural sandwich units and special purpose products such as formwork. Exterior grade applications and boat construction plywoods are produced in significant volumes.

In consequence the previous preservatives and practices required modernisation, particularly as the trend is to continuous peeling/drying systems. Most significantly the hazards for which treatments are necessary required review.

It is significant that although commercial general purpose preservation using water-borne salts did not obtain general usage in Australia until 1958-1960, there was in fact commercial treatment and products available treated with these preservatives as early as 1954-55, when Mr Vallance of Brown & Broad correctly predicted future developments and in conjunction with this Department, carried out impregnation of veneer by the momentary dip using Tanalith C to a retention level of 0.35 lb/cu ft. No gluing problems were found and the experience then gained has proved of major importance in subsequent developments.

Commercial general purpose treatment began in Australia in 1958-1960 and in Queensland in 1962. It was found that major problems existed and treatment and gluing above a retention of 0.5 pcf was not effective. Rain forest species presented major problems, high surface concentrations of dichromate were found to interfere with the adhesive and this combined with surface sludge has prevented its general adoption. Many species cannot be treated in bundles. The pressure treatment of the finished plywood has also been found to present technical problems in addition to problems in costs and utilization. These aspects lead in time to the development of treatment of the finished plywood with solvent based preservatives using processes applicable in the plymill.

The treatment of veneer

Under current production conditions a total of 18 plants produce veneer only, of which 13 are located in Queensland. These are in addition to 35 mills producing veneer and plywood products.

Unfortunately there are currently - other than sliced and specially thin veneers - a total of seven different veneer thicknesses produced in Australian mills. There is currently action to rationalise these but the present number adds significantly to problems and costs of treatment and in certain instances limits methods of preservation.

The production and cost structure of the industry is shown in Table 1. It will be seen that preservation costs form an overall 5-10% dependent on area of total costs. Due to variable conditions through Australia, average data have been used, and specifically for cost of raw product, weighted data based on Queensland departmental costing are used.

The following specific comments are also made:-

(i) in South Queensland, Sydney, Melbourne and Western Australia, the major volumes of species peeled are imported, e.g. Brisbane mills currently peel 70% of production in these species.

(ii) Particularly in Brisbane and Sydney, plywood production includes not only species as in (i) but also veneers supplied from North Queensland, Mackay and Northern Rivers of New South Wales.

TABLE 1. COST STRUCTURE BASED ON QUEENSLAND DATA. WEIGHTED MEANS USED

Item	Unit	Data
Current veneer production - Australian	sq ft 3/16"	250×10^6
Mill door log value South Queensland	Cost/100 s.ft hoppus	$11.34
Mackay	"	8.37
North Queensland	"	5.64
Equivalent mill door South Queensland Value veneer(1)	100 sq. ft 1/16"	1.26
Mackay(3)		0.93
North Queensland(3)		0.63
Equivalent drying costs (average)	100 sq. ft 1/16"	20¢
Current costs by momentary dip process(2)	100 sq. ft 1/16"	25¢
Costs by in-line spray and block stack or reel(2)	100 sq. ft 1/16"	10-15¢
Cost by momentary dip process using CCA to 0.35 per cu. ft	100 sq. ft 1/16"	25-30¢

(1) Recovery averages: prime species 10 sq. ft/s. ft hoppus, imported species 8-9 sq. ft/s. ft hoppus, miscellaneous rain forest species 7-8 sq. ft/s. ft hoppus, mean peeling (i.e. green veneer) recovery of 9:1 taken for costing.

(2) Using simple insecticides e.g. boron salts, dieldrin emulsion or sodium fluoride.

(3) Graded seasoned recovery for sale, miscellaneous rain forest species fall in some species to 60% of green recovery i.e. equivalent to approximately 5 sq. ft/s. ft hoppus.

The requirement of preservative treatment is shown in Table 2 which presents the results of a survey made by the writer of sapwood depths as determined by starch concentration covering a range of 31 species inclusive of rain forest and imported species. In this context, although the original study was primarily for Lyctus studies, the significance is in terms of sapwood irrespective of hazard and excludes consideration of the natural durability of the heartwood.

TABLE 2. SUMMARY OF SAPWOOD TYPES - 31 SPECIES

	Classification	No. of (a) species (b)	Mean depth Inches	Percentage
Type A	Those having a constant range of sapwood depth	16	1.84	Approx. 30%
Type B	Those having either complete sapwood or non-uniform range	11	0.5"-100%	Variable up to 100%

(a) A total of 561 individual logs were examined of which 185 represented 8 imported species, 272 covered 13 North Queensland species and 104 representing 10 South Queensland species. Girth classes ranged from 44"-175" gbh.

(b) The remaining 4 species were represented by insufficient samples to allow effective conclusions to be drawn.

A statistical relationship was developed in the equation.

$$S\% = 3948 \frac{x}{G} \left(0.318 - \frac{x}{G}\right)$$

where S% = starch percentage of total volume (s. ft hoppus)
G = centre girth in inches
x = starch depth in inches

It is felt that some allowance should be made in log values for the need of treatment.

The long term storage of veneer does not present in practice any decay hazard, mechanical driers effectively sterilize any existing insect attack e.g. log borers or Lyctus, termite hazard is slight in storage and in practice Lyctus presents the only hazard.

For rain forest species, if the industry developed to a stage which precluded severe degradation of veneer in storage, it is reasonable to consider that treatment of the veneer, per se, is not economically justified, but present evidence within the industry indicates that this position will not be obtained within the next decade. Costs of loss must be balanced against the cost of protection. Climatic conditions are of importance.

Under existing conditions of the industry, I consider that a practical and economic alternative which should be considered is the large scale fumigation, under controlled conditions, of stored veneer. I consider that this would effectively prevent attack for up to at least 2 years by annual re-treatment at a much lower unit cost than existing methods. Present data indicate a cost factor of 0.7 - 1.2 cents/ 100 sq. ft of 1/16" veneer (dependent on volume). If this were adopted final preservation practices would be a function of the plymill manufacturer. This is desirable. Legally and under existing SAA standards the the Timber Users' Protection Acts of 1949-1964, sale of un-immunised veneer is permissable provided such is declared. The restriction in both cases is for use of untreated Lyctus susceptible veneer or veneer containing active insect attack in the manufacture and sale of plywood.

It is also pointed out that adoption of fumigation practices as an alternative would also materially reduce environmental pollution problems and disposal of preservative waste currently under review by relevant state authorities and which presents technical and cost factors.

The treatment of plywood

I have examined the application of plywood to structural and speciality components. With three principal applications the results have not indicated any major hazard from decay or insect attack. This is reinforced by the present strong trend to seal the faces with materials such as Crezon or 29A (phenolic) or melamine, or alternatively the use of surface finishes such as polyurethanes. Principal hazard points are the edges of sheets which can also be protected by sealants.

The major exceptions are:-

(1) Boat construction where decay hazards are present.

(2) Constructional units such as barracks for work gangs, slab-on-ground construction or storage sheds. These are in general situations where termite or decay hazards exist.

(3) High hazard usages such as cooling towers.

Pressure treatment using general purpose water-borne preservatives does not permit the complete penetration of all veneers of all plywood; discoloration can cause sale loss; for high hazard loadings it is necessary to select sapwood or treatable species for inner plies. There are major costs and problems in re-drying such treated plywood and subsequent gluing or finishing practices are influenced. In most plymills it is necessary to transport the plywood to a pressure cylinder and to prevent post-treatment distortion and more effective treatment the plywood should be stripped.

The present position is shown in Table 3.

TABLE 3(a). SUMMARY OF ASPECTS OF PLYWOOD TREATMENT COSTS

Item	Unit	Data
Range of plywood sizes[b]	feet	6' x 3' - 12 x 4'6"
Range of plywood thicknesses	inches	$\frac{1}{8}$" - 1.5"
Approximate Australian production	sq. ft 3/16"	$>100 \times 10^6$
Average veneer cost	100 sq. ft 3/16"	$6.00
Average selling price[a]	100 sq. ft 3/16	$11.00
Broad estimate of profit margin	percent	probably less than 7.5%

[a] Mean all sizes/types.

[b] Sheet sizes often preclude cylinder treatment.

TABLE 3(b). SUMMARY OF GENERAL PURPOSE COSTS - CCA (TRANSPORTED FROM PLYMILL TO CYLINDER).

Item		Unit	Cost
Typical preservative treatment[x][a]			
	0.5 pcf	100 sq. ft 1/16"	21¢
	0.75 pcf	"	28¢
	1.0 pcf	"	34¢
	1.5 pcf	"	40¢
	2.0 pcf	"	50¢
Transport (return)		sq. ft (3/16")	1¢
Re-dry		100 sq. ft $\frac{1}{4}$"	85¢

[a] currently these figures return a profit margin of less than 2%.

[x] includes stripping at cylinder.

Examination of these data shows that for treatment of plywood to a retention of 0.5 pcf with CCA, excluding the problems cited above, a minimum cost of $2.69 is involved in the treatment and re-drying of $\frac{1}{4}$" plywood.

NOTE: It is mandatory under SAA specifications that plywood be sold as seasoned 7-15%

Examination of the average profit margin which compares unfavourably with a general economic minimum of 10% return on costs, shows this cost cannot be absorbed and represents an increase of approximately 25% on the average sale price.

Australian plywood, although of a standard equal to or better than plywood from other world sources examined, is also, based on overseas sale prices, the highest cost plywood. However, this high cost is directly due to problems of species and conversion. The industry, for other than the high hazard or speciality products, is justifiably reluctant to add this extra loading to the consumer.

Although CCA salts are used as the example, the same reasoning applies to all similar treatments, and in practice the use of boron salts would reduce the quoted cost by approximately 30¢ without conferring the general purpose protection.

An alternative treatment approved under States legislation has been the treatment of the finished plywood in solvent based preservatives after hot pressing. Currently copper-naphthenate with a chlorinated hydrocarbon to ensure insecticidal control is used. The added cost is approximately 10% on untreated list price.

The major economics are in the process used, capital outlay and ease of treatment.

The current cost of conventional preservative has focussed interest on glueline additives. For the purpose of this paper, technical aspects of this are ignored with the major exception of the problem of veneer thickness.

Based on studies by the writer these treatments, if effective, would result, when combined with adoption of the principle of fumigation of veneer for storage, in a saving to the Queensland industry of approximately $250,000/year or the equivalent of 50¢/100 sq. ft 3/16". A chemical cost of 4-6¢/100 sq. ft 3/16" is involved.

Critical evaluation of the results of present manufacturing procedures and applications leads to the following conclusions:

1. With modern processing and finishing operations, <u>Lyctus</u> attack is no longer a significant factor or hazard in plywood. Sawn framing should be treated to prevent emergence through the plywood.

2. Until veneer thicknesses and plywood assemblies are rationalised e.g. maximum of 1/10" veneer in any assembly, costs of segregation etc. preclude effective usage of this protective treatment. The proposed SAA upon preservation of building timbers limits to 1/10" maximum.

3. For effective utilization - other than as a fire retardant - any preservative must give general protection i.e. it is inadequate and uneconomic to treat only against one hazard such as termites. For most structural applications I consider these treatments are technically not necessary or justified.

Protective maintenance of the building is a justified alternative.

Future trend

After examination of all aspects, and accepting the assumptions that:-

(a) Structural types plywood will form the major output of the industry.

(b) Rationalisation of beneer thicknesses and sheet sizes etc. will develop within 5 years. I would submit that in the industry plywood treatment - by on site processes - will develop along the lines of -

(i) Three levels of treatment based on general purpose hazards and these should be approximately equivalent to:

(a) current CCA levels of 0.35 pcf
(b) current CCA levels of 0.5 pcf
(c) current CCA levels of 1.0 pcf

(ii) Unless the plywood is to be re-cut that these treatments be on the basis of an envelope treatment involving full penetration of face and back and end-grain absorption to a minimum of 6" from the edge.

(iii) Preferably treatment should be by a solvent-based or vapour entrained preservative.

(iv) The only exception to this proposal is the application of fire-retardant treatments.

There is a conflict of opinion within the industry as to whether these are technically justified but current evidence from southern capitals strongly indicates that using and specifying authorities are giving serious consideration to these requirements for interior panels e.g. in high-rise offices or transport structures.

In conclusion it is submitted that a review of present practices and their relation to future trends is justified. It is felt that these can be amended to ensure that more effective treatments can be achieved at lower cost without reduction of the preservative standards currently prevailing in the industry. Failure to examine these factors can only militate against plywood as a major product.

ITEM 7/1d. SUPPLY OF TIMBER FOR PRESERVATIVE TREATMENT*

Preservative treatment of posts and poles has been established for 15 years and at present there appear to be reasonable supplies of round hardwood and pine for both commodities, although pole contractors in Victoria have to haul them up to 300 miles to the plant and some of the smaller post treatment plants are finding pine harder to get.

However, the demand for treated power poles has eased considerably at least in Victoria and the Postmaster-General's Department have virtually ceased buying. In the event that demand for poles recovers to former levels in the next 10-15 years, will there be enough trees in the forest to meet it? In spite of assurances that only material unsuitable for other purposes is used for chips it seems that a large quantity of small, clear round timber is now being used, e.g. at Eden. This could mean that when demand increases again there will not be sufficient poles of the required quality to meet AS O117. While the demand will be much less the same would apply to marine piling where large piles of very good form could be required.

Pine for fence posts will certainly be harder to obtain unless specific action is taken to meet the demand. Treated pine, round and sawn, is rapidly gaining ground in house building and domestic fencing, recreational use and public works. It would be disastrous if this market was lost for lack of supplies. A greater proportion of hardwood must be used and further work on such aspects as plantation culture, coppicing, de-barking and control of splitting is required.

Rail sleepers present the most important supply problem of the future. There are roughly 70 million sleepers in Australia which are being replaced at the rate of about 3 million per annum. High pressure treatment or boultonizing can be used to treat a wide range of suitable timbers. If timber is to remain the predominant rail sleeper material treatment must be introduced progressively as the preferred durable species cut out. However, this will be impossible if supplies of treatable timbers of the right quality are not available. This may not be the case if they are diverted to chips. The quality of lower durability sleepers supplied to the Victorian Railways in some cases would be quite unacceptable for treatment which will <u>not</u> eliminate mechanical defects.

To my knowledge west Australian karri is the only timber available in the quantity and quality needed for rail sleeper treatment at present, but some of the Tasmanian, NSW and Queensland sleeper timbers could be in this category.

*Prepared by F A Dale

If supplies cannot be assured beyond 10-20 years then this Division must seriously consider how much effort is to be spent on improving rail sleeper treatment and rail fastenings on which we are now concentrating.

Discussion - Items 7/1a-d

SMITH: Rail sleeper demand can be satisfied in Queensland by the extended railway specifications, which have added more than 30 species to the list plus 8 others if given a hot and cold creosote/pcp/dieldrin treatment. Despite preservation, pole users still prefer species of high natural durability. The trend in marine piling is now to use naturally durable species in a bark-on condition in preference to treated piles.

However, we have been recommending that unsarked timber-clad external walls use either highly durable or treated wood, and are now deciding whether this is necessary. Experience has shown that it may not be.

We are currently organizing a survey of the performance of untreated pine framing in external walls of post-war imported prefabricated houses and request cooperation from other States in this survey.

BRYANT: NSW would be pleased to assist in this project.

VAILE: Sections of Western Australian industry are concerned that the Division's intervention could have prevented the sale of treated karri sleepers in the northwest of WA. The limitations were explained to the purchaser, and although there was no shortage of jarrah, in this case price was the important factor.

TAMBLYN: We did nothing to prevent the sale of karri sleepers. However, we are concerned whether the treatment offered will give the required service life. When the limits of finance for treatment were explained, we accepted that the proposed treatment was all that could be done, but we certainly feel justified in questioning its effectiveness.

MOSS: The industry is not happy when the research bodies make recommendations which cannot be put into economic practice today.

RUMBALL: In considering the question of the preservative treatment of all Class 4 durability timbers, we have looked at dip diffusion and would appreciate comments as to the suitability of the CSIRO dip diffusion preservative being used as a cheap method of treating these timbers for house construction.

TAMBLYN: There was considerable discussion on the need for treatment of Class 4 durability timbers in buildings some 10 years ago. The Division was reluctant to advocate dip diffusion at that time because of the comparative infancy of the pressure preservation industry in Australia. The position has changed today and it is now a matter only of assessing the comparative economics of diffusion and pressure treatments and of deciding if, and when, there is need for treatment.

EDWARDS: The treatment of Class 4 timbers was raised because the whole situation needs re-examining. The actual method - diffusion or pressure - is of secondary importance. However, I am sure that a dip diffusion treatment could be found which would be satisfactory.

COLWELL: The situation obtaining in the Territory of Papua and New Guinea should be reviewed. Dip diffusion has been a requirement for six years, and treated Class 4 timbers have been in service for 16 years, including vertical weatherboards, and still there is no sign of degradation. It has been so successful that one of our treatment operators is considering the exporting of our treated timber to Sydney.

ANTON: The life expectancy of treated timber needs to be defined. 0.35 lb/cu ft means nothing to an engineer.

PARROTT: New Zealand reported to the last Conference on our findings of redistribution and loss of CCA in marine piles. We are still losing copper and still getting redistribution within the pile.

COKLEY: We find the same and do not know why it occurs. It is variable, depending on the exposure position and the species of timber and it occurs particularly in hardwoods. The higher the loading of preservative, the more redistribution occurs.

ITEM 7/2. REPORT OF THE WOOD PRESERVATION COMMITTEE (JUNE, 1971)*

The Wood Preservation Committee (comprising Messrs Clifford, Cokley, Edwards and Tamblyn) has held three meetings since the last Forest Products Conference in May, 1969. All meetings were fully attended though at the first in July, 1969, Miss Rosalie Kierle and Mr Rex Johnstone acted in place of Mr Edwards who was then abroad. To meet the future possibility of similar absences the Committee has now nominated alternatives for each member.

*Prepared by N Tamblyn (Convener)

The function of the Committee - to deal with matters which would otherwise overload the agenda of the Forest Products Research Conference - is being well maintained as is illustrated by the fact that at the two meetings held in the last 12 months there were 51 agenda items for discussion. It is clearly not possible in a brief report to summarize all matters discussed by the Committee and I have therefore followed the precedent set at the last Conference of selecting a few items to illustrate the work of the Committee.

1. Field studies

To enable members of the Committee to study at first hand current preservation practices and problems in different States, opportunity has been taken after the last two meetings to inspect typical preservation facilities in Queensland and New South Wales. The tour in Queensland was organized by the Queensland Department of Forestry who provided car travel from Brisbane to Rockhampton so that a range of plants could be inspected and a number of problems discussed. The tour in New South Wales, arranged by the Forestry Commission of New South Wales, involved inspections in the Northern Rivers district and also in the Sydney area. These field excursions have been valuable and it is planned, after the next meeting in Melbourne, to look at facilities and problems in Victoria.

2. Lyctus susceptibility gradings

At present there is some confusion in *Lyctus* susceptibility classifications of Australian and imported timbers due to differences in the grading systems used by Queensland, New South Wales and the Forest Products Laboratory (Melbourne) and due also to insufficient information on some species. The need for a complete and uniform classification has been raised in the past at more than one Forest Products Research Conference but effective action to resolve this was not then organized at Committee level. The Wood Preservation Committee is now examining this problem, and with the close cooperation which it can achieve, is hopeful that differences can be resolved and a uniform classification issued. It is proposed as far as possible to include Pacific island timbers for which information is available.

3. Preservatives

Although the Committee, as such, is not an approving body, its members as individuals have responsibility either for approval under State legislation (as in New South Wales and Queensland) or for statement of opinion to industry, quarantine or other prospective users. The status of new preservatives and their suitability for different uses is therefore a regular topic and where necessary the Committee, through the departments it represents, is prepared to undertake evaluation of preservatives as a cooperative project. This is illustrated in the case of copper quinolinolate, which has desirably low mammalian toxicity and is accepted in America for treating wood in food containers. When its wider use in Australia for treatment of shipping containers, plywood, window joinery etc. was proposed the Committee found the evidence for its effectiveness to be insufficient, particularly in regard to its performance as an insecticide. Members agreed to undertake its further assessment - Lyctus and termite tests to be done by the Forest Products Laboratory, Melbourne, decay tests by Division of Wood Technology and gluing properties and distribution in wood by the Queensland Forestry Department. This work is now proceeding.

Another preservative on which the Committee has deliberated is the plywood glue additive "Basileum S P I", the principals for which are Bayer Leverkusen in Germany. This additive was tested by the Forest Products Laboratory, Melbourne, at the request of Plant Quarantine and found to give excellent protection against termites but to be less effective in preventing decay. On the basis of these tests it has been approved by Plant Quarantine for treatment of shipping containers and its wider use in Australia has been sought by its suppliers. The Committee has considered the evidence available and decided not to recommend its wider use until two requirements are met. The first is that its formula, at present confidential, should be released sufficiently so that treatment to a given standard can be proved. The second is that further decay tests shall be made to determine whether its practical performance in exposure tests of treated plywood panels is better than indicated from laboratory tests. Members will cooperate in the installation and inspection of this decay test so that the assessment of this preservative is expedited as much as possible.

4. Brush box rail sleepers

The Committee has been impressed by the need for a suitable method for treating brush box to overcome rail sleeper shortage in Queensland and particularly to provide treated sleepers for use in new mineral railways. Hot and cold bath treatment of this species and pressure treatments, including Boultonizing, have given limited penetration. While at Maryborough in Queensland, the Committee took the opportunity to discuss this problem fully with the principals of Hyne and Son Pty. Ltd. and to plan a series of tests of incised and not incised sleepers given high and low pressure treatment after drying by the Boultonizing method. Green sleepers for these tests were provided by Hyne and Son Pty. Ltd. and the treatments were made by the Melbourne Laboratory. Results with incised sleepers have been more promising and the Committee is favourably impressed with preservative oil treatment of incised brush box sleepers by Boultonizing followed by application of 200 psi pressure or preferably higher.

5. Preservative treatment of plywood

There has been much discussion on this subject over the last two years and members of the Committee and cooperating organizations have agreed to examine various aspects of the problem of developing fixed preservatives for veneer which will not affect gluing properties. Work in Queensland will be concerned mainly with the distribution and penetration of glue line insecticides, in New South Wales with the development of an improved copper pentachlorphenate treatment, and in Melbourne with the testing of treated plywood to assess the effectiveness of treatment. Results of this work will be reported as soon as available.

Discussion

TAMBLYN in response to a question, said that details of Dr Ruth Turner's visit to Australia had been covered in the Forest Products Newsletter.

Now that the first requirement of a complete and authoritative taxonomic survey has been met, it is intended to go ahead with more research in the marine borer field.

MOSS: In looking at the composition of the Wood Preservation Committee, my Association felt that if a Committee exists to decide what is best for industry, then industry should be represented on that Committee.

COKLEY said that where there is a need for the Committee to refer to industry for discussion of certain aspects of its work, this was done.

HUDDLESTON said that collaboration between the Committee and industry is good, but that compulsory addition of an industry representative would not work. The Wood Preservation Committee must continue to be allowed to meet without industry representation, but to collaborate with industry as necessary, and this must be stated as a matter of policy.

TAMBLYN said that the Wood Preservation Committee was formed by the Forest Products Research Conference to discuss in depth items arising from the agenda of the Conference with which many Conference delegates were not closely concerned. For some time also, recommendations were made to the Standards Association concerning preservative loadings and acceptance, but this is now handled by an industry-represented Committee on which members of the Wood Preservation Committee serve.

At the last meeting of the Wood Preservation Committee in Sydney, an industry representative was coopted, and this would be done as necessary. It cannot be done all the time because confidential information is discussed and assessment of commercial preservatives made. This difficulty was discussed at the last Forest Products Conference when it was considered not feasible to include industry representatives.

MOSS said his Association intended to set up a Technical Committee. If and when asked they would be pleased to join or assist the Wood Preservation Committee.

KAUMAN summed up by saying that it was apparent that delegates wished to maintain the status quo.

ITEM 7/3. THE DEVELOPMENT OF THE TIMBER PRESERVATION INDUSTRY WITH THE BACKING OF FOREST PRODUCTS RESEARCH*

We appreciate the opportunity of submitting our views to this Conference through the medium of the Timber Preservers' Association of Australia. We are aware of our relative youth and appreciate that we were pre-existed in Australia by Government Departments and Laboratories encouraging the preservation of timber. We believe, however, that our industry is now sufficiently well grown up to play our proper part in the formulation and recommendation of treatment practices.

Your title "The economics of preservation in relation to recommendations" is well chosen because recommendations which cannot reach economic fulfilment are useless to industry, and thus useless for all practical practical purposes.

Your Departments have certainly done valuable work during our industry's formative years and we have noticed the energy and enthusiasm with which the various officers concerned have applied themselves. What we suggest now is the development of a system whereby we, in industry, are brought much more fully into the picture whenever and wherever advice or recommendations relevant to our industry are sought.

It often happens that your Departments - and sometimes individuals in your Departments - consider that a particular form and degree of treatment is necessary or desirable in a given situation, whereas, in industry, we might consider that a requirement for such form of treatment will result in the loss of a market for treated timber which could have been properly won. Take, as an example, railway sleepers and the work involved in the up-grading of many species not previously used. If you suggest or recommend incising and/or high pressure treatment and/or arsenical creosote, etc., then the Railway Departments will surely end up using concrete sleepers and once your Departments have promulgated your thoughts, beliefs or wishes, let alone recommendations, it is very

*Prepared by the Timber Preservers' Association difficult - if not impossible - at least in the shorter term, for industry to then step in and arrange with the customer for an economic and acceptable degree of treatment in which he then has confidence.

Maybe, the treatment offered by members of our industry would not be as good as your research has shown to be possible, but it is normal in all fields for technology to be ahead of commercial implementation. We certainly want to do the best job we can, but it must be realised that a growing industry is confronted with many problems, not the least of which is availability of capital. Already, we have something like $10 million behind us and, in continuing to grow, we will always want to tell the truth about what we are offering by way of preservative treatment in its various forms and we always want to do the best economic job possible.

Who is really responsible for the development of our industry?

What happens in other countries, such as in the USA and throughout most of Europe? Doesn't industry work to standards which it has itself set? So far as we know, the preservation industries in these countries have conducted themselves with some distinction and have developed good standards. Here, our Standards Association makes public the statement "All standards are drafted by committees fully representative of all interests concerned". We want to make this statement true.

Another area of quite vital concern to suppliers of wood preservatives is that if we are to have a proper progressive industry, we must be able to provide a good after-sales quality control service to ensure the preservatives are properly and economically employed. To achieve this, suppliers must obtain a sufficient price mark-up to cover marketing costs, development expenses, a field and laboratory quality control service and then be left with a reasonable profit on the funds employed. All this is well understood by many of you, but there are some who do not appear to be aware of the facts and where such persons have an influence in the market place, an obviously dangerous situation can develop.

The members of our industry who are active in providing the type of quality control service which we believe you also wish to see, therefore, look to you for support in maintaining economic levels of operation, so that this important aspect of our work can be properly maintained and further developed.

So far, we have referred to "you" and "us". Now, can we go forward on the basis of "we"?

"You" should, we believe, concentrate more on material testing, preservative evaluation, laboratory development work on improved and new preservatives and processes etc., and the results of such work should be available to industry.

Whenever you receive general enquiries about preservatives or preservation, these should be referred to industry as a routine matter. As and when you are asked for specific opinions or recommendations you should, we believe, first consult with industry so as to ensure that any recommendations made are such that they can be handled by industry in an economic and expeditious manner.

"We" will do the best and most economic job we possibly can today, and with a new awareness of the true position of each of us, coupled with the very substantial degree of cooperation which we know exists, we look ahead confident in the knowledge that, by doing our best with the skills at our disposal today, we are already doing a very worthwhile job and can look forward to doing an even better job in years to come.

Discussion

TAMBLYN: While there is, of course, merit in the TPAA proposals, a principle is involved and I would like to comment briefly from this particular aspect.

In essence the paper says "stay in the laboratory, our clients do not need to see both sides of the penny". Then naively it says "the advice of industry is sure to be good for our client because we have to make a profit".

As a matter of principle I should remark that my Section and our colleagues in State Departments represent a highly experienced team of some 30 people who have worked in the wood preservation field for 30 years or more. In that time we have set up field tests in all States representing more than 20,000 posts, poles, sleepers and small specimens in marine and land tests. When we give advice therefore it is based on a very large fund of practical experience which we offer fairly and impartially to both the treater and the user of treated timber. When the Australian wood preservation industry has comparable technical knowledge and the organization to set sound standards and to see that its members abide by them, we will be delighted to step aside.

Until then we have a responsibility to give sound advice to anyone who may ask for it. I could quote many examples where our advice has saved the industry from indiscretions and the user from unnecessary expense. I believe we should continue to do this as long as is necessary and in doing so to cooperate closely with the industry and the user as we have always done.

In most cases our advice agrees with that of industry, but if it does not and we have sound reasons for disagreeing, [illegible] sound a warning and not simply to bow to commercial expediency which may profit the industry but may not be best for the user.

COKLEY: The wood preservation industry is now approaching an age and expertise where they must be given the responsibility for a large share of quality control and technical service with overall Government legislative supervision. I rely on the industry a lot for this and will continue to do so. Effective quality control must be done by industry itself and for our part, we must balance technical requirements with what can be achieved. In general I endorse the recommendations of the paper.

EDWARDS: Two lines of action which we should strengthen are: (1) Full participation of the Timber Preservation Industry in the deliberations of Standards Committees concerned with matters affecting the industry. (2) Support for a Technical Committee within TPAA. Further, we should proceed to the completion of as many preservation Standards as we can.

MOSS: The operation of wood preservation in Australia is very different from most other countries where the industry sets the standards and controls them itself. However, the TPAA will form its Technical Committee and then, I hope, we can get together on a proper basis, along the lines of Mr Edward's suggestion.

ITEM 7/4. PERFORMANCE OF PRESERVATIVES IN EUCALYPT SAPWOOD*

It has been recognized for some time that the performance of wood preservatives is markedly affected by the timber species treated and that in particular the performance of CCA preservatives in eucalypt sapwood in tropical soils is much poorer than in pine sapwood. Results obtained at the Division of Forest Products since the 1969 Conference show that the problem is more serious, more complicated and more puzzling than expected.

Data from field stake tests (Table 1) show that the relatively poor performance of CCA at commercial retentions in eucalypt sapwood is not confined to the tropics but also occurs in Victoria, and that other preservatives can show at least as marked a difference as CCA. Early data from exposure tests of CCA-treated slats in cooling towers with very high soft-rot hazard (Table II) suggest that the difference is not simply a Pinus v Eucalyptus difference or a softwood v hardwood difference. Although the CCA tends to perform better in softwoods

*Prepared by E W Da Costa

than in hardwoods, there are marked inter-specific differences in both classes of timber, with some hardwoods performing almost as well as softwoods and others very poorly.

It was thought that the inferior performance of CCA preservatives in eucalypt sapwood as compared with pine sapwood was probably due to different fixation mechanisms, probably associated with differing extraneous materials, leading to the formation of different compounds in the wood. The compounds formed in eucalypt sapwood could be either less toxic or more leachable than those in pine sapwood. Large differences in leaching behaviour of CCA in pine and in eucalypt sapwood have been demonstrated (probably due to structural as well as to chemical differences in the timbers) and these probably account for most of the differences shown in Tables I and II, particularly the latter. However, laboratory tests (Table III) show that differences between CCA performance in pine and in eucalypts occur even where no leaching has taken place and that these differences are not lessened by drastic extraction of the specimens before treating.

Examination of the distribution of copper within the cell wall has not disclosed any differences between the pine and the eucalypt specimens in these tests which would account for the test results. Further investigations aimed at defining and explaining this complex problem are being made. Future inspections of field tests, and service records, will enable more reliable assessment of its economic importance but results to date suggest that the effect of timber substrate must be taken into account in commercial wood preservation.

TABLE I: Performance in P.8-14 graveyard test. "Percentage soundness" of Pinus radiata and of Eucalyptus regnans stakes after 6-7 years (Decay data only).

Treatment	Timber species	Site				
		TPNG	N.Q'ld	Sydney	Melbourne	Mallee
Tanalith C 0.75 lb/cu ft	Pine	90	98	100	100	100
	Euc.	66	76	100	82	90
K55 Creosote 8 lb/cu ft	Pine	82	95	100	100	100
	Euc.	31	35	92	62	88
5% PCP in furnace oil 8 lb/cu ft	Pine	84	92	100	100	100
	Euc.	69	70	100	82	100

TABLE II: Performance in cooling towers. "Percentage soundness" of CCA-treated experimental slats after 3 years.

Timber	Cresco tower (WA) Control	Cresco tower (WA) 0.5 lb/cu ft	Cresco tower (WA) 1.25 lb/cu ft	Wallerawang tower (NSW) Control	Wallerawang tower (NSW) 0.5 lb/cu ft	Wallerawang tower (NSW) 1.25 lb/cu ft
Redwood	100	100	100	60	100	100
Radiata pine	77	100	100	50	87	100
Hoop pine	80	100	100	63	90	100
NSW sassafras	80	100	100	53	80	97
White cheesewood	77	100	100	50	90	93
English beech	63	73	73	57	63	73
Spotted gum	73	77	77	50	67	70

TABLE III: Performance in laboratory tests. Percentage weight losses of CCA-treated specimens of <u>Pinus radiata</u> and <u>Eucalyptus regnans</u> sapwood, and of matched specimens treated after removal of extractives ("EXT"). None of the specimens were leached before testing.

Test fungus	Timber and treatment	Retention of CCA (lb/cu ft) 0.0	0.05	0.1	0.2	0.4	0.8
<u>Trametes versicolor</u>	– Pine	40	14	3.1	1.5	0.8	0.1
	– Euc.	63	48	36	30	9.3	2.8
"	EXT Pine	46	23	0.0	-0.5	-0.7	-0.9
	EXT Euc.	83	74	61	54	27	6.9
<u>Chaetomium globosum</u>	Pine	18	10	3.5	1.4	1.2	0.7
	Euc.	29	32	28	24	12	3.4
	EXT Pine	18	2.7	1.5	1.7	0.0	-0.8
	EXT Euc.	41	37	34	22	11	6.1

ITEM 7/5. PRESERVATIVE TREATMENT OF PLYWOOD BY USE OF GLUE ADDITIVES*

Plywood for exterior use often needs protection from biological attack, including attack by fungi, termites, wood borers, and perhaps marine organisms, but prevention by impregnation of the finished plywood or by treatment of the veneers before gluing has proved difficult or expensive. In recent years, there has been a considerable amount of interest, especially in Europe, in preservation by incorporation of insecticides and fungicides in the glue used. Since this involves no extra handling costs or interference with normal factory operations and can be varied to suit small batches of material, it would be commercially attractive, if a sufficiently effective treatment could be developed.

Protection against insect attack is the easier problem. A proprietary glueline additive (Xylamon SPI, containing chlorinated hydrocarbons and pentachlorphenol, used at 15% of wet glue weight, gave complete protection against termites in laboratory tests even after a severe laboratory weathering, whilst arsenic trioxide, at 3.6% in the glue gave virtually complete protection. Use of chlorinated hydrocarbons in the glue has given effective protection against Lyctus and Anobium in laboratory experiments and long term exposure tests in Melbourne and in New Zealand, but was not satisfactory in Queensland exposure tests, so that further testing is needed.

Protection against fungi has been less successful. Xylamon SPI gave some protection from brown rot fungi in laboratory tests but failed badly against white rot fungi. Sodium pentachlorphenate (at up to 18% in the wet glue), thiabendazole and the proprietary glueline additive F Emulsion (B ASF) all gave only poor protection if any. Arsenic trioxide at 3.6% in the glue was more consistently effective but did not give complete protection (since tests were made only on unweathered samples, results may have been worse after leaching). In all cases, protection was much greater when only thin veneers (1/16 in. or less) were involved.

At present, glueline additives can probably give adequate control of termites and borers (provided that the materials now used are not banned as health or pollution hazards) but are quite inadequate against decay. For most plywood, protection from insects is more important and work on this aspect is being intensified by CSIRO and by State forest services, but some further work is also being done on development of antifungal glue additives.

*Prepared by E W da Costa

Discussion

COKLEY: We now have a committee responsible for carrying on this test. Dieldrin and arsenic are used, tagged with radioactive tracers. If successful this could save industry at least $\$\frac{1}{4}$ million.

ITEM 7/6. DECAY IN WOODEN WINDOW JOINERY*

Last year the Timber Development Association of South Australia drew our attention to the problem of decay in wooden window joinery in South Australia and expressed their alarm that the Housing Trust might soon reject wood in favour of aluminium for windows. Subsequent discussion with architects of the South Australian Housing Trust and an inspection of houses said to be typical, confirmed that a serious decay problem had developed in recent years mainly in untreated meranti sashes and frames. In the brief inspection which I made, five houses close together in two streets were seen in which about 10 window frames needed replacement after only eight year's service. In some cases the bottom sash was also decaying. Despite this, we were assured by two senior architects that action to replace wood with aluminium was not contemplated at present, because Adelaide joinery manufacturers were now dipping windows in light oil solvent preservatives and that this treatment was understood by the Housing Trust to be effective and reputable. The Division was invited to confirm this both to the Housing Trust and to some Adelaide joiners who were sceptical. We were further invited to cooperate in tests to demonstrate that the conventional three minute dip was longer than necessary to wet the internal contact faces of joints and that the immersion period could therefore be reduced.

For various reasons based on experience abroad and our own tests of superficial treatments we could not agree that this was a satisfactory treatment for joinery where it was necessary to extend a probable life of about 10 years to a span of 50 years or more. However, as the life of any preservative is very dependent on the depth of penetration, we suspended judgment until dipping tests had been made on several species of meranti. For these tests we used two species of white and three of red meranti and compared three different treatments using a highly penetrative light oil solvent preservative. The three minute dip treatment produced about 1/32 - 1/8 in. of end grain penetration and a side grain penetration which was entirely negligible. A vacuum-low pressure treatment (10 psi) produced $\frac{1}{4}$ - 1 in. of end grain penetration and a 100 psi treatment gave $\frac{1}{2}$ - 1 in. of end grain penetration in the red meranti and considerably more in the white

*Prepared by N Tamblyn

meranti. From these tests it was clear that upwards to 1 in. of end grain penetration, which we would regard as the minimum necessary for long term decay protection of window joints, can be achieved in red meranti by pressure treatment of the prefabricated components, but certainly not by dipping. We advised the TDA in Adelaide to this effect last November, but it seems that the joinery industry is either unwilling to accept this advice or economically unable to take the necessary action. In the meantime dipping continues and we are in the awkward position of having soon to decide whether to allow this to continue or whether to precipitate matters by advising the Housing Trust that we consider they are buying an unsatisfactory product.

There may be some economically feasible alternatives such as the use of more durable or more permeable timbers than red meranti. If there was regular shipping from Papua-New Guinea to Adelaide, a durable species such as Kwila or a readily treated species such as Homalium might provide an answer. Alternatively members of the Radiata Pine Association might be able to provide CCA-treated pine of suitable quality for window joinery. This is more an economic than a technical problem and I raise it here because we have reached an impasse which if not solved soon may result in the loss of the wooden window market in South Australia. It is a problem which is present to some extent in other States and which could become serious at any time if traditionally satisfactory timbers become less available or if methods of jointing are not carefully watched. We are, at present looking at the possibility of an improved pressure treatment for prefabricated joinery components, in which the preservative and water repellent additives will be carried into the wood in a volatile recoverable solvent (such as methylene chloride or a fluorinated hydrocarbon) of negligible fire hazard. This would be an advantage because deep penetration would then be possible without a subsequent painting problem. However, whether or not this type of treatment can be developed successfully in the future, does not alter the present fact that a situation dangerous to the reputation and future use of wooden joinery in South Australia needs urgent decision.

ITEM 7/6(b). PRESERVATION OF EXTERNAL JOINERY*

There are several disturbing trends in the use of exterior joinery which must react unfavorably to timer within the next 10 years.

One is the increasing use of meranti and other low durability timbers without proper protection against decay.

*Prepared by F A Dale

Another is the disregard of good design e.g. excessive exposure, poor joint design and lack of proper watershedding, particularly in flats and home units.

A third is the widespread use of preservative stains, and pigmented finishes not necessarily water repellent, sometimes advocated with extravagant claims such as "doesn't need attention for 7 years or more".

If these stains are used on western red cedar their performance is of minor importance. Used on ash type eucalypts, Douglas fir and meranti they will look nice for 3-12 months, long enough for the builder to disclaim responsibility. They will then need painting over or refinishing; at least every 12 months in exposed conditions.

An authoritative statement, preferably issued by the lending authorities, is needed on the subject as well as the cooperation of timber merchants, builders, architects and paint manufacturers, in order to correct the situation.

Wooden joinery is still very popular in better class home building and it would be a great pity if it fell from favour because of disregard of these trends.

Discussion

SMITH: Durable joinery timbers from North Queensland are available.

EDWARDS: The Standards Association of Australia is attempting to produce a Standard for water repellent preservatives and a Code of Practice for their application. Can we hear from industry representatives on their experience with vacuum treatments used for the application of water repellent preservatives to joinery?

MOSS: My company operates automated "VAC-VAC" treatment in the UK where the joinery industry has incorporated the treatment operation into its production schedule. One plant, for example has a larger throughput than all the joinery produced in South Australia and Victoria.

VAILE: What evidence is there that dip treatments, as used in South Australia are not satisfactory? Why is 1 in. penetration necessary?

TAMBLYN: If you read the reports of Dr Verrall's dipping tests in the USA, you would agree that the protection afforded by dipping is not of long term duration. Three minute dipping of southern yellow pine often gave only 12/15 years life. We think that a 1 in. minimum is realistic for 50 years life.

What do delegates feel is our duty to the South Australian Housing Trust?

COKLEY: Our results agree, particularly with meranti. I suggest that the matter be discussed with the supplying industry rather than direct with the Housing Trust.

THOMSON: TDA Adelaide believed that this was a serious problem and this is why we referred it to Mr Tamblyn for investigation. The problem is not as serious as it at first appeared and we are not convinced that dipping is unsatisfactory provided the paint surface is properly maintained. We would like to discuss this further with Mr Tamblyn before he precipitates matters with the Housing Trust.

SOUTH: If Mr Tamblyn wishes to consult with us on this matter we will assist locally where possible.

MOSS: This is a case which could be usefully referred to an industry technical committee so that we could agree jointly as to what is best for the client.

RUMBALL: If the Forest Products Laboratory was asked the question surely they must answer it. They should supply relevant information to the Trust and invite them to discuss the matter.

THOMSON: Any further action contemplated should be referred back to us beforehand.

ITEM 7/7. FIRE RETARDANT PRESERVATIVES FOR FENCE POSTS - THE ROLE OF INDUSTRY*

CCA preservatives, though excellent in many ways, suffer from the defect of imparting afterglow to the extent that treated pine fence posts if ignited are liable to glow until they are destroyed. This defect received considerable publicity and caused alarm among farmers and sections of the preservation industry. Although surveys by the Division of Forest Products indicated that losses of CCA-treated posts from grass fires were relatively small, it was apparent that CCA preservatives could be discredited not only in the fence post market but also for other uses. Therefore the Division, in the absence of satisfactory alternative proprietary waterborne preservatives, undertook to investigate the problem.

*Prepared by D McCarthy

Initial experiments with fire retardant chemicals indicated that there were two choices - either to try to develop an entirely new fire retardant waterborne preservative or to attempt to modify CCA formulations so that their propensity for afterglow could be restricted to acceptable limits. In view of the urgency of the problem it was decided to follow the second approach and the work that followed lead to the development of some ZnP CCA formulations that had a measure of fire retardance as well as permanence and toxicity. Some of these formulations were extensively tested and then released to industry as an interim solution to the problem. One formulation known as 3S has been preferred by salt suppliers because of its low cost and manufacture. From April, 1970 to February, 1971, approximately 150 tons of 3S were used in Victoria and South Australia for the treatment of Pinus radiata fence posts. Treatments with this formulation do not reach their full fire resistance until sodium sulphate, a by-product of fixation, has been leached from the treated posts.

At this stage, as 3S comes increasingly into use, it is pertinent to consider some aspects effecting future work in this field. These are:

1 The development of 3S has involved us in much work over the last three years. We were reluctant to do this work because we consider that modification of proprietary CCA preservatives for special purposes should be attended to by industry. There is still some room for modification of the 3S formulation - particularly in respect to reformulation to avoid formation of sodium sulphate and possibly in respect to elemental ratios to allow for any change in solutions in continuous use. The question is should we do this additional work ourselves or leave it to industry to do? A related question is should we insist under the licensing agreements resulting from our patent application covering the ZnP CCA preservative that the slightly more expensive and difficult to make but more effective non-sulphate producing formulation be used.

2 3S is not an ideal, cheap, highly fixed fire retardant preservative. It attempts to overcome an inherent weakness in CCA preservatives by adding two new components which do nothing to increase effectiveness against decay or insects. While this is a reasonable approach to the special problem of improving the fire resistance of treated posts it has some implications less desirable. If use of 3S is extended to the treatment of hardwood posts it is most likely that it will be used by some

plants as a general purpose preservative. We are not happy about this prospect as it would be technically and economically better if straight CCA were used for all waterborne treatments where 3S is not specifically required.

This raises the question of whether 3S and related formulations should be regarded as interim solutions to the wide problem of developing a general purpose fire retardant waterborne preservative. In this case the additional question arises as to whether we should now be starting the probably long term search for a cheap fixed fire retardant waterborne or whether we should leave this development to industry.

Discussion

RUMBALL: The timber industry waited a long time for the preservation industry to solve this problem, but a solution was not forthcoming. The Forest Products Laboratory is to be congratulated on this work and I suggest that they continue the research rather than leave it to industry.

SOUTH: I would like some information on the de-toxification of arsenic in the presence of phosphorus as mentioned in the DFP Research Review.

DA COSTA: Although the arsenic is detoxified to some extent in the 3S formulation, we believe that 3S is still adequate for its intended use.

BRYANT: In addition to looking for an alternative fire retardant formulation for fence posts, someone should be looking at the formulation of a new all purpose, highly fixed pollution-free preservative. The industry cannot be left to do it so long term work should be initiated in this field.

TAMBLYN: There are difficulties in industry using preservatives that we have devised. They are reluctant to accept responsibility for them, and feel, rightly, that the business of preservative formulation and manufacture is not our prime function. For our part we prefer to assess the formulations offered by industry.

ITEM 7/8. DISTORTION OF SEASONED TIMBER IN TREATMENT (Q'LAND)

In Australia it is common practice to size and dress timber prior to its treatment. In consequence this material requires preseasoning. The subsequent treatment by any waterborne preservative process results in an increased moisture content, changes in sectional dimensions, the raising and discolouring of surface grain. If the treated product is installed in this high m.c. condition, subsequent in-service problems arise e.g. shrinkage, painting difficulties, corrosion of metal fittings, and defective gluing. If the material is required to be installed in a seasoned condition, there occur the problems of stripping, and possible distortion and checking during redrying. It is usually necessary for this material to be re-dressed. However, this often removes the highly loaded skin portion, and the picture this presented is not economically very attractive.

These same problems also appear in the plywood field complicated by the indeterminate variability of effective penetration by general purpose water borne preservatives.

In an attempt to alleviate these problems the Queensland Forestry Department has introduced copper naphthenate treatment for both plywood and light building framing. The required retentions are 0.1% as elemental copper in every veneer of the plywood sheet or the outer ¼" envelope of the framing material for internal hazard conditions and 0.2% as elemental copper in external hazard conditions above ground.

For light building framing, this is classified as a protective treatment, i.e. the treatment is there to protect the material from non-continuous incidence of the particular hazards. Framing on slab-on-ground construction is a typical example of its envisaged use. The method of treatment is to fill a vat with the material in such a way that all faces are accessible to the solution. The 2-5% solution, depending on end loading is then run in and the material immersed for a minimum of 30 seconds. The material is then removed and allowed to stand in block stack at least overnight.

For the treatment of plywood, a portion of the ply-manufacturing cycle itself is used in setting the conditions for treatment. After gluing, sizing, and sanding, the sheets are again returned to the presses and heated to about 290°F, then placed in a vat, and flooded with 5% solution. The sheets are immersed in the solution for about 20-30 minutes in which time the temperature drops approximately 70°. It is in this period that the solution is absorbed in to the material. The sheets are then removed and air dried for a day. This is followed by kiln drying to remove the excess solvent, mineral turpentine.

A chlorinated hydrocarbon is included in the copper naphthenate solution for insecticidal control. Firms engaged in these processes are experiencing no difficulties in meeting the retention specifications as laid down. Adding the bonus of water repellancy from copper naphthenate the resulting products from both materials are free of raised surface grain, are dimensionally stable, of uniform moisture content and show no problems in painting and gluing.

Discussion

SMART: The application of CCA preservatives to plantation grown softwoods has created the problem of originally seasoned wood being marketed after treatment without redrying.

EDWARDS: We have approved the use of plywood treated with copper naphthenate for inside and outside use at appropriate retentions, but not for ground contact.

JOHANSON: How long will chlorinated hydrocarbons last before they degrade and what is their hazard to occupants?

COKLEY: I think that the chlorinated hydrocarbons will be available to us as preservatives for only 5 years or so. The hazard may be less than that of many other preservatives and their use is to date approved by our Health Department. There is no evidence that they will break down in timber in this usage, however, there is need to investigate alternatives.

TAMBLYN: Why do you require such a solid schedule for plywood while permitting dipping of building frames for 30 seconds?

COKLEY: Because the plywood is often used for purposes such as boat construction and we require that all veneers contain the minimum amount of preservative. The hazard in the case of softwood building timber is much less.

ITEM 7/9. PRESERVATIVE TREATMENTS IN RELATION TO HAZARD LEVELS IN BUILDING*

It is desired to put forward the proposal that preservative treatments frequently far exceed the needs of hazards with which they are intended to cope, resulting in unnecessarily high costs of production.

*Prepared by K Cokley and N Heather

The main hazards are accepted to be Lyctus, termites, and decay, and possibly Anobium. Good building practice can totally preclude damage by termites and decay in at least 99% of utilization. Therefore, these hazards need not be taken into account in determining the level of protection required from routine preservative treatment. However, it must be conceded that they are of sufficient importance to warrant standard specification treatments where these hazards cannot be avoided in the abovementioned way.

From this, it is apparent that routine treatment should not exceed the level required to immunize against Lyctus in hardwood and possibly, Anobium in pine, provided that should Anobium require a higher level than Lyctus this level might need to be applied to Lyctus treatments of all hardwoods.

There have been instances where general purpose preservatives have been used to treat flooring. Since conditions conducive to decay would result in constructional and other problems in a floor, the use of general purpose preservatives can only be condoned where it is of equal or lesser cost than other treatments, usually borax. Similarly, the possibility of leaching must be fully considered and it is pointed out how infrequently borer damage results from leaching of a preservative.

The decay hazard in external cladding must be accepted as low, even in structures receiving only average maintenance. Hoop pine chamfer-boards have given, consistently, a service life in excess of 70 years (demonstrated in a recent survey of 800 houses in Maryborough, Queensland) while exotic conifers, possibly of lower intrinsic durability than hoop pine have given 20 years service as cladding without serious problems or any hint of problems within the expected service life of these buildings (in excess of 55 years).

It is believed therefore that consideration could well be given to restriction of treatments to the minimum needed.

A factor arises with respect to hazard ratings and present accepted durabilities of species with particular reference to external cladding.

It is considered that as pointed out above, decay in external sheeting is not a major problem assuming normal maintenance or building practices. The present proposal in Australian standards to use "in ground" ratings of durability is considered to be unfair to available species. It is of particular economic value to North Queensland and New Guinea where reputedly durable species are in short supply.

Studies by the authors over a number of years lead to the conclusion that properties other than durability, e.g. checking, nail holding of shrinkage are in fact of equal or greater importance. This is illustrated by species such as Queensland maple or red tulip oak as compared to brown and blush tulip oak. One further aspect which is of increasing importance is the use of untreated pine framing on slab construction. Decay is considered in this instance to be a long term problem. Similar problems arise in "under-house" construction. These are prominent among the few cases where treatment per se may be justified.

In conclusion it is submitted that greater consideration be given to the part which should be played in utilization by building practices and maintenance rather than the imposition on the timber industry of additional costs to guard against lack of these principles.

Discussion

TAMBLYN: Our field tests, in cooperation with the Radiata Pine Association, of CCA treated pine have shown that untreated heartwood in joints above ground is showing considerable decay in less than 2 years at the wettest site, Innisfail. I therefore cannot agree with the sentiments of this paper.

HUDDLESTON: I believe that in many cases we sell preservation when we could get a better effect in a different way. Alternative construction methods are often cheaper than treatment.

ITEM 10. REPORT OF THE FIRE RETARDANT COMMITTEE

For some years the Fire Retardant Committee which was set up by this Conference has been investigating various aspects of the behaviour of Australian Timbers, fire retardants and wood preservatives in relation to fire, in buildings.

Reliable quantitative data on the burning properties of Australian building timbers are almost non existent, in spite of their strongly held reputation for fire resistance.

Australian Standard AS 30.3.1970: Fire Tests on Building Materials and Structures - Tests for Early Fire Hazard Properties of Material, describes tests for rigid and semirigid building materials so that they may be classified according to the tendency to ignite, spread flame, develop heat once ignition has occurred, and to produce smoke during the early stages of a typical "small fire".

The Committee has concluded fire tests of ten commonly used Australian building timbers.

These results showed that density, at 12% moisture content, has some bearing upon the EFH Index and that the denser timbers had a lower index than lighter ones. Two of the species of intermediate density, mountain ash and brown tulip oak, departed from this rule and the results for individual specimens were sufficiently consistent to make the departures significant.

Except for white cypress pine (EFH Index 58), the EFH Index for species lighter than 50 lb/cu ft did not fall below 60 and did not exceed 68. For the species denser than 50 lb/cu ft, the correlation between average species density as tallowwood, had a rather better EFH Index. However, since the density figures used are averages for the species and were not determined on the material actually tested, there is a strong probability of a difference in density between the two species, in the panels tested.

It is noteworthy that jarrah, which enjoys an international reputation for fire-resistance, is relatively no better as far as EFH Index is concerned than is to be expected from its density and that Eucalypts with a greater density than jarrah (e.g. tallowwood and spotted gum) are likely to have a lower (i.e. better) EFH Index than jarrah.

The Committee has also investigated the respective merits of several fire-retardant pressure impregnation systems. There was no obvious difference in performance between the two fire-retardant preservatives in softwood timbers but, in the two hardwoods, Fire-retardant Impregnation A was consistently better than Fire-retardant Impregnation B, and the difference was accentuated when a boron compound was present. No attempt has been made to offer an explanation for these differences.

It has also investigated the performance under fire conditions of timbers treated with CCA preservatives and the toxicity of the products of combustion of such timbers.

With each of the three species tested, (radiata pine, hoop pine and messmate) the presence of the CCA preservative improved the fire behaviour of the timber, as measured by the Early Fire Hazard Index. Judged by the same criteria, the performance of the treated timbers was no better than that which could be obtained from the denser hardwoods, untreated. Therefore where both durability and low EFH index are desired, timbers of low natural durability ahd having relatively high EFH indexes may be given preservative and fire retardant treatments and substituted for the denser, more durable eucalypt species which are normally used untreated.

The EFH index classifies building materials according to their behaviour during the early stages of fire in a building. Because of experience of CCA treated timbers in grass fires it was decided to examine the tendency of these timbers to smoulder after the flames had been smothered following EFH test.

The loading of CCA preservatives that would normally be used for building timbers made little difference to the EFH index and increased the loss of weight due to smouldering or afterglow by about 5%. At loadings higher than would be used for building timbers the additional loss of weight due to afterglow becomes significant. This indicates that if higher loadings of CCA preservatives are to be used for building timbers care must be taken to ensure that the fire is thoroughly extinguished at the conclusion of any fire fighting operations.

The extent to which this conclusion applies to treated timbers other than radiata pine has not been established but, from other experience, it can be expected to hold good.

Although the continuous burning of CCA-treated timber could be hazardous from the continued presence of arsenic in the smoke plume, measurements made by the Division of Occupational Health, NSW, Department of Health, indicate that a hazard in fatal terms is unlikely from the arsenic released from treated timber during any one building fire.

During the course of their investigations the Committee also looked at the value of certain wood preservatives which contained fire-retardant components. These preservatives were the CSIRO's dip diffusion multi-salt and a zinc-phosphorus copper-chrome-arsenic formulation. When compared with CCA treated timbers both formulations effectively reduced weight losses in the afterglow test.

In spite of its good effect on EFH Index, 0.35 lb/cu ft of the CCA preservative failed to reduce the ultimate weight loss in the treated specimens below that of the controls. In this regard it was noticeably inferior to the boron diffusion treatment. The preservative containing zinc had very little effect upon the burning properties of the treated wood but conferred some slight benefit in preventing afterglow and reducing total weight loss.

This work has been done by courtesy of the Commonwealth Experimental Building Station, Fire Research Section.

Before the work is put out for publication one aspect still needs to be cleared up. This is the effect of the concentration gradient of the fire retardants in various species of solid timbers on their subsequent fire performance. It is important to ascertain whether machining fire-retardant impregnated timber will reduce its fire performance and to this end material has been collected for a suitable experiment. It is hoped to complete this work within the next few months.

A draft of a publication entitled "Fire Tests on Australian Building Timbers' is being prepared by Messrs. Beesley, J J Keough, and A W Moulen.

Discussion

JONES: The plywood industry is very interested in this report. We have reservations about the use of fire retardant coatings for plywood because subsequent coatings put over them may not be fire retardant. We need to know not only how much fire resistance is applied to timber but whether it is sufficient to raise its rating to an acceptable one. It may be easier to obtain a rating by construction than by treatment.

KEOGH: The test to which these timbers was subjected was for internal linings. It should be remembered that if plywood is used to face either side of a fire door, it must be considered as a surfacing material and the ability of the material to reduce the likelihood of ignition by heat is what is being tested.

MARTIN: Will the Fire Retardant Committee concentrate more on fire retardant treatment of sheet materials than on structural materials?

EDWARDS: The Committee needs guidance from the Conference.

JONES: TDCA has made enquiries about the fire retardant treatment of sheet and structural materials. A report was issued and the Fire Retardant Committee might obtain guide lines from this report.

NOTE: Conference decided to delete reference to publication from the Committee's report. It also endorsed the substitution of Mr D McCarthy for Mr J Beesley during the latter's absence overseas.

POLICY SESSION

(a) Future Conferences

It was moved by Mr Cokley, seconded Mr Huddleston that this Conference recommends that the Forest Products Research Conference be continued, with industry organization representation included, and with extension where required to a "Heads of Delegation" closed policy session: that the next Conference be held between 18 months and two years hence, in Melbourne.

The motion was carried.

Conference thanked the ANU for their offer to host the next Conference in Canberra.

(b) Format

It was generally agreed that selected topics rather than areas of research constitute the main agenda headings. The format of this Conference was considered to be satisfactory. It was suggested that preprints are desirable for long items, but brief summaries distributed before each session would be preferred. A suggestion that a Seasoning Committee be established was considered to be unnecessary.

(c) Suggestions made during the Conference for new or extended research topics:

(A) Conversion

1 Continuation of work on effects of log and wood characteristics on (a) conversion processes, (b) end use.

2 Grading and branding.

3 Extension of work on log storage under water sprays to rainforest spp.

4 Further work on the relationships upon which the use of machine stress graders is based.

5 Production of a saw servicing manual.

6 Review of abrasive and other methods of surfacing wood products, including combination of "breaking down" and surfacing in one operation.

(B) Harvesting, preparation etc.

1 Liaison between the various interested research groups on development of new and improved harvesting methods.

* 2 Methods for debarking eucalypts.

(C) Utilization - general

1 Improved methods of construction using timber, including methods to obviate the need for preservative treatment.

2 Continued revision of product need forecasts.

3 Survey of work necessary to keep wood products in the building industry.

4 Utilization of residues, including bark and wood waste.

(D) Environmental problems

1 Effects on underground water of chemical discharge from wood preservation plants.

2 Biological disposal or degradation of bark and wood wastes and pulp mill effluents.

3 Noise level in mills.

* 4 Survey of problems associated with the Clean Air Acts.

5 Development of non-toxic slimicides.

(E) Pulping, chips etc.

1 Chip pile degrade, covering degrade from chipper to digester.

2 Pulping properties of rain forest species from NSW and Queensland.

(F) Wood Preservation

1 Development of a durability classification on other than in-ground ratings for external sheathing.

2 Development of a new wood preservative.

3 Sub floor ventilation.

4 Performance of untreated pine framing in external walls (Q'land project - NSW agreed to assist).

5 Glue additives and other plywood preservatives.

*Considered to be of high priority.

6 Effect of wood substrate on preservative performance.

7 Study of premature failure in poles.

8 Reduction in arsenic content of CCA preservatives.

9 Protection of untreated heartwood in bridge and marine timbers.

10 Disposal of wood preservation residues.

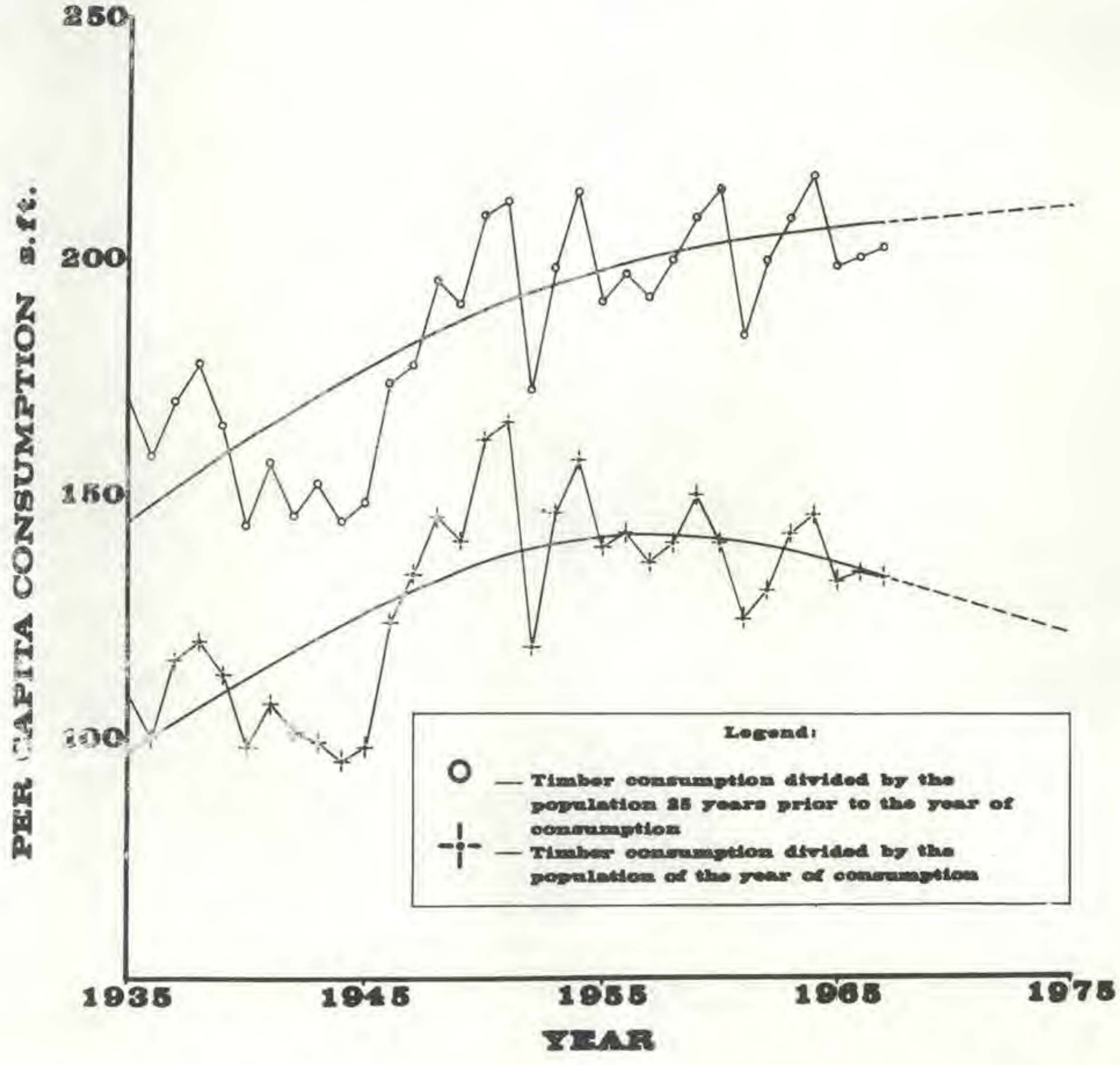
(G) Surface protection

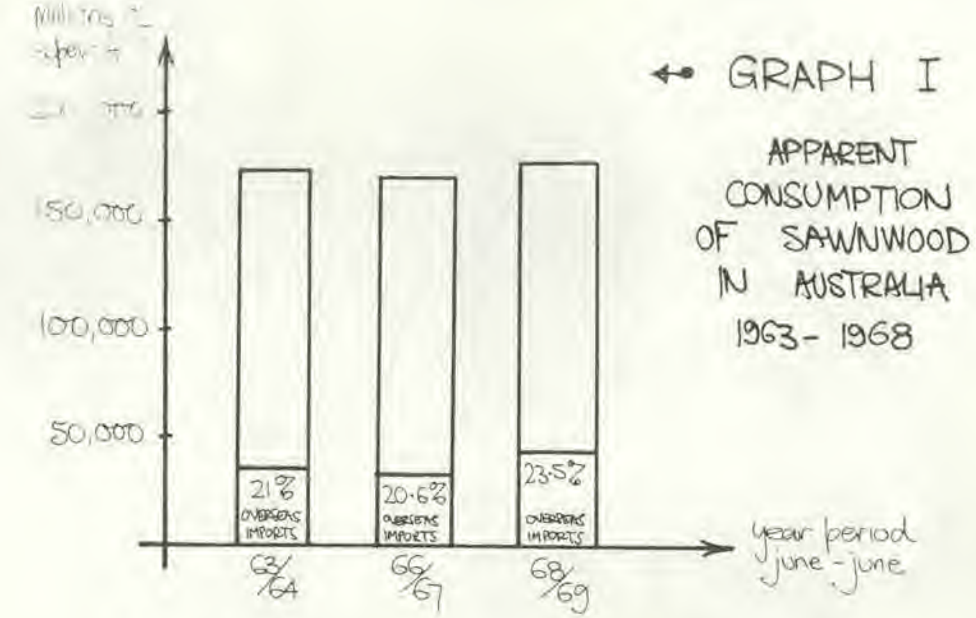
1 Impregnated dyes to prevent colour loss on exposure.

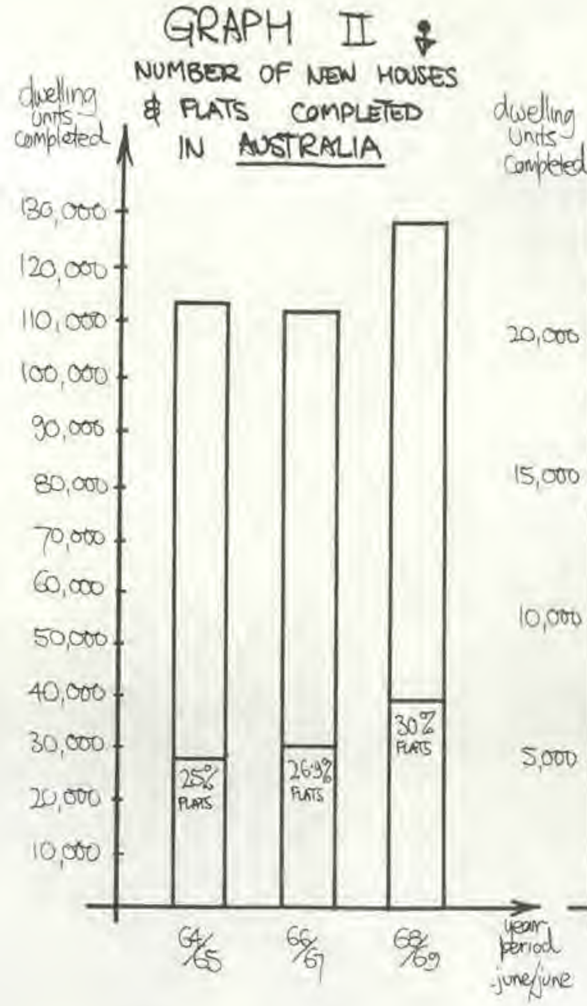
* 2 Knot and surface sealers capable of better endurance to temperature and actinic exposure which reduce the life of wood finishes.

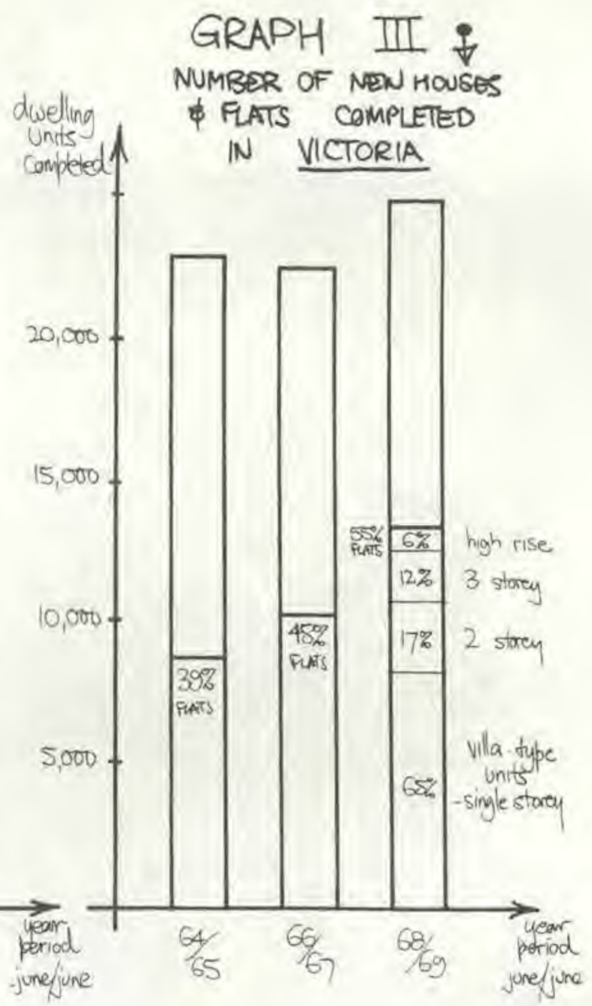
*Considered to be of high priority.

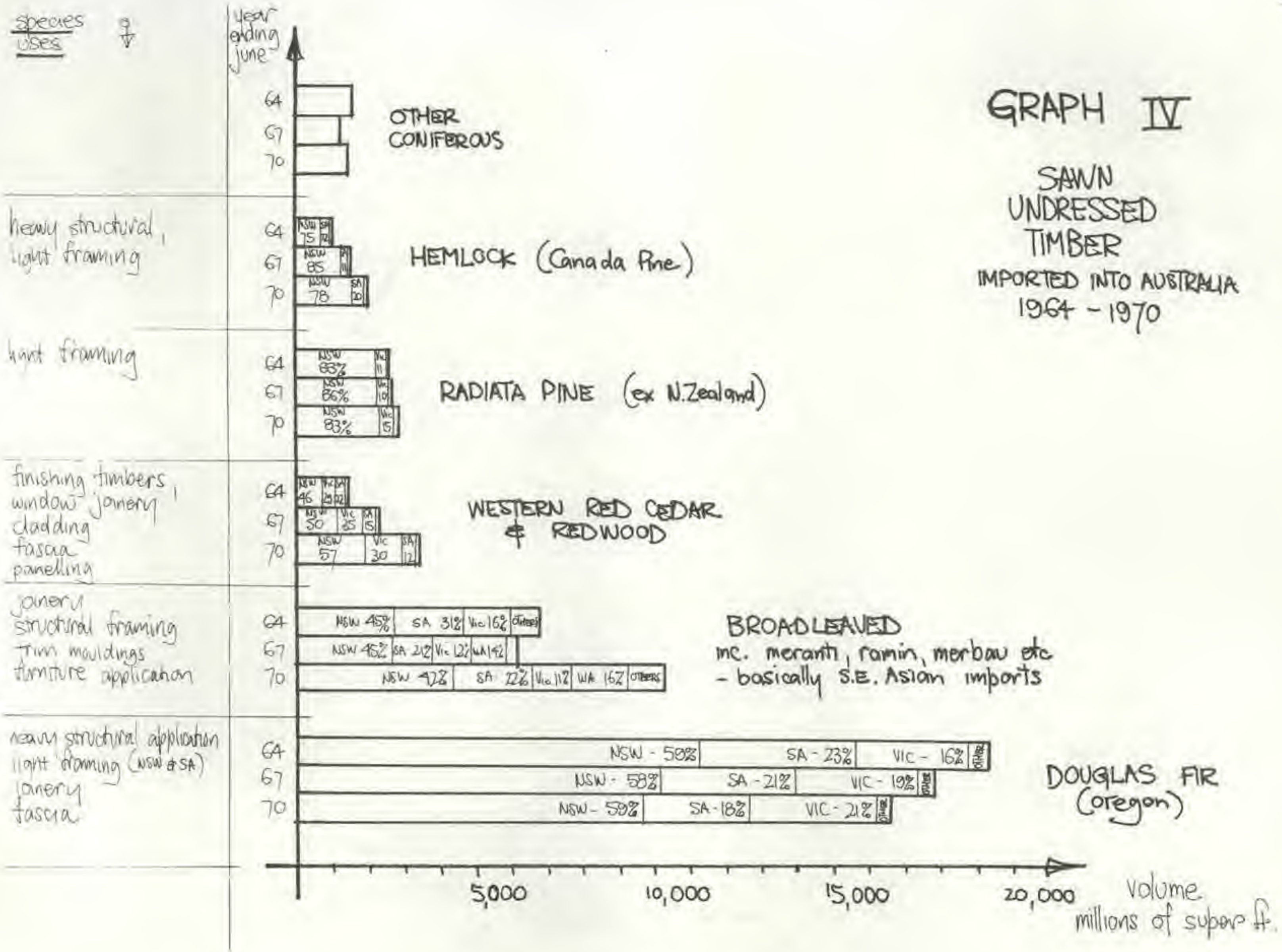
PER CAPITA CONSUMPTION OF SAWN TIMBER N.S.W.




GRAPH I
APPARENT CONSUMPTION OF SAWNWOOD IN AUSTRALIA 1963 - 1968
150,000
100,000
50,000
21% OVERSEAS IMPORTS
20.6% OVERSEAS IMPORTS
23.5% OVERSEAS IMPORTS
63/64
66/67
68/69
year period june - june


GRAPH II
NUMBER OF NEW HOUSES & FLATS COMPLETED IN AUSTRALIA
dwelling units completed
130,000
120,000
110,000
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
25% FLATS
26.9% FLATS
30% FLATS
64/65
66/67
68/69
year period june/june


GRAPH III
NUMBER OF NEW HOUSES & FLATS COMPLETED IN VICTORIA
dwelling units completed
20,000
15,000
10,000
5,000
39% FLATS
45% FLATS
55% FLATS
6% high rise
12% 3 storey
17% 2 storey
65% villa-type units -single storey
64/65
66/67
68/69
year period june/june


GRAPH IV
SAWN UNDRESSED TIMBER
IMPORTED INTO AUSTRALIA
1964 - 1970
species & uses
year ending june
64
67
70
OTHER CONIFEROUS
heavy structural, light framing
HEMLOCK (Canada Pine)
NSW 75
NSW 85
NSW 78
SA 10
light framing
RADIATA PINE (ex N.Zealand)
NSW 83%
NSW 86%
NSW 83%
Vic 10
Vic 15
finishing timbers, window joinery, cladding, fascia, panelling
WESTERN RED CEDAR & REDWOOD
NSW 46
NSW 50
Vic 25
NSW 57
Vic 30
SA 12
joinery, structural framing, trim mouldings, furniture application
BROADLEAVED
inc. meranti, ramin, merbau etc
- basically S.E. Asian imports
NSW 45%
SA 31%
Vic 16%
others
NSW 45%
SA 21%
Vic 12%
WA 14%
NSW 42%
SA 22%
Vic 11%
WA 16%
others
heavy structural application, light framing (NSW & SA), joinery, fascia
DOUGLAS FIR (oregon)
NSW - 59%
SA - 23%
VIC - 16%
NSW - 58%
SA - 21%
VIC - 19%
NSW - 59%
SA - 18%
VIC - 21%
5,000
10,000
15,000
20,000
volume
millions of super ft.