PROCEEDINGS

THIRD ANNUAL

FOREST PRODUCTS RESEARCH CONFERENCE

HELD AT

THE DIVISION OF WOOD TECHNOLOGY

FORESTRY COMMISSION OF N.S.W.,

SYDNEY,

ON

OCTOBER 11-15, 1948

DIVISION OF FOREST PRODUCTS
COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH
MELBOURNE

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THE THIRD ANNUAL FOREST PRODUCTS RESEARCH CONFERENCE

The Conference was held at the Division of Wood Technology, Forestry Commission of N.S.W., Sydney, October 11th - 15th inclusive 1948.

REPRESENTATION

The following Commonwealth and State Departments were represented during the course of the Conference.

Commonwealth Forestry and Timber Bureau	Mr. H. R. Gray Mr. D. A. N. Cromer
Commonwealth Department of External Territories, New Guinea Administration, Department of Forestry	Mr. J. B. McAdam
Forestry Commission of N.S.W., Division of Wood Technology	Mr. E. B. Huddleston Mr. K. L. Taylor Mr. D. T. H. Hartigan Mr. L. H. Bryant Mr. R. A. Moulton Mr. P. W. Hadlington Mr. E. R. Fogl Mr. F. B. Shambler Mr. A. J. K. Hutchison Mr. C. G. Scott Mr. K. H. Worley Miss A. H. Balmain
Queensland Forestry Department	Mr. C. Ellis Mr. K. V. Cokley
Victorian Forests Commission	Mr. C. J. Irvine Mr. F. R. Moulds
Woods and Forests Department, S.A.	Mr. A. L. Finches
Western Australian Forests Department	Mr. L. N. Weston
Tasmanian Forestry Commission	Mr. H. Payne
Defence Research Laboratories	Mr. J. R. Rischbieth
Division of Forest Products, C.S.I.R.	Mr. S. A. Clarke Mr. C. S. Elliot Mr. N. H. Kloot Mr. N. Tamblyn Mr. R. F. Turnbull Mr. G. W. Wright Mr. R. G. Pearson
Division of Economic Entomology, C.S.I.R.	Mr. F. J. Gay

PROGRAMME AND TIME TABLE

MONDAY, 11th OCTOBER.

11 a.m. Assembly of delegates.
12 noon Official opening.

2:15 p.m.

1. General business arising from 1947 Conference.
   - (a) Australian standards.
     - (i) Nomenclature of Australian timber producing species.
     - (ii) Synthetic resin adhesives.
     - (iii) Waterproof plywood.
   - (b) Standard terms and definitions in forest products research.
   - (c) Utilization of secondary species.
   - (d) Building boards (excluding sawdust boards).
   - (e) Marine borer investigations.
   - (f) High pressure preservation treatment.
   - (g) Battery separators.
   - (h) Forestry abstracts.

TUESDAY, 12th OCTOBER.

9:30 a.m.

2. Equilibrium moisture content.
3. Improved wood from radiata, pinaster and muricata pines.
4. The pre-drier.
5. Timber mechanics.
   - (a) Report on F.A.O. Conference, Geneva, June, 1948 - Sub-committee on mechanical testing of timber.
   - (b) Report on Empire Forestry Conference, Ottawa and Madison, September, 1948.

2:15 p.m.

6. Grading instruction.
7. Uniform building regulations - Building research
8. Mill studies.
9. Tests on flooring to determine minimum thickness.

7:30 p.m.

10. Durability tests.
    Field tests, laboratory tests and tests on hardwoods of different rates of growth.
11. Pole tests.
    - (a) Issue of recommendations based on present series.
    - (b) New series of tests.
12. Australian standards: railway sleepers, wide and narrow gauge.

WEDNESDAY, 13th OCTOBER.

9:15 a.m. 13. Visit to
(a) Balmain
N.S.W. Forestry Commission (experimer yard).
D. Hardy & Sons Ltd. (Kilns and bori acid treatment.)
(b) Putney
N.S.W. Forestry Commission (D.W.T. new premises).

2:15 14. Lyctus Conference.

THURSDAY, 14th OCTOBER.

9:30 a.m. 15. Silviculture.
(a) Effect of silvicultural treatment on properties.
(b) Utilization of Eucalyptus thinnings.

16. Utilization of sawdust.

17. Sawmill engineering.
(a) Plantation operations.
(b) Machinery - end matchers, log flitch radial arm benches.
(c) Training of operators.

18. Paints and lacquers.
(a) Major problems - painting over weath boards, boric acid treated timber, knots, etc.
(b) Present provision for paint research.
(c) Co-ordination of activities.

2:15 p.m. 19. Report on Lyctus Conference.

20. Preservation.
(a) Surveys.
(i) Railway sleepers.
(ii) Cross-arms.
(b) Treatments.
(i) Treatment of mine timbers.
(ii) Dip treatments against surface moulds and sapstains on radiata pine and scrub woods.
(iii) Use of chemicals as anti-stain agents for fruit cases.
(c) Taxonomy: classification of wood-destroying fungi based on Cunningham' work in N.Z.

FRIDAY, 15th OCTOBER.

9:30 a.m.

21. Veneer and plywood.
    - (a) Substitute glues made from rennet casein and soya bean, starch, peanut meal, blood albumen, caustic substitu[te]
    - (b) Co-ordination of research work.

22. Fibre content of bark of radiata pine.

23. Use of ring connectors for solebars and other railway timbers.

24. Tanning materials.

2:15 p.m.

25. General.
    - (a) Provision of library of educational films for forest products.
    - (b) Forest Products Sub-Committee of F.A.[O.] National Committees.
        - (i) Representation on committees.
        - (ii) South Pacific Conference.

26. Co-operation.
    - (a) Publications.
    - (b) Assumption of applied work by State Forest Services.
    - (c) Timber bank for research purposes.
    - (d) Selection of material.
    - (e) Collection of material.

OFFICIAL OPENING OF CONFERENCE

by

THE N.S.W. MINISTER FOR CONSERVATION, IRRIGATION AND FORESTR
THE HON. GEORGE WEIR, M.L.A.

The Hon. George Weir was introduced by Mr. L. S. Hudson, Commissioner of Forests, N.S.W.

Mr. Weir: Ladies and Gentlemen, first of all I should like to extend to you a very cordial welcome to Sydney. I understand that this is the first of these conferences to be held in Sydney and I feel sure that the results of your deliberations here today will be of benefit to N.S.W. and to you generally. Today, forestry is facing problems that rarely, if ever, it has faced in its previous history. We are facing the problem of finding sufficient timber to meet a hugely expanded housing programme and of finding adequate kinds of timber for use in the expans of industry. All of these things coincide at the conclusion of a war which also called for great demands upon our forestry resources. The more we endeavour to meet these demands the greater they become. Before the war, of course, we were able to look for a certain amount of relief in timber imports, but now we have had to endeavour to ensure that the native timber production can meet these increased demands. Due to the co-operation of the timber industry generally, and the efforts of the Forestry Commission of the various States, we have been able to expand our timber production to such a stage that today it has reached a position not only not far below that achieved during the war, but also is taking the place that was filled by timber imports. This has not been accomplished merely by a wave of the wand. It has meant an enormous amount of work, planning, and determination on the part of the officers concerned and a great deal of co-operation between them and the native timber industry. That we are in this position today is, I think, a tribute to the work that these officers have done. Also I think it has a particular lesson for you sitting today and deliberating on the problems of forestry, because it emphasises the overwhelming importance of ensuring the full utilization of our timber resources: but that, no doubt, will be amongst the major problems which you will be considering at this conference. I hope that an opportunity will be available for you to see some of the things that we have been able to do here in regard to utilization. The activities of the Wood Technology Section of the Forestry Commission of N.S.W. have played a very big part in the job that we have had to face.

It will be necessary for the authorities to consider the proper utilization of their timbers, and in that regard your activities are going to be of particular benefit. The N.S.W. Government recently purchased for the Forestry Commission a site at Putney, where a creosoting plant is installed, the advantages of which we think will contribute in a major way towards the full utilization of our timber resources. I know that you have a full agenda and I do not intend to delay you. The fact that you have representatives of the various States and of the C.S.I.R., which has done a great pioneering job in many of the things I have mentioned, is an indication of the co-operation that is most necessary if we are to succeed in overcoming the problems that confront forestry today. I want to congratulate you on the fact that you have these conferences from time to time, and I hope that conferences of this nature may continue to take place. I have very much pleasure in declaring this conference officially opened.

Mr. Clarke: Mr. Minister, Ladies and Gentlemen, I should like to thank you very much Mr. Minister for opening the conference and for the very nice words which give great point to our conference, the third Forest Products Conference. I think it may interest you to know the various representatives. (Introduced the members to the Ministers.) Mr. Gay, Division of Economic Entomology, Canberra, Mr. Rischbieth, Defence Research Laboratories, will be coming along when certain special items are under consideration. So you see we have a very wide representation of people to discuss forest products.

These conferences have arisen from the fact that we felt the need of a co-ordinated basis on which to discuss our technical problems, in order to derive the utmost value from the funds available for this work. The two previous ones have been particularly good and from them some very important developments for the industry in general have taken place.

I would like to thank you very much indeed for opening the conference for us.

A telegram from Sir David Rivett was read to the conference - "Very sorry cannot join you in Sydney. Best wishes for your work."

1. GENERAL BUSINESS ARISING FROM THE 1947 CONFERENCE

(a) Australian Standards:

(i) Nomenclature of Australian timber producing species

Mr. Shambler: It was decided that the N.S.W. Divisi of Wood Technology should compile a list and submit it to the Division of Forest Products who would then forward it to different bodies interested. Owing to shortage of staff and other difficulties, we have only now finished the list. I can table it for the conference to inspect, and will later on forward it to the Division of Forest Products

Chairman: It is understood, of course, that anyone looking at the list now and making suggestions will have an opportunity of seeing it officially at a later stage. The idea is that you will make these copies available during the currency of the conference, and at the end of that time send down to us a list of any comments coming forward.

Mr. Shambler: That is what we hope to do.

Mr. Ellis: Mr. Chairman, on this point the decision was that the Division of Wood Technology should compile this list, but we in Queensland also circularized our officers, and are now assembling a comprehensive list which will be forwarded to Division of Forest Products for addition to the N.S.W. list. This action, I take it, will be in order?

Chairman: Yes, we shall be glad to have those. Is any work going forward in other States besides Queensland?

Mr. Irvine: In Victoria we have recently issued a so-called species distribution map showing the distribution of species within Victoria, and, on the basis of advice from the National Herbarium, there have been certain differences between the names as laid down in Trade Circular 47 published as a standard. I think we may have some difference of opinion on certain names which are now in the standard nomenclature. I cannot detail them at the moment.

Mr. Shambler: I may mention the method adopted in compiling this list. We have listed every timber that we knew of that was not in the present standard list, and then eliminated timbers or small shrubs that were not of any commercial importance. A list of eucalypts was compiled and sent over to Dr. Anderson, who is an authority on the eucalypts, at the Botanic Gardens. From his comments we compiled a final list of the eucalypts to be included in the revised standard.

Mr. Bryant: Is it not a fact that these particular species also include those which produce forest products other than timber, or are they only timber producing species?

Mr. Taylor: No, I think it was agreed last year to include any species that are of economic importance.

Chairman: It is difficult to say how far we can go there. Any suggestions regarding it?

Mr. Tamblyn: We are repeatedly being asked for information on New Guinea and Pacific Islands timbers. Although it may not be practicable, or possible at this stage, it would be quite helpful if our nomenclature list could include an appendix with some of the commoner island timbers likely to appear on the Australian market.

Mr. Taylor: I suggest that we extend the list to include timbers that might come onto the Australian market.

Mr. McAdam: Obviously it could not cover all species from Malaya and Borneo, but some outstanding common timbers could be listed.

Chairman: I would like to hear some comment on that. It might slow up the production of this Australian list if we were to add timbers from outside Australia.

Mr. Wright: Should we regard the Australian list as covering the Australian territories too? I think an Australian territory list would be desirable as an appendix, and possibly also a limited number of other overseas species commonly used in Australia, but at this stage I think the list should be confined to Australian species.

Mr. Turnbull: I suggest that New Guinea and other territories be brought out in other consecutive parts.

Mr. Huddleston: I consider that the Australian list should be completed and published, following that with timbers of economic value to Australia. At the present time this may involve 25 or perhaps 50 timbers. In addition to these timbers there are many other timbers of considerable importance to Australia.

Mr. Shambler: Here in this Division we have much trouble with New Caledonian timber. At the present time there is very little information, even from New Caledonia, available on these timbers. Also they come through under all sorts of names which makes it very difficult to make up a standard list. I think it would be best to leave it at the Australian list at this stage, but we should make some attempt to get on to the standardization of island timbers which are being imported into Australia.

Mr. Ellis: A number of separate lists rather than one wider list seems desirable.

Chairman: We could quite logically make territorial timbers in separate parts, one part for each territory, if that would do.

Mr. Huddleston: I don't think that would be necessary, even at the present time.

Chairman: One thing we have to watch is that where timbers occur in territories other than Australia, the territories are consulted when we fix the Australian name. I think that might be regarded as a fundamental principle.

Mr. Turnbull: We can get that automatically covered by arrangement with the Standards Association to send the list for comment to interested people in the territories.

Chairman: I suggest that when preparing the early draft a copy be sent to the Association, or have Mr. McAdam comment on the original draft.

Mr. McAdam: I think it is very wise to get the list on New Guinea timbers commenced. Work is proceeding on a publication on 25 New Guinea species. At an early stage I propose to discuss a list covering two or three subsequent publications. The standard trade names of some 75-80 species could be fixed then in discussion with Dr. Dadswell. At the moment very few New Guinea timbers are entering Australia but with improved shipping the numbers will increase rapidly. It is desirable, therefore to have a separate list which can be expanded independently of the main publication. The first "25 New Guinea Timbers" could be published at an early date. The list for the following publications would take some time.

Chairman: The general discussion seems to be going along the lines of a start for Part 1, Australian timbers, and carrying on with other parts covering territory timbers and others outside Australia.

Mr. Taylor: On the matter of island timbers, can the conference ask Dr. Dadswell to get something started or are we to set the ball rolling?

Mr. Huddleston: I suggest we ask Mr. McAdam to furnish a list of suggested standard names.

Mr. McAdam: You want me to fix a trade name for 25 species?

Chairman: Yes, as a start.

Mr. Cromer: Would it not be advisable to issue something in the form of a provisional list on the basis that half a loaf is better than no bread.

Chairman: An objection is that it is very dangerous to issue standard trade names unless we are perfectly definite about it and want to retain them for all time.

Mr. McAdam: We have got to get our programme of collecting timbers started for the publications. From that work a list which should cover the bulk of the New Guinea timbers going onto the Australian market within a period of time could be prepared.

Chairman: We will leave it in your hands then. You might be the convenor on that side.

Mr. McAdam: Yes. Further I suggest it would probably be better to have the New Guinea name for timbers which are more common in New Guinea than in Australia. I will run through the list and see if there are any others. In the N.S.W. legislation do you describe the timbers by botanical or standard trade name?

Mr. Huddleston: We list our timbers with the standard trade name and against the standard trade name we have the botanical name. The legislation requires that timbers shall be sold under the standard trade name.

Chairman: The position now is that we have a provisional list, in fact 2 lists, one each from N.S.W. and Queensland, and we have also arranged with Mr. McAdam to prepare a list for New Guinea timbers. There is still one point outstanding, the matter of other species coming into Australia. How about you preparing such a list Mr. Cromer?

Mr. Cromer: Yes, I think the Forestry and Timber Bureau could put the initial work in hand for timbers that come into Australia.

Mr. Weston: I think we forwarded a list of botanical and trade names of W.A. timbers to the C.S.I.R. They have long been available and can be supplied if you have not received them.

Chairman: We would like to have names from other States. We will probably add to the list wherever we can and send it on to other States for revision.

Mr. Ellis: Could it be clarified whether or not standard reference names are to be retained. Some difficulties have arisen in Queensland, where two species which, according to botanical procedure are distinct, have been included in the Standard's list under one standard reference name. In the case where any one of two such timbers have different properties of practical significance, such as Lyctus susceptibility, the use of the standard reference name cannot be justified.

Chairman: It might help those who are not familiar with the work that led up to the standard reference name to recall that it was put in to replace the botanical name, and to stop splitting of species. I think as far as splitting was concerned, it went a bit too far - silky oak is a particular case. As far as its use in place of the specific names is concerned, it is doubtful if it served any good purpose, because most of us use botanical names rather than standard reference names.

Mr. Huddleston: In the case of silky oaks there are two species under one standard reference name, one susceptible to borer and the other not. We have had to incorporate one of these species into an Act of Parliament, making it an offence to sell it by any other name. At the same time we had to include the species which was not susceptible in order that it would not be involved in any way. For that reason we have had to depart from the Australian standard to meet our requirements.

I would suggest we standardize on trade names and have a cross reference to botanical names.

Mr. Wright: The present practice of the Division of Forest Products is to use the standard trade name in reports, and where it is first mentioned to use the botanical name in brackets. Afterwards, wherever reference is made to that species, we use the standard trade name. No reference is made to the standard reference name. This practice seems to give satisfaction without being unwieldy.

Chairman: We have found that it is practicable to use standard trade names only. I feel we should confine ourselves to using standard trade names and botanical names, and not worry any further about standard reference names.

Mr. Tamblyn: With exceptions like E. rostrata, which is hard to swallow.

Chairman: We have suggested there that we should show a synonym.

Mr. Tamblyn: I think the previous nomenclature list unnecessarily emphasises the standard reference name. A new list might be able to place this in the right perspective by putting in brackets the standard reference name where it is different from the true botanical name, or where two species are marketed under one name. At present one list is almost repeated by the other list.

Chairman: We can list E. rostrata under the true botanical name with "synonym E. rostrata" in brackets.

Mr. Payne: That is the standard practice more or less and it seems good practice.

Mr. Turnbull: I think we should urge a decision on this matter. When the standard was proposed and became endorsed by the Standards Association names were perhaps more confused than today. We feel the standard has played some part in bringing about the adoption of one name in preference to others which were sometimes tagged onto it, but I doubt very much whether we have reached the stage yet where we can say that the standard name is the only one applied to a timber. I do not think the name laid down in Australian Standard O.2, as it stands today, has been so universally adopted as to warrant us taking everything under that name. Part of the reason for bringing out the standard reference name was to pinpoint again what was thought to be the right and most widely understood botanical type of name for a timber. I think that the decision to publish the standard reference name was tied up with the objective of encouraging Government departments, and other bodies, to quote a botanical type of name after a common name so that there would be no misunderstanding as to the timber meant. After a campaign had been running for some time on that plan it was found that botanists were attempting to split some botanical names. One case comes readily to mind. They were planning to drop rostrata and introduce camaldulensis which was not very well known. Another example is radiata pine. The standard took definite steps of standardizing "Pinus radiata" which was in that case the true and accurate botanical name for that timber instead of Pinus insignis which was incorrect. Now I think the nomenclature has served a useful purpose. If we decide now that no standard reference names are to be again prepared their stabilizing influence will be lost and we should recognize that fact clearly.

Chairman: There are very sound reasons why the laws of priority should be adhered to. Perhaps botanists seem over-zealous in following out the laws, but we cannot help that, and it does not alter the fact that the reasons for the laws of priority are sound. If we depart from them we will be in more trouble than ever. The only way out is to come back to the laws of priority, even with their shortcomings, and meet the position by showing the well established name in brackets after the true botanical name.

Mr. Gray: Is the standard reference name really only the botanical name commonly used?

Chairman: It is not quite a botanical name because the author is never quoted.

Mr. Gray: The aim should be to increase, not lessen, the use of the correct name.

Mr. Turnbull: The standard reference name for Eucalyptus rostrata is a well understood botanical sort of name. While it appears in the Standard Nomenclature, E. rostrata will stand, despite the name changing that botanists may advocate. If we decide at this meeting that standard reference names should be dropped, automatically that decision means that the idea of preservation of "rostrata" for all time goes by the board.

Chairman: If we do decide on standard reference names, we are all to agree to use them. I am afraid we decided to use them originally, but found it impracticable. My opinion is we have just got no help from standard reference names.

Mr. Payne: I think Mr. Turnbull quoted a pretty clear case. If at the time usage had been considered Pinus insignis would have been fixed as a standard reference name. Time has shown that radiata is the name commonly adopted and, outside of South Africa, it is everywhere used.

Mr. Gray: That is my point.

Mr. Tamblyn: This does not meet all objections. Take the case of Queensland maple which has one common name and one standard reference name but includes two species. You couldn't separate Queensland maple into its two species as you couldn't recognize them apart as sawn timber. Some ironbarks are another example. Hence for groups like that we should have one name by which the group is known as a whole.

Mr. Bryant: If we had a new set-up in which we did not quote the standard reference name except to determin the difference from the botanical name, this simple nomenclature would do away with all of these duplications.

Chairman: You are suggesting that we still leave in a column for standard reference names.

Mr. Tamblyn: No, delete the column altogether, and leave the botanical name without comment unless it is necessary to add a standard reference name in brackets or use a synonym for the botanical name.

Chairman: So we would have *E. camaldulensis*, rive red gum, synonym *E. rostrata* in brackets.

Mr. Moulds: Perhaps it would be better in cases like that not to use the word "synonym", but to put in "Formerly *E. rostrata*" and that would encourage people to use the new term and regard the old one as something that was used in the past and is now incorrect.

Mr. Huddleston: That cannot be covered by standar izing the trade name. In the case of Queensland maple, the trade name has been bracketed against *Flindersia brayleyana* and *F. pimenteliana*, two species which may have to be separated at a later stage. I want to bring up another point and that is the use of an alternative trade name. Take *E. regnans*, *E. obliqua* and *E. gigantea*, each requiring a separate trade name. When the three are mixed together (_obliqua_ comprising the bulk of the parcel) the timbers are sold under a trade name. A common name in N.S.W. is Tasmanian oak, and whatever you do you will not get rid of the term Tasmania oak. I would suggest to overcome that to give an alternative trade name for the species of Tasmanian oak unless the species are separated and sold under their individual trade names.

Chairman: That might be tried out on the basis of our standard trade names and our botanical names. A suggestion has been put forward to cover the cases where the botanical names have been changed.

Mr. Irvine: I think the only suitable occasion for the use of _E. rostrata_ is if somewhere there is a reference in a prior publication to _E. rostrata._ Even the use of "Formerly _E. rostrata_" would be preferable.

Chairman: Yes, in other words, there are two suggestions - one "Synonym" and the other "Formerly". That's understood.

Mr. Huddleston: There is nothing to stop us explaining the reason for the use of the word "Formerly".

(ii) Synthetic resin adhesives

(iii) Waterproof plywood

Mr. Elliot: The 1947 Conference suggested that standards for these two items are required urgently. The position is that the whole matter is now awaiting completion within the Standards Association of the re-organization of the committees dealing with timber. There is sufficient information available for both standards to go ahead as soon as those committees are organized.

Mr. Turnbull: There is progress to report in this connection. A Timber Industry Committee has been formed by the Standards Association to act as a steering committee for all standard matters affecting timber. Under the Timber Industry Committee it has been decided to form several sectional committees, six have been approved, one of which is a sectional committee on plywood. The whole field of timber standards has been considered and tentative suggestions made as to what specifications are required to cover it adequately. A tentative assignment of work to the respective sectional committees has been circulated for postal ballot. The present proposal, although not final, is that the sectional committee on plywood shall have included in its programme of work standards for synthetic resin adhesives and waterproof plywood.

(b) Standard Terms and Definitions in Forest Products Research:

Mr. Turnbull: Arising out of the 5th Empire Forestry Conference, London, a committee was formed under the chairmanship of Mr. T. A. McElhanney to prepare for publication standard terms and definitions used in Forest Products Research. Australia has been asked, through Mr. S. A. Clarke, to prepare a draft covering such terms and definitions used in Forest Products Research in Australia.

After the Forest Products Conference in 1947 the staff of the Division of Forest Products has given consideration to tentative lists of terms, and out of the discussion there has emerged a draft ready for comment by the various States. At this stage attention has been confined to the terms to be included. Efforts have been made to cover all those commonly used in forest products research so that the final list might become a reference to which investigators might turn to find explanation of words outside their own personal field. Certain terms included in Mr. McElhanney's own publication prepared in 1935 and in other overseas' publications, but not common in Australia, have been retained because the final list will be on an Empire basis. In such cases the Australian equivalent term has been added to the list. Where-ever possible, the following have been omitted:-

(a) Scientific terms defined in technical dictionaries and used in Forest Products Research in their generally accepted scientific meaning.

(b) Trade terms.

(c) Terms pertaining to machinery or parts thereof in the accepted engineering terminology.

It is hoped that research workers outside the Division will give the list careful attention and submit any desired modifications.

As soon as an acceptable draft is ready, it will be sent to Mr. McElhanney for information and the job of preparing definitions will commence. The draft is only a list of terms at the present time. We feel that to try and prepare the definition is premature. We are awaiting agreement on the terms before we put any of that work in hand. We would like to get comments and suggestions as early as possible because of the tremendous amount of work to be done to bring the list to the stage required by the Empire Forestry Conference.

<u>Chairman:</u> Members probably remember some discussion took place over a list prepared by the Empire Forestry Association. Mr. Cromer, would you like to comment on that?

<u>Mr. Cromer:</u> Yes. The list prepared by the Empire Forestry Association was along the lines of the

"American Glossary of Forest Terminology" which was more in the nature of a dictionary, so that in reading the literature from other countries and other centres it would be possible to look up the definition of any term. Consequently, it is not quite comparable with that of "Standard Terms and Definitions used in Forest Products Research", which it overlaps to a certain extent as it covers both forestry and certain forest products research terms, and includes a very wide range.

Chairman: Do I take it, Mr. Cromer, that an improved list is coming forward and that you will circulate it in Australia?

Mr. Cromer: The list has gone out to all countries who attended the Empire Conference from the Empire Forestry Association for their comments and to add any of their own localized terms that were not covered in that list. The comments should all be back now with the committee handling it for the Empire Forestry Association, but I think a severe pruning by the Empire Forestry Association will be necessary to bring out something that will endeavour to cover everything and not be too cumbersome. Some of our local terms, I am afraid, will not appear.

Mr. Irvine: There are two points I would like advice on. In the list there are a number of electronic engineering terms, presumably for radio-frequency heating and drying of wood. I doubt whether in a list of terms used in forest products research it is necessary or desirable to have an extract from a set of definitions dealing with electronic engineering. The same remarks also apply to certain statistical terms in the list.

Chairman: Just how far we should go with terms of this sort is a very serious problem. One of our difficulties was that if we omitted all terms used in any other branch of science we had practically no terms left. So we come back to the reason for the list. I think the general idea was to include sufficient terms so that a man working in one branch of forest products research could understand terms used in another branch in which he was temporarily interested. For that reason we decided the list should be reasonably extensive but not too detailed as a too theoretical discussion in a science outside a man's own would not be of very much value to him. But it is a very difficult problem, and I would be glad to hear some comments on it.

Mr. Huddleston: The aeronautical industries experienced the same problem some years ago, and prepared the British Standard Glossary of Aeronautical Terms, but terms that appeared in papers dealing with a particular branch of the science were not included in the Glossary. That glossary has proved very useful for engineers reading aeronautical literature, and I think the same practice ought to be adopted here.

Mr. Turnbull: What we are trying to do is to avoid putting into the list scientific terms that are used in their generally accepted scientific meaning. If those scientific terms are used in forest products research with a slightly specialized meaning, we hope to show the particular shade of meaning. Similarly, parts of machinery, or generally accepted engineering terms, are not being listed unless they have an unusual sense or application in forest products research.

If the list is going to be of use to anybody working on forest products research it should be a useful reference. Mr. Wright, in Seasoning, would perhaps like to look through this list for explanation of many terms Mr. Tamblyn might use in Preservation. Some words might be used in their usual scientific sense but so often that they will become common enough to justify their inclusion. I personally would like to see this list cover 90 per cent. of the words likely to be found in other people's reports.

Mr. Hartigan: Is there any implied onus on a particular individual to couch his reports in such a way that they can be read by somebody else from some other scientific branch by referring to the glossary?

Chairman: He's not forced to do that, but so many people use these terms that they have become part of the jargon of forest products. They are continuall recurring, and people must have some means of finding out what is meant. As Mr. Turnbull has said, we hope to be able to understand almost 90 per cent. of any particular officer's special scientific contribution.

Mr. Hartigan: I suggest that this glossary which is being prepared be not a means of limiting the vocabulary of a man writing his report in his own branch of study.

Mr. Turnbull: Even common terms might be interpreted slightly differently by different people. It would be advisable to set down standard definitions and explain various other meanings.

Chairman: I saw a very good example of this recently in connection with the possibility of making paper from Pinus radiata. An objection was raised that pitch would cause trouble. Someone with a fair knowledge of forest products said that in his opinion there was no pitch in Pinus radiata. What he did not know was that pitch is an accepted paper makers' term for certain fatty acids with a pitch-like appearance accompanying resin and giving trouble on the paper machine. So if you speak with a paper man about pitch you will not be speaking about pitch as we know it.

(c) Utilization of Secondary Species

Mr. Kloot: Mechanical testing is in progress on three foothill species, silvertop ash, white stringybark and brown stringybark. The seasoning and machining techniques necessary to accomplish virtually complete utilization of previously waste 1-in. thick red gum have been worked out.

Several species have been tested for suitability for impregnation under high pressures.

I would like to mention that later in the session there will be discussion of the plans which we hope will speed up the mechanical testing of Australian species generally.

Mr. Taylor: Secondary species have been rapidly gaining recognition in a wide field of utilization. The initial impetus has been the overall shortage of mild-working timbers and the expanded facilities for immunization. The second, and probably stronger cause is the qualities of the timbers themselves. The total of these trends has resulted in a large increase in the quantities of brush timbers diverted from case manufacture to uses more consistent with the qualities of the timbers.

The firms operating boric acid immunization plants are all working at full pressure and enquiries for information for supplies of immunized timber show a strong demand for all species. These firms are unable to supply the quantities of immunized timber demanded, and at this stage there are no signs of them meeting this demand. It is thought that the supply would still not equal the

the demand if all susceptible species logged and converted were immunized. The plywood trade is firm on its demand for white birch (Schizomeria ovata) peeler logs and now shows a preference for this species as against coachwood. This is a reversal of previous preferences and an indication of the recognition of the peeling qualities of the timber. Veneers of this timber are treated and used as face veneers for the furniture trade.

In all branches of the woodworking industries, cabinet making, plywood, joinery, sporting goods, etc., the so-called secondary species are becoming to be regarded as the most desirable for many specific purposes. In industrial processes, dyeing, bleaching, filtration processing and others there is a growing demand for individual species for specific uses in place of oregon and Queensland maple and others. The joinery manufacturers are turning towards yellow carabeen (Sloanea woollsii) in preference to timbers previously used, chiefly on account of its superior working qualities. This means that not only are brushwoods entering markets of specific utilizations but also they are being recognized as superior timbers for general purposes. This extension of usage is becoming general for many species and will ultimately result in the loss of the name "secondary species" in many cases and have the effect of increasing the quantities of general purpose mild-working timbers available and suitable to a variety of uses.

The popularity of these species will also help to retard the drain on many of the other first class species which are becoming scarcer allowing them to be more specifically utilized to better purposes. This is applicable particularly to coachwood (Ceratopetalum apetalum) which has been badly over-cut during and after the war years for lack of suitable substitutes for general uses.

Mr. Ellis: At the present moment, with a few exceptions, any log of reasonable form and quality can be utilized economically by veneer mills, and with such logs there is virtually no utilization problem.

In some of the outlying scrub areas however, the cost of processing smaller logs or logs of poorer form and of marketing the product in Brisbane is higher than the cost of competing species and in some cases is greater than the approved retail price. Under such a circumstance, potential log supplies are lost - sometimes irretrievably, as when the scrub area may be clear felled for any purpose.

As indicative of the present position it might be mentioned that the price of seasoned 4 in. x 1 in. T. & G. flooring, first class, in Brisbane is 73/3 for eucalyptian hardwoods and 74/9 for scrubwoods, - to the latter has to be added 11/- when treated with boric acid. There is little that Forest Products Research can do to improve the prices position.

In its proper field, Forest Products Research may be able to point the way to higher grade uses for these miscellaneous species, but again a problem has already arisen here which is beyond the Forest Products Research scope. Reference is made to the position in Queensland, in which such timbers as ivorywood and yellow boxwood have been proved to be highly valuable as boxwood substitutes; their occurrence however is so spasmodic that sawmillers generally are not prepared to go to the trouble of marketing them separately - rather they prefer to stick to a routine within the mill and to take no cognizance of the higher worth of such timbers. This problem is being overcome in some cases but generally speaking specialty timbers are not finding their optimum utilization.

Mr. Huddleston: Both your own organization and, I think, the Queensland Forest Service have had copies of reports dealing with butter box timbers circulated to them. The position in New South Wales is that the dairy industry advises that tulip oak is the best timber they have had up to the moment in regard to taint. We have had no trouble with regard to brown or blush tulip oak being accepted for export. The main trouble is getting enough material for plywood.

Mr. Ellis: Has the Department of Commerce officially, that is in writing, advised you that brown or blush tulip oak butter boxes for export will be accepted?

Mr. Huddleston: It is not in writing because there has been no need to approach the Department. The dairying industry is satisfied with the boxes provided for export.

Mr. Ellis: We can tell them in Queensland that they are acceptable in New South Wales but they do not believe us.

Mr. Turnbull: Export boxes go into the Department of Commerce and Agriculture in which there are various officers dealing with sections of industry; expert dealing with dairy produce, another expert dealing with fresh and canned meat exports, and another with fresh fruit. It is left very largely to these officers as to just what is approved. There are, I believe, statutory regulations covering the export of a number of food stuffs. We understand that during the war there was a close co-operation between the Department of Commerce and Agriculture and the C.S.I.R. on the problems related to food stuffs investigations and so on, and recently there were discussions between the secretaries of these authorities to try and ascertain to what extent this work could continue. Arising out of these discussions it was decided to form a Consultative Committee on Food Investigation and Standards. This Committee had its first meeting early last month and represented on it are two officers of Food Preservation, C.S.I.R., one officer from Dairy Research, C.S.I.R., 3 officers of the Department of Commerce and Agriculture, one officer of Forest Products. Its functions were decided to be (1) to frame and revise foodstuffs regulations, (2) to receive from C.S.I.R. information in regard to work in hand and contemplated and (3) to receive from Department of Commerce and Agriculture suggestions as to investigations required. It is really a meeting place where information may be exchanged and problems discussed. These conferences might possibly be a channel through which steps can be initiated to improve conditions. I gather from initial reports that it is not likely to meet very often - perhaps twice a year - but it would, through correspondence and the activity of the organizing secretary, keep in touch, and keep its members in touch, with the various activities that are progressing.

Mr. Clarke: When the Division was asked if it would like a representative on this Committee, it seemed to me to be a good liaison between this body and the Department of Commerce and Agriculture along the lines brought up at the last conference.

Mr. Hartigan: Will this Committee deal with the inspection of cases for general purposes, where such cases may be affected by moulding?

Mr. Turnbull: I understand that a Foodstuffs Specification Committee still exists which includes representatives of the Departments of Army, Navy and Air, Supply and Shipping, Commerce and Agriculture and C.S.I.R.

Mr. Huddleston: Our experience has been that the Department of Commerce and Agriculture is most helpful. In New South Wales most of the approaches to them which have been made in the last 12 months have been made by the industry concerned. The matter has been discussed with the Department by representatives of the industry and on each occasion we have found that the difficulties have been overcome. But I can visualize circumstances when New South Wales may have adopted one standard and Queensland adopted a different standard and there would be no standardization between the States.

Mr. Ellis: I think it would be helpful if copies of correspondence were sent to each Division for consideration. We are dealing with different types of men in Queensland. The regulations governing specifications of butter boxes provide that a certain amount of blue-stain and borers might be permitted, but interpretation of the specification is a matter left entirely to the individual inspector. Quite a number of butter boxes have been rejected because their appearance is considered a bad advertisement for Australia. As far as butter is concerned, I understand London will take it any way, even in paper bags, but Queensland dairy authorities will not permit timber to be used for export when there is a certain amount of bluestain.

Mr. Weston: There has been no difficulty in Western Australia about butter boxes for some time.

Mr. Cokley: In the matter of utilization of secondary timbers I would like to mention that we have tried both peeling and slicing of brush box in Queensland. We got fairly good results with the exception of a low recovery (0.87 c. pd. with 3 or 4 in normal practice).

Out of 14 logs peeled 4 or 6 developed concentric shells quite early in the peeling operation.

Mr. Weston: Using marri for case making is a big problem in Western Australia and one to which we look to C.S.I.R. for help.

Mr. Gray: Should a timber used extensively be called a secondary timber, for example, white stringybark?

Mr. Wright: Secondary applied in some cases to new uses. White stringybark, for example, had not been used for joinery and this avenue of use was being examined.

(d) Building Boards (Excluding Sawdust Boards)

Mr. Turnbull: We have taken delivery of an attrition mill, and a pulp screen and forming box have been set-up in the laboratory. A small hand press and a hot platen hydraulic press are on order. A small quantity of building board pulp from radiata pine has been obtained and some preliminary studies are being carried out.

The process consists of chipping, defibering in an attrition mill, mixing the fibre with water to make a pulp, forming a thick matt of fibre, pressing that into a board under heat and pressure. A product similar to Masonite can be produced and also insulating types not so highly compressed - about ½ in. thick.

Mr. Ellis: I take it that at the present moment the Division is merely getting the equipment together and for a little while will be more or less perfecting techniques.

Mr. Turnbull: That is so, but we will certainly have a good deal of information to present to you next year.

Mr. Ellis: Will your process follow the lines that have been developed in America for small scale commercial operations mentioned at our last conference.

Mr. Turnbull: Yes.

Mr. Ellis: In due course then, may the States expect to hear from you as to what timbers will be required for specific tests?

Mr. Clarke: The hardboard position in Australia as you all know, is changing. The Masonite people have been duplicating their plant and have announced that they are going to triple it. They now have two presses and propose to have three presses. Colonial Sugar Refining Company are in production with hardboard and paper makers in Tasmania are at the stage of having quite a lot of equipment delivered. Do all the States feel that this project is still an important one?

Mr. Ellis: Definitely! At our last conference it was advised that the Masonite people had doubled their plant and that possibly the Australian market might be near saturation point. Today the plant is to be tripled. I am not inclined to drop this very important line of work on the grounds that the Australian market is possibly saturated. The potential Australian market cannot be estimated and I believe that it will continue to expand rapidly. Research work, therefore, should be pressed forward, particularly so with respect to the development of manufacture suitable for relatively small-scale operations as an adjunct to our larger hardwood mills.

Mr. Moulds: Is this process an alternative to the Masonite explosion process or is it suitable for small-scale operation, say on waste material?

Mr. Clarke: There are two major problems in manufacturing boards - firstly of reducing material to a suitable pulp, secondly of forming it into a board and pressing it. If a pulp can be produced, then boards can be made on a large scale. There are at least two other processes in addition to the Masonite process in commercial use today; the Swedish process which is somewhat similar to the process we have been investigating, and a process which makes an insulating board first, then dries it and converts it into hardboard. All these processes can be used for manufacture on a large scale. Manufacture on a small scale involves certain other problems.

Mr. Weston: Western Australia is very interested in small-scale production.

Mr. Turnbull: Masonite is the only hardboard manufactured in U.S.A. on a large scale. One other U.S.A. manufacturer is making hardboard on small scale with the attrition grinding process. Masonite patents ruling production of hardboard in America have recently expired.

Mr. Gray: As disintergration of fibres for hardwood manufacture is carried out by the attrition and also by the explosive process can any information be given on their relative merits, economic or otherwise?

Mr. Clarke: It is impossible to give a general answer to that. For example, in the particular case in which Mr. Weston is interested - waste from jarrah mills - the explosion process might give low yields of pulp because of the high percentage of extractives in jarrah and much of these might be hydrolysed and lost.

(c) Marine Borer Investigations

Mr. Tamblyn: Our Wood Structure Section is doing some work on the correlation of silica content and resistance to marine borers. Firstly, a paper by Amos and Dadswell in which the low resistance to marine borer of Hawaiian grown turpentine is correlated with low silica content has been published in the August issue of the C.S.I.R. Journal. The paper marshals the evidence available that timbers resistant to teredine borer typically contain inclusions of silica, which is suggested as the principal reason for their resistance.

Amos is at present making a survey of timber in our collection to list those with considerable quantities of silica. The species include a number of timbers from New Guinea, the Dutch East Indies, Malaya and Borneo, as well as from Australia. Many of the _Anacardiaceae_, _Bombacacea_, _Burseraceae_ and _Dipterocarpaceae_ contain high silica contents.

An unidentified species of the _Combretaceae_ from New Guinea and the species _Anisoptera polyandra_ from New Guinea (_Dipterocarpaceae_) are promising.

In the Lauraceae - Queensland Walnut (_Endiandra palmerstoni_) is particularly interesting with high silica content. Amos considers that the next step is to set up tests in the Brisbane River and in Sydney harbour to test the resistance of specimens of known silica content from various species.

With regard to the recommendation made by the previous conference that a marine biologist be appointed to the staff of the Division, the Executive has agreed to this but no provision has been made on this year's Estimates of the Division because of the unlikelihood of securing a suitable graduate. It is hoped however, that a suitable student might apply for one of the C.S.I.R. overseas research studentships and the needs of the Division in this respect have been stressed with the

Executive.

Mr. McAdam: Do teredine borers include nausitoriae?

Mr. Tamblyn: Yes.

Mr. McAdam: In New Guinea we are taking five matched sets of specimens, one of which is being hung by Mr. Johnson in Sydney waters.

Mr. Tamblyn: It would be necessary for an analysis of silica content to be made of matched specimens before they are immersed. I understand your test in New Guinea contains only one or two timbers of high silica content. To prove Amos' hypothesis perhaps a dozen species would be needed.

Mr.McAdam: From one of our Papuan sawmills, if the timber could not be sawn through it was thrown into the sea water. The person in charge wrote in recently that the logs which had become exposed at low tide showed signs of being resistant to teredine borers. I am having samples shipped for identification if the species are available in fair quantities. We hope to extend this test considerably.

Mr. Tamblyn: Locating tests only in New Guinea may limit attack to only a few borer species so two or three different localities as varied as possible should be chosen. I would suggest that sets be installed in Sydney, Brisbane and New Guinea and that someone sufficiently acquainted with the taxonomy of marine borers be detailed to report on progress. I suggest Johnson for Sydney and Watson for Brisbane.

Mr. McAdam: We are sending one set down to Sydney for Mr. Johnson. One of the remaining four sets could go to Brisbane providing there is staff to look after it. I hoped C.S.I.R. might have a marine biologist fairly soon who could inspect and correlate all tests.

Mr. Clarke: It will be some little time before C.S.I.R. are in a position to provide a marine biologist. We will have to train one. This will take several years. If we take over one of the existing marine biologists the overall position will not be improved.

Mr. Huddleston: It appears to me that Amos has got on to some information which definitely requires following up. We shall be pleased to supply any samples that are required.

Mr. Ellis: We shall be happy to co-operate. Could Mr. Amos be more specific as to where he wants the tests. Any station in the Brisbane River might be attacked by a number of organisms.

Since Mr. Amos is particularly interested in timbers of high silica content, he might include Stenocarpus sinuatus and Cryptocarya obovata.

Mr. Taylor: In both Brisbane and Sydney more than one site should be used as conditions vary through the harbours. What is the standard set of samples?

Mr. McAdam: Mr. Johnson wants five pieces 5 ft. x 3 in. x 3 in.

Mr. Ellis: In Brisbane tests are normally carried out at three different sites.

Mr. Clarke: Amos tells me that there is some evidence that by feeding plants certain materials you can affect the silica content of the plant and that brings up an interesting point as to whether you can do the same with trees. It seems to me that some of the forestry people might be interested.

Mr. Huddleston: Before we treat trees we ought to prove the hypothesis re silica content first.

Chairman: Yes, there is a definite line of work in making a silica survey of particular species and relating that to resistance to marine borers.

Mr. Weston: I think, Mr. Chairman, that is a particularly interesting point you have just made. Some years ago I saw some piles which should have lasted in sea water a matter of about 20 years, but which failed in 18 months. These piles were coarse grained and appeared to be very fast grown and not true to type for their species. I think the trouble was due to an inferior type of timber grown under very fast growing conditions and indicates soil can have a big bearing on the suitability of timber for sea use.

Mr. Hartigan: What is the distribution of silica in timber? Is it related to early growth rather than to late growth?

Mr. Tamblyn: I do not know.

Mr. Gay: The question of where the silica is distributed is important.

Mr. McAdam: D.F.P. are taking a keen interest in identifying trees coming down to Australia. Mr. Womersley, who has been collecting the specimens of New Guinea timbers, is coming to Australia for 6 months work very soon and hopes to discuss the matter with D.F.P. The question of wider tests can be considered in more detail then.

Chairman: To sum up the position - it will be some time before C.S.I.R. can get a marine biologist on their staff, but in the meantime there are certain activities which can go ahead.

(f) <u>High Pressure Preservative Treatment</u>

<u>Mr. Tamblyn</u>: We are now quite satisfied that high pressure treatment has great possibilities as a method for treating refractory truewood. Since my original tests with over 30 eucalypts in small specimen sizes we have systematically tested 15 species in lengths 4 feet long and 4 in. x 4 in. cross section. For each species a number of different trees have been represented and as far as possible tests have been made on green, air dry and kiln dried material at 200 lb. and at 1000 lb. pressure. Creosote oil has been the only preservative used and was selected as probably the most difficult to obtain penetration with. Of the 15 species so far tested 9 are considered treatable at 1000 lb., 2 are definitely refractory and 4 are at present under test. These 4 seem likely to be treatable.

The nine probable species are
<u>E. obliqua</u>, <u>viminalis</u>, <u>sieberiana</u>, <u>marginata</u>, <u>eugenioides</u>, <u>capitellata</u>, <u>diversicolor</u>, <u>calophylla</u>, <u>regnans</u>.

The two refractory species are

<u>E. considenianа</u>	<u>E. botryoides</u>
(3.5 - 4.5 lb./cu.ft.)	(3.9 - 5.5 lb./cu.ft.)

The four under test at present are
<u>E. dalrympleana</u>, <u>australiana</u>, <u>macrorrhyncha</u>, <u>bicostata</u>.

Three species seem promising at 200 lb. pressure though it is possible that higher pressures (say 500 lb.) would be needed to cope with occasional refractory specimens. The 3 species are

<u>E. viminalis</u>	- 8.9 - 12 lb./cu.ft.	(mean 10.4)
<u>E. capitellata</u>	- 3.8 - 9.8 "	(" 7.1)
<u>E. marginata</u>	- 10.9 - 17.8 "	(" 15.0)

The above treatments were made on dry material but some tests have been done on green specimens. The results are as follows. (1000 lb. pressure.)

E. obliqua	-	green 4.4 lb./cu.ft.	dry 6.5 lb./cu.ft.
E. viminalis	-	" 6.6 "	" 9.0 "
E. sieberiana	-	" 4.5 "	" 6.3 "
E. capitellata	-	" 4.9 "	" 8.5 "
E. calophylla	-	" 4.4 "	" 7.7 "

This suggests that a semi-dry sleeper may treat quite well for some species at least. In the semi-dry condition it will be drier at the ends than in the middle and the distribution of creosote will thus be approximately ideal from an economic aspect.

Our tests to date have been with 12 Victorian species and 3 Western Australian. It is now time to consider what species should be tested from Queensland, New South Wales and Tasmania.

Queensland have already suggested E. maculata, E. micrantha, E. pilularis, E. tereticornis, E. propinqua, E. hemiphloia, E. eugenioides, Tristania conferta and Syncarpia hillii. Of these we are doubtful whether it is worth treating E. hemiphloia, E. propinqua or S. hillii and would prefer to see some scrubwoods included such as Eugenia gustavioides, the brown tulip oaks, brown penda etc.

New South Wales has so far made no suggestions and Tasmania has not yet been approached.

I feel that we should decide as soon as possible the species to be tested from all States and arrange for their cutting.

The work is now entering the practical phase. are constructing a 25 in. diam. cylinder which will treat sleepers at a charge. We have discussed the tests with the Railways Department and the Forests Commission and arranged tentatively to treat 2400 sleepers from six species and install under varying service conditions. Species are E. obliqua, viminalis, sieberiana, eugenioides, capitellata, gigantea.

Mr. Moulds: Does high pressure treatment affect the mechanical properties of wood? I understand some American experience has shown that extra high pressures did have deleterious effects.

Mr. Tamblyn: The appearance of the piece of timber is the best criterion, I think, of its condition after treatment, and with all the eucalypts that we have treated, the timber has remained quite uncollapsed and unsplit. We have not made mechanical tests but the American work to which you referred was made at very much higher temperatures than those which we used and most of the damage, I think, was attributable to the wood being semi-plastic at higher temperatures and failing under pressure. It collapsed, whereas our timber comes out looking just as it went in.

Chairman: It might be of interest to know that we have designed an experimental cylinder with a quick opening door which we feel essential for a commercial cylinder. We see no serious problem as far as cost of the cylinder is concerned but obviously it will be greater than that of the ordinary treating cylinder. The time of treatment will be less, so that the capital expenditure for a given output will not be unduly great. A 5 ft. diam. cylinder would be a feasible commercial cylinder. The length is not a problem.

Mr. Ellis: Mr. Tamblyn has suggested that E. hemiphloia, E. propinqua and Syncarpia hillii should not be tested and he would prefer to have eugenias and tarrietias included. Would he be good enough to tell us his reasons?

Mr. Tamblyn: They are three of the most durable timbers, and are, incidentally, the most refractory, with practically no room in them to put in a preservative. It would seem better to select species of lower durability, rather than concentrate on the best and most durable species to try and make them a little bit better.

Chairman: The general principle of preservation is, it is important to add 5 years to the life of timber which naturally lasts about 10 years, but not if its normal life is 25 years.

Mr. Ellis: Agreed, but I still have to be convinced that the three timbers which Mr. Tamblyn proposes to eliminate from the schedule are going to be in the 25 year durability class when grown at a fast rate.

Chairman: You have drawn attention to the fact that material grown in future may be different from that grown now. Can you supply us with details of any timber you are going to grow in future?

Mr. Ellis: All of the timbers listed in our correspondence with Division of Forest Products will be available in perpetuity in considerable quantity in Queensland and I would suggest also in New South Wales, and I feel that they will find their proper utilization in railway sleepers if it is established that they can be treated by high pressure creosote. While open tank non-pressure treatment may be quite satisfactory with pole material, I believe that there will be quite large quantities available for sleepers.

Chairman: You have made your point, Mr. Ellis. We shall include those timbers which are rapid grown and will be available in the future.

<u>Mr. Tamblyn</u>: What is your reaction to my suggestion re <u>Eugenia gustavioides</u>, tulip oaks and brown ponda?

<u>Mr. Ellis</u>: Brown tulip oak is probably not particularly suitable for a sleeper timber on account of its poor spike holding properties. It is inclined to be rather susceptible to climatic influences in that it checks very readily. It is conceded that creosote treatment might eliminate to some extent the checking tendency but this point has not yet been established. If D.F.P. is prepared to include a number of other timbers not mentioned in our list of timbers to be tested, we shall be happy to supply test materials, but I should like to examine their future availability before recommending that they be accepted for test.

<u>Mr. Huddleston</u>: One reason why you have not had any recent suggestions from us is that we have had advice from the Railway Department that their sleepers failed through spike-killing. There is very little loss of sleepers due to decay even using what we regard as timbers of low durability such as blackbutt. The average life of sleepers in New South Wales is 20 years. I understand also that after 20 years sleepers are usually removed from the main line and put on a branch line. When a track is relaid, new sleepers are usually used, rather than replacing the track on old sleepers. Under these circumstances I do not see any justification for the preservative treatment of sleepers in New South Wales.

<u>Mr. Shambler</u>: Mr. Tamblyn said that he proposed to treat E. gigantea for sleeper timber. I doubt if this is justified as we are getting very short of timber for joinery and cabinet work and <u>E. gigantea</u> should be reserved.

<u>Mr. Tamblyn</u>: It was suggested by the Victorian Forestry Commission.

Chairman: Much of E. gigantea is not suitable quality for cabinet work.

Mr. Shambler: Better class timbers should be reserved for joinery and cabinet work. That seems to be our trouble here. Many timbers suitable for specialty use are going into anything whereas they should be reserved for specific purposes.

Mr. Gray: This is an extremely important question as far as sleepers are concerned. I have spent some time recently compiling estimated annual requirements from data supplied by Railway authorities. Production is about 80 million super feet and exports, which have been restricted to a figure far below what overseas consumers would like, are about 11 million super feet. The bulk of sleeper exports goes to New Zealand which is deficient in suitable timbers. Requirements of the various States and Commonwealth for normal maintenance and to make up the arrears of maintenance together with standard gauge proposals, are nearly double the present production. Such increased production is only likely if there is a very great widening of the range of species used including some which are not naturally durable.

As a matter of urgency we should not be so concerned with tests on species such as jarrah which have a fair life, as with species not at present used. Once it is admitted that adequate supplies can be obtained only if some proportion of the sleepers to be used have to be treated, the question of the use of softwoods such as P. radiata in which penetration of preservative is easier than with Eucalypt timbers, is obviously important. From the practical aspect we should think seriously of tests on species obtainable in considerable quantity to meet the very large requirements of a few years time.

Apart from treatment to increase resistance to decay and termites, it is almost certain that we will have to use improved methods of fastening rails to sleepers and in the case of the softer timbers to use plates or other measures to minimize rail cutting. In other words, because of the possibility of adopting measures to lengthen the mechanical life of sleepers preservative tests on softwoods should certainly not be ruled out. A large proportion of the sleepers used in Europe and North America are treated softwoods.

Mr. Huddleston: The railways have been using blackbutt for more than 10 years.

Mr. Weston: That is not a test really.

Mr. Huddleston: It is a test in this respect. Sleepers that were put in 10 years ago are still sound and it is anticipated they will last another 10 years, in which case they would normally come out anyway. From examination of tracks it is estimated that the life of blackbutt sleepers will be comparable with other sleepers on the track.

Mr. Weston: We in W.A. were particularly concerned with this treatment. Comprehensive experiments are to be carried out in co-operation with C.S.I.R. We are only concerned with jarrah as a control and are particularly interested in the impregnation of karri. Where the climate is dry, as on the Nullabor Plain, karri gives excellent results with an average life of 28 years. In heavy rainfall areas karri does not give satisfaction. We are looking forward to getting results with the creosote impregnation treatment. Spike killing is severe with karri. In the trans-continental line they leave the spikes for a long time even when badly corroded. If it is found that the spikes have been extensively knocked loose they fill the hole with cement and asbestos preparations and put the spikes in the holes again. Gratifying results have been obtained with galvanized spikes in W.A. and in jarrah have shown no serious corrosion after 15 years. We are asking C.S.I.R. to assist us with additional experiments involving pressure-creosoting of karri and marri and research into galvanized spikes. The demand for jarrah is so great for other purposes that we are loath to increase the output of jarrah sleepers. We hope to use karri and marri in a lot of cases where we are now using jarrah.

<u>Mr. Payne</u>: The Tasmanian Forestry Commission would be a party to these tests in conjunction with the government railways. When Mr. Tamblyn wants his samples they will, of course, be forthcoming. The species to be tried are fairly obvious.

<u>Mr. Tamblyn</u>: I think we should test <u>E. obliqua</u>.

<u>Mr. Moulds</u>: We are particularly interested in getting some of our non-durable timbers accepted by the railways.

<u>Mr. Huddleston</u>: If you start treating timbers from New South Wales and Queensland you are going into the field of the more common sleeper timbers which are naturally durable, but if you concentrate on the lightwood eucalypts, the others are automatically covered, such as the eucalypts of the southern part of New South Wales which do not provide a great number of sleepers but in Tasmania and Victoria sleeper supplies are almost entirely obtained from such timbers and it would be desirable to concentrate on their problems.

<u>Mr. Pinches</u>: In South Australia we have red gum, not a very extensive amount of it, but the Division of Forest Products are conducting experiments at the present time on softwoods which will automatically cover the ground

as far as we are concerned. There is no quantity of non-durable hardwoods available commercially to enable us to build up a supply as treated sleepers.

Mr. Hartigan: What about tramway sleepers sunk under the ground?

Chairman: From my experience, they show much less decay. Air is excluded and moisture content is sometimes too high for attack. Also they are out of sight, so that until the faults become too obvious replacements are not made.

Mr. Hartigan: Mr. Tamblyn said something to the effect that a 3-cycle pressure treatment with the pressure as low as 200 lb./sq.in. will give an effect almost similar to 1000 lb./sq.in. in one operation. Does that mean that 0 - 200 lb./sq.in. and back again three times will still give the same effect as 1000 lb.?

Mr. Tamblyn: If the timber treats very easily you might be able to achieve the same effect with 200 lb. as with 1000 lb./sq.in. but if it is refractory there is no doubt that high pressures achieve a better result in an hour than low pressure treatment for a week.

Mr. Hartigan: Expense might be a limiting factor.

Chairman: If you can reduce your time, it would be better to use 1000 lb./sq.in. than 3 cycles at 200 lb./sq.in.

Mr. Cokley: Does Mr. Tamblyn intend to carry out work with other preservatives as well?

Mr. Tamblyn: Yes, for sleeper treatment we propose using tar-crude oil-creosote mixture and possibly pentachlorphenol. Creosote mixture will probably be varied for purposes of test. The whole thing is bound up also with end-coating of sleepers to prevent splitting during seasoning.

Mr. McAdam: Is the high pressure treatment suitable for piles?

Mr. Tamblyn: Presumably.

Chairman: Would penetration be sufficient in piles 60 ft. long?

Mr. Tamblyn: I would not like to answer that. I would, however, suggest that piles thoroughly treated with creosote in the sapwood would give all the protection required without any truewood penetration.

(g) Battery Separators

Mr. Elliot: No progress has been made towards having the testing taken over by another laboratory. The National Association of Testing Authorities has been approached but cannot take any steps until it has completed its survey of Australia's research facilities. Our general policy at present is to continue research into substitute timbers because overseas timbers are no longer coming in.

Draft specifications covering wooden separators for all types of accumulators have been drawn up and are at present being considered by the appropriate Committee of the Standards Association.

Some life tests were carried out on batteries containing Port Orford cedar, North Queensland kauri, Douglas fir and klinki pine, but further tests will be necessary because the plates failed before the separators. These tests are in hand. Klinki pine has been proved suitable in all other properties.

Bending and flexibility tests were carried out on North Queensland kauri separators supplied by various manufacturers.

The treatment and measurement of hardness, breaking radius, flexibility and electrical resistance of Borneo red cedar and Borneo white cedar were carried out. These separators tend to break on handling.

The mechanical properties and electrical resistance of klinki pine separators from four additional trees were measured and results indicate, subject to life tests, that klinki pine may be a suitable substitute.

Tests are being planned for two New South Wales species, sassafras and yellow carabeen, and for radiata pine. In addition, we are looking into possibility of using timbers from Sarawak and New Caledonia. Supplies are being arranged of sempilor, ramin and amberwood from Sarawak and kauri and perhaps some others from New Caledonia.

Parana pine has a large proportion of pin knots and cannot be bought in thicknesses greater than 2 in., and so is not suitable.

<u>Mr. Gray</u>: I consider this subject is of considerable interest to this conference because of the necessity to conserve dollar expenditure by reducing the import of battery separator veneer. Port Orford cedar is in any case getting very short in supply. Some manufacturers here would like imported Douglas fir although according to Mr. Kingston, it has little if any superiority over Queensland kauri. At the present time fair supplies have been organized of Queensland kauri, but there are difficulties and in any case, it is not a good thing to have all one's eggs in the one basket. It would be a very good thing if a second source could be established and especially as Mr. Kingston suggests, to try the species of the southern States. He proposes to carry out tests on New Caledonian kauri, but that is not very important because supplies may

be uncertain, are unlikely to be permanent, and cannot be very large. It would be very satisfactory if P. radiata were found suitable as it is in plentiful supply.

Mr. McAdam: Can Mr. Gray supply the meeting with annual requirements of battery separators?

Mr. Gray: Estimates received from the trade are not always reliable. If one added up all estimated requirements the figure would be about 15 million square feet. This is considered an over estimate. For the time being we are working on an annual requirement of 10 million square feet of veneer which represents approximately 1 million super feet of sawn flitches. The actual requirement may be rather less but as stocks have fallen low and reserves must be built up, 10 million square feet is a reasonable target and we are trying to get the rate of production higher than this.

Mr. Cokley: A lot of these imported timbers have been found when converted to plywood to have suffered from being immersed in salt water. For example, in the case of "seraya" it was found recently that one log was very high in salt content (2.5 per cent.). I suggest that you get samples and make certain on that point.

Mr. Huddleston: Sodium chloride should come out in the washing. Separators of some species at least are treated and washed to remove manganese.

Mr. Gray: What supplies of Dacrydium are there in New Guinea?

Mr. McAdam: In New Guinea this tree normally grows at 5000 ft. and supplies are very light but in Sarawak it is found at coast level in pure stands which have a density of about 3-4000 cu.ft. to the acre.

Mr. Ellis: A good deal of work has been done on Queensland kauri, which covers both Agathis palmerstoni and Agathis microstachya. It would seem desirable to examine these two species separately, and to this end we have been in correspondence with the Division of Forest Products.

(h) Forestry Abstracts

Mr. Cromer: I have received a circular from the Director of the Commonwealth Forestry Bureau at Oxford asking for considered and constructive criticism on the Forest Products Utilization Section of Forestry Abstracts. I thought that if this question was examined and some expression were to come from the conference I could pass it on to the Director.

Chairman: I suggest discussion be postponed to enable members to examine the letter and copies of the Abstracts.

At the end of the Conference, after a short discussion, delegates considered that there was adequate representation of forest products matters.

2. EQUILIBRIUM MOISTURE CONTENT

Mr. Wright: I am sure that all delegates at this conference are familiar with the term "equilibrium moisture content", and that it refers to a condition when the vapour pressure in the wood is equal to the vapour pressure of the surrounding atmosphere. Over the past few years, the Division has become aware that much loose thinking exists with respect to the implications of equilibrium moisture content, and that our background is extremely limited concerning the inter-relationship between climatology (or locality) and equilibrium moisture content, and the effect of variables in the condition or history of the wood itself on the equilibrium moisture attained.

(A) Effect of Properties of Wood on E.M.C.

With respect to the second of these fields it has seemed to me that some of us have got into the habit of over simplifying our thinking with respect to E.M.C. Possibly the use of charts or tables showing the relationship between psychrometric conditions and equilibrium moisture content has lead us into thinking of the mean values so shown as having much wider application than they should, so that we have tended to use them for particular cases without consideration of the fact that in a particular case the value required may be considerably different from the mean shown on the chart. In some cases too, when using E.M.C. values, we have failed to remember that wood is a substance of which neither the chemical composition nor the physical characteristics are constant, even within the one species let alone over a range of species; so that the need for recognition of a margin of tolerance in moisture content when considering seasoned timber, even that which has been conditioned, has been overlooked, and we have sometimes tended to be too restrictive in recommendations and specifications.

The practical significance of equilibrium moisture content is, of course, its relationship with dimensions. If timber used for a given purpose, whether it be joinery, cabinet work or in the constructional field, is not at a suitable moisture content for the purpose or environment at which it is to be used, then dimensional change will occur, and we can get degrade in such forms as open glue joints, the sticking (or, alternatively, rattling) of sliding parts, warping, buckling, cracking or splitting. The magnitude of the change of dimensions that can occur in M.C. is often greater than we sometimes realize: for example, in a 12 in. wide back sawn panel of mountain ash, a moisture content change of as little as 2 per cent. will, on an average, cause a movement of as much as 1/12 in. Of course, for high precision work where very small tolerances in size are allowable (for example, rifle furniture) as well as knowing the mean E.M.C. at which the wood is likely to be used for a particular environment, it is desirable to know the probable range in M.C. that will be achieved: this will indicate what special measures may be needed to restrict or nullify the effect of dimensional changes should the E.M.C. range be considerable.

What are the principal factors which can cause variations in E.M.C.?

(1) Species: First, of course, there is a species effect. Although on our charts only mean values are shown, so that for any given psychrometric condition all species would appear to have a constant E.M.C. value, actually, of course, there can be a differential of as much as 4 to 5 per cent.: it is possible, as indicated by Princes Risborough, that this difference in relative hygroscopicity is related to the extent of lignification of the cell wall. Furthermore, although it is reported that extractives appear to have little effect on hygroscopicity itself, (except in the vicinity of 100 per cent. relative humidity), an associated factor, and one which is almost as important as the actual E.M.C. attained, is the rate of response to change in E.M.C. as affected by the degree of perviousness to moisture movement from such causes as the structure, the

amount of included substance, the quantity of medullary tissue, the extent of sapwood or truewood, etc.

(ii) Density: With respect to density, in general, it appears that this property has little practical effect on E.M.C. It has been reported by A. Ushkov, that if anything, high density timbers tend to have lower E.M.C.'s, but the difference is too small to be of practical value. It appears that with very high humidity, of the order of 95 per cent., the less dense woods take up the greatest amount of M.C. and have the higher E.M.C.'s.

On the other hand, density has a large influence on the rate of moisture exchange, the higher the density the slower the rate.

(iii) Hysteresis Effect: Wood has a different moisture content or E.M.C. under fixed conditions of temperature and relative humidity according to whether it is desorbing or sorbing moisture. The E.M.C. for desorption is higher than that for sorption, except at the oven dry condition and at the fibre saturation point, when they are equal. At the point of maximum divergence the difference is in excess of 3 per cent. M.C.

With respect to rate of moisture exchange absorption equilibrium is obtained more readily than desorption equilibrium.

(iv) High Temperature: Subjection to high temperature, and/or drying to a low moisture content, reduces the hygroscopicity of wood so that its E.M.C. is permanently lowered. In this regard, the higher the temperature and the longer it is maintained, the more the hygroscopicity is reduced. Steaming and boiling have similar effects.

(v) Method of Sawing: There appears to be no marked difference in the E.M.C. of matched quartersawn and backsawn stock:

again, however, there appears to be some difference in some species in the rate of response to change, the backsawn stock reacting the more quickly.

(vi) Dimensions: Variation in the thickness of stock, theoretically, should not affect the E.M.C. attained: some workers claim, however, that E.M.C. is lowered with increased thickness: a difference of 1 per cent. moisture content is claimed between samples of Douglas fir 3/8 in. thick and 13/16 in. thick.

Again, however, thickness will have a marked effect on the rate of response to change in psychrometric conditions, the thinner samples following more closely, and more fully, external changes than thicker ones: this is due, of course, largely to the slower rate of response and the restraining influence of the core material of the thicker samples.

(vii) Effect of Impregnation: The impregnation of chemical salts in timber frequently causes a change in E.M.C. Some, such as common salt and sugar, tend to raise the E.M.C., other, such as synthetic resin, tend to reduce it.

(viii) Temperature and Humidity: The factors which control the E.M.C. of wood far greater than any others, are the temperatures and humidities of the surrounding air: they indicate the vapour pressure of the surrounding atmosphere and, with the rate of air circulation, control the drying characteristics of the immediate environment. The relationship between temperature, relative humidity and mean E.M.C. has been demonstrated in many graphs and charts, and is generally familiar.

It is somewhat difficult to assess the relative importance of each factor as they are, to some degree, inseparable in their effects: however, changes in relative humidity are more important than changes in temperature. For example, a change of only 1 per cent. in E.M.C. needs a change of 30°F. in dry bulb temperature, with relative humidity kept constant: but a change of only about 3 per cent. to 4 per cent. in relative humidity with temperature kept constant.

The relationship between E.M.C. and wet bulb depression is well known: increase in wet bulb depressions causes a decrease in E.M.C.

(x) Other Factors: With respect to such factors as the dressing of surfaces, the rate of air velocity, and the use of surface coating of a commercial nature such as oils, paints, french polish, etc., it must be noted that these factors do not appear significantly to affect E.M.C.; the latter two do, however, affect the rate of response to change and the degree of fluctuation which will occur.

It is clear then that in any consideration of the relationship of E.M.C. to wood material, a considerable number of factors may be involved. We cannot afford to be too restrictive in any interpretation of the degree of moisture content tolerance it is possible to obtain from a given parcel of timber dried, for example, under commercial conditions. Of course, the length of final conditioning treatment given and the more strict the control, the smaller the tolerance which can be anticipated.

The Conference may be interested to hear that the Division has commenced a laboratory study of the effects of the following variables with some six major Australian species: some 2300 samples being used.

(a) Thickness: material in thicknesses of $\frac{1}{8}$ in., $\frac{1}{4}$ in., $\frac{1}{2}$ in., and 1 in.
(b) Grain direction.
(c) Drying conditions.

(d) Reconditioning: It is expected that this study will also give preliminary information as to the range of E.M.C. attained by the species being examined when exposed to a wide range of psychrometric conditions, and also the effect of the above factors on rate of change of E.M.C.

(B) Inter-Relationship Between Locality (Climatology) and E.M.C.

As no doubt most of this audience knows, little information is available on the relationship between locality in Australia and the corresponding seasonal E.M.C. conditions. Systematic studies have been carried out to a very limited degree, and appear to have been confined to a series of restricted studies by the Queensland Forest Products Research Branch, the New South Wales Division of Wood Technology, and the Division of Forest Products, C.S.I.R. Useful data have been gained by this work, but a very brief examination of any map of Australia with this data plotted shows huge gaps on which no information is held.

In an attempt to overcome this handicap, recourse has been made to meteorological data, and as an initial approach the recorded values for E.M.C. for sheltered outdoor positions, as obtained in the co-operative study made in Capital cities some years ago, has been plotted against several expressions of the meteorological conditions which prevailed at the time the study was carried out. From this data a regression equation for moisture content was derived for each species used, incorporating temperature and humidity. A typical equation takes the form

$$y = wH_o + xT_o + yH_1 + zH_2 - k$$

As an example, the equation for mountain ash in Melbourne is as follows:-

$$y = 0.107H_o + 0.104T_o + 0.0365H_1 + 0.0800H_2 - 8.31$$

The agreement between calculated and actual values has not exceeded $\frac{1}{2}$ per cent. moisture content.

Where y = equilibrium moisture content

H_o = relative humidity of current month

T_o = temperature of current month

H_1 = relative humidity of previous month

H_2 = relative humidity of two months previous

w, x, y, z and k are constants derived from a multiple regression analysis.

These equations were then applied to the average of the yearly figures of temperature and relative humidity for some 220 meteorological stations throughout Australia, and three maps were drawn up for each species, showing the average yearly moisture content, the average maximum and the average minimum.

Due to lack of comparable data, the validity of these maps for some parts of Australia is uncertain. To verify them it will be necessary to set up standard samples under standard conditions of exposure throughout the Commonwealth and to measure their moisture content over a period of at least two years.

In this work the assistance of the State Forest Services is essential. It is suggested that some 40 stations be selected, comprising some 5 to 9 in each State situated in various climatological regions, the actual locality being determined by the possibility of using State F orest offices for stations. It is tentatively suggested that the following conditions might act as a basis for consideration of this co-operative study. In general, these conditions are similar to those found satisfactory from the co-operative studies carried out between the Division of Forest Products and the States in Capital cities over the period 1931 - 1933, the information from which has proved extremely useful. As indicated earlier, however, data from a wider field than that planned for in the earlier study are now considered necessary.

(i) Six species (which will represent those most used throughout Australia.

(ii) Two thicknesses (1/2 in. and 1 in.).

(iii) Quartersawn (or back sawn) material only (to keep down the number of samples needed.

(iv) The use of duplicate sites for each State. (One to represent a sheltered outdoor condition and the other normal indoor conditions).

(v) Samples to be used in duplicate.

(vi) All samples to be prepared by the one authority and all end coated.

(vii) Measurements of M.C. to be made weekly on a specially prepared scale or balance calibrated in moisture content in order to reduce work for the co-operator.

(viii) Daily readings of dry and wet bulb temperatures at each station (by means of a sling hygrometer or suitable equivalent).

Mr. Ellis: The objectives are excellent and I feel that the project should be developed. A good deal of detailed work is involved however and some difficulties might be anticipated in securing the number of observers desired.

Mr. Huddleston: In the west of New South Wales we have no facilities for taking observations and so have very little information. We have endeavoured to use high schools to obtain information, but they close down for two of the most important months, and a change of masters often results in the samples being thrown out. We have been forced to consider alternatives and we have designed an instrument to give direct reading of E.M.C.

Mr. Fogl: This instrument is housed in a coachwood frame and consists of an 8 in. x 3/4 in. x 3/4 in. piece of Queensland maple (F. brayleyana) which is firmly fixed at one end and attached to a lever at the other end which magnifies movement in the timber. The movement of the lever operates a steel pointer moving over a scale graduated in E.M.C.

Mr. Huddleston: We hope to put out a number of these, and thus get increased co-operation from field officers who are not very concerned with the job at present.

We hope also to examine the effect of local variation which may be large. Sydney has an average of 2 per cent. varying from 10 to 14, although some factories in Botany Bay have E.M.C. as low as 8 per cent. This type of instrument would involve half a dozen instruments being set-up at each centre and observations could be taken continuously over a number of years.

Samples 10 in. x 4 in. x 1 in. stacked here since 1932 have shown there is a seasonal variation running over a period of years as distinct from the annual variation. It is desirable to observe that seasonal variation.

Mr. Wright: Where Forest Service offices are not available, I think we should consider the use of meteorological stations throughout Australia to help us, of which there are about 240 scattered throughout Australia. For some areas where your equipment would not be available preliminary laboratory studies may help to tie in results from your method with those we were proposing. With regard to your equipment, I am concerned about the degree of reliability obtained from only one sample per place. No material which was not truly representative of the species should be used.

Mr. Clarke: Are we covering the position from the broadest position possible? The E.M.C. variations throughout the States might be of considerable importance but we should study the variation within and between buildings in any one location. This work should be repeated in widely different localities. Suitable stations are a problem but we might take advantage of some of C.S.I.R.'s stations, which are situated in irrigation areas, wool areas, etc.

Mr. Wright: The stations of C.S.I.R. could well handle work in some areas. We now have an officer who could give some of his time to this work. He has some meteorological training and is interested in this field of work and he could ensure that we got similarity in site and other factors by visiting all sites involved. We are, of course, continuing our laboratory work to cover basic relationships between variable factors.

Mr. Huddleston: Many of the meteorological stations in New South Wales are located at post offices and very often supervised by the local postmaster who has no idea of instruments or how they are handled.

Mr. Wright: In the broad survey made in 1932 only one species was used in each Capital city other than Melbourne. This gave us some difficulty of correlation as between all Capital cities. The tests should be duplicated at each site. Meteorological stations might still be useful.

Mr. Clarke: They would be useful for establishing the relationship between air movement and relative humidity and temperature.

Mr. Wright: The Division of Forest Products would be prepared to take the responsibility of looking after such a project as outlined. I agree that there may be secondary meteorological stations which are poorly manned, but we can be selective. The meteorological stations suggested are only a means to an end and should there be any other means, so much the better.

Mr. Irvine: In Victoria we are interested in the relationship between E.M.C. and fire hazards and are reading a number of fire hazard sticks in some areas. We have tried balances reading moisture content directly, and have also tried wet and dry bulb thermometers.

Mr. Wright: We would suggest using a sling hygrometer for humidity readings as it is simple to make.

Mr. Clarke: Can working plans be circulated to all States? -

Mr. Huddleston: A corresponding committee could be set up to see to this.

Mr. Ellis: What purpose is to be served by this, I cannot see why machinery existing in the State Forestry Departments should not be utilized.

Mr. Clarke: It serves the purpose of making somebody Convenor and it is his job to get it moving.

Mr. Payne: If there is no Forest Products branch the problem is difficult.

Motion, proposed Mr. Huddleston seconded Mr. Taylor, to set up corresponding committee representative of each State on E.M.C. was passed.
Committee to comprise:-

Convenor:	Mr. Ellwood
Members:	Messrs. Fogl (N.S.W.), Ellis (Q'ld.), Irvine (Vic.), Wallace (W.A.), Pinches (S.A.)

Mr. McAdam: I would certainly like to see tests extended to the tropics. We could man four stations. When the final form of the test is decided upon, I should be quite happy to be kept in touch by progress reports.

Mr. Ellis: Would it be possible to determine, before setting out on this survey involving so many samples, the relationships between species, size, grain etc. and E.M.C. If these relationships could be established we would need only one sample at each station, results from which would then be used for interpolating the E.M.C. for other species. Field work could thus be considerably reduced.

Mr. Wright: Some of the basic relationships are being investigated with the 2500 samples being tested at D.F.P. particularly thickness, grain direction, elevated temperature, and reconditioning treatments. The studies should show actual E.M.C. obtained and also the rate at which it changes to new values. This is important for a knowledge of time needed to condition material. So far as field studies are concerned we hope to cover variation within tree as well.

For the field experiments, assuming we have 30 to 40 stations, each with 12 samples under internal and external conditions, would give us 360 samples. Duplication would require 720.

Mr. Huddleston: I would not like to see the number of samples in the field reduced. Even though the relationship shown between meteorological conditions and different species may be established, variation throughout day affects the E.M.C. of hoop pine more than, say, tallowwood, and the results of the investigation may be affected by the species.

Mr. McAdam: There is just one point. Is there a term to cover the lines of equal equilibrium moisture content?

Mr. Wright: We use the term Isomems tentatively.

Mr. McAdam: Isomecs might be more pertinent. I think this might become important in view of the standard terms and definitions publications we have discussed.

3. IMPROVED WOOD FROM RADIATA, PINASTER AND MURICATA PINES

Mr. Pinches: The shortage of timber for all purposes is being felt throughout Australia and it is possible that such conditions will hold for some time.

In view of this I think it is of considerable importance that a much closer and more efficient utilization of the timbers we have should be made. We have the prospect of large areas of exotic softwoods reaching the conversion stage in a very short time, and I propose that in order to be prepared for this investigations could be commenced now, particularly as samples of these species can be made available. As far as South Australia is concerned, it is anticipated the present output of log timber will be trebled within a very few years. It is felt that apart from its present uses it could be developed to serve more useful purposes, such as improved wood. As far as we know, very little work has been done in this connection and South Australia would welcome a thorough investigation. Although I mention three species particularly, no doubt in the eastern States and particularly Queensland there are also large areas of exotic conifers. They might welcome an investigation in this connection.

Mr. Tamblyn: During the time we were making improved wood we tested radiata as one of the possibilities for airscrew root material. The properties of the impregnated wood were satisfactory except that toughness was low and machining properties were poor, so it was decided to discard it for our particular purpose. Most of the softwoods, including hoop pine, gave an uneven product; late wood and incipient compression wood bands caused uneven impregnation. However, it should be possible, for electrical purposes, to make quite an acceptable product from radiata, but the cost is high and it could not stand competition from other accepted materials except for special purposes where high strength is required. South Australian Brush Co. had a good sale during the war for its product but it is doubtful if this use still exists unless the cost can be reduced in some way.

Mr. Elliot: Unless adequate quantities of pinaster and muricata pines say 10,000 acres for each species are potentially available there does not seem to be much point in making an intensive study of these if they do not give outstanding results in scout tests.

Current production and potential availability of radiata pine veneer suitable for improved wood are such that carrying out of a full-scale investigation of this species might be favourably considered if scout tests are at all promising.

Mr. Pinches: At the moment there would be a good ten thousand acres.

Mr. Huddleston: Developmental work on the softwoods and conifers would involve a large amount of investigation and is not warranted as far as New South Wales is concerned. Improved wood is being manufactured in New South Wales by Densified Woods Ltd. and is sold under the name of "Permali". Electrical material not only requires high resistance wood, but high strength is also required. The Company find that the selection of material is most critical. Yellow carabeen is being used and for some uses coachwood, spotted gum and blackbutt. Application of improved wood is limited and is highly specialized and unless the species used at present cut out there is no justification for development of other species.

Mr. Moulds: In the matter of P. radiata, is it the idea to use higher classes of material or waste material for which there is no other use?

Mr. Pinches: To widen the field of use of these timbers and if they could serve more useful purposes than they are at the present time, then investigations are worthwhile. We passed through a critical period during the last war in regard to timbers for various requirements and if we can make our own timbers more useful we think it is worthwhile.

Mr. Ellis: Spot tests should be done if they have not already been done. I do not think it necessary to have 10,000 acres planted first.

Chairman: There is no justification for any work on airscrews as the fighter planes in future will not have any airscrews.

Mr. Turnbull: It seems to me that the requirements for airscrews are exacting. With lesser improvement in properties radiata from South Australia might be able to meet some manufacturing needs for which she may not be able to get other woods in emergencies. Suitable forms of improved wood of radiata would extend the utilization of the species.

Chairman: It may be possible to do something with radiata particularly as we get large sizes of radiata here. A prima-facie case seems to have been made out for carrying out tests.

Mr. Tamblyn: As a result of our tests it is possible to determine the general properties of the final product before making it. We know that the three species mentioned will be low in toughness. The suitability for certain specialty uses cannot always be determined in advance, and service tests must be done.

Chairman: We have much information on improved wood but it has not been published. Mr. Tamblyn is at present preparing a report on the work.

4. THE PRE-DRIER

Mr. Wright presented a paper on "The Construction and Performance of a Progressively Operated Stack Pre-Drier".

Full details of the pre-drier will be available shortly in the C.S.I.R./D.F.P. Internal Report, Project 8.9, First Report - " The Construction and Performance of a New Timber Pre-Drier" by G. W. Wright.

Accordingly, a brief summary only will be given in these proceedings as follows:-

"In several parts of Australia, notably in parts of Tasmania, and possibly in parts of Queensland, climatic conditions are not very favourable for air-drying. As a result, relatively large stocks require to be held for air-drying to ensure economic drying through the kilns. The need for relatively simple drying equipment to overcome the disability of partial air-drying in localities subject to adverse climatic conditions has been recognized for some considerable time and several attempts, none wholly successful, have been made by industry in Australia to develop an effective pre-drying unit. Since the mid-winter of 1947, however, a pre-drier erected at the plant of the Circular Head Amalgamated Timber Pty. Ltd., of Stanley, Tasmania, has been operating with success. Credit for the conception of the somewhat revolutionary principle on which this unit operates is due to Mr. H. Fenton of Smithton, Tasmania, who subsequently constructed the prototype at Stanley from a design prepared by officers of the Division of Forest Products and which incorporates his basic ideas. This pre-drier operates on the progressive principle, but the timber loads are left stationary in the drying chamber. This has been achieved by a damper system by means of which any two of a number of progressively spaced vents can be selected at will to become points of air entry and discharge, the remainder being left closed. In effect, the usual progressive principle of a moving charge with fixed points of air entry and discharge has been reversed. The air enters the chamber on the fan side of the driest stack and passes progressively through stacks of increasing moisture content to the end of the chamber. It then goes through over head ducts to re-enter the chamber at the other end. It passes through the remaining stacks until it reaches a movable deflector, between the wettest and driest stacks, which forces the air into a basement duct for subsequent heating and re-circulation. Air circulation in the pre-drier is obtained from seven 54 in. diam. flat-bladed propeller type fans spaced at approximately 10 ft. centres and operating at 400 r.p.m. The rated free air delivery per fan is given as approximately 33,500 cubic feet per min. Assuming that some 20 days are needed to dry a particular sized species to the required moisture content, and that the pre-drier is designed with six effective loading lines only, each line would therefore be unloaded and the adjacent line loaded once every three days; with each loading line holding two kiln charges, the discharge rate of one kiln charge every two days would be obtained. The pre-drier is heated by means of six steam heated finned unit air heaters located at intervals along the 72 ft. length of entering air duct fitted across the width of the pre-drier. Where green wood is used to raise the steam approximately 7 lb. of green wood per hour per 1000 super foot is required for average conditions. The pre-drier dimensions were chosen to satisfy kiln requirements, the overall internal width being 72 ft. and the overall internal length being 52 ft. (including space for ducts, fans and heating equipment). The total charge capacity approximates 96,000 super feet. All external walls are lined with T. & G. flooring, and are sheathed externally with weatherboards. Planer shavings filled all wall and roof cavities. There was one door to each of the charge lines. Performance tests carried out on the Stanley prototype indicate that the principle of operation and design generally is sound, but that some improvements can be made in detail. The conclusion was reached that even with species susceptible to collapse, the quality of drying was not significantly different from that of stock which had been partially air-dried to a similar moisture content. The pre-drier does not appear to appreciably affect the response of collapsed stock to the reconditioning treatment. At this stage in the development of the pre-drier it is difficult to assess fully the economics of operation, particularly as these depend considerably on plant operation. It should be recognized that where conditions are suitable for air-drying, and no special features exist to favour the pre-drier or to increase the costs of air-drying, partial air-drying is much more economical than drying by the pre-drier."

Mr. Ellis: How long does the unit take to dry to 20 per cent. moisture content?

Mr. Wright: This particular unit has been operating some 8 months and in that period has dried something over 1 million super feet. On that basis it works out at about 18 days to dry 1 inch thick "ash" eucalypts from the green condition to a moisture content in the range 20-28 per cent. The range is largely affected by a considerable variation in the density of the stock used: the operators were drawing timber from a wide area, and it is well known that the density and drying rate of this stock does vary considerably. Drying time was not continuous over that period and the steam supply was only 5 lb. pressure. Despite plant inefficiencies the pre-drier still seemed to give a reasonably good performance.

Mr. Ellis: Has any test been made on drying timber down below 25 per cent moisture content?

Mr. Wright: Not systematically: some ½ in. to ⅝ in. stock came down fairly fast to a fairly low moisture content.

Mr. Ellis: It occurs to me that in the Tasmanian wet season, with high E.M.C. conditions, you would not want to get down much below 15 per cent., in which case it might be worthwhile trying to see whether this unit would actually finish drying.

Mr. Wright: A possibility, but we might get more variation in final moisture content, and steeper moisture gradients than desirable. Final treatments would help to even the moisture content out, particularly the reconditioning treatment. A desirable practice would be to dry out to 20 per cent., then recondition and re-dry.

Mr. McAdam: Any reconditioning after kiln drying?

Mr. Wright: No.

Chairman: What would be the minimum number of kilns per pre-drier for a satisfactory proposition?

Mr. Wright: I would not like to express an opinion at this stage. In any case it would have to be qualified by conditions of operation of plant. The present pre-drier is operating with 6 kilns, 4 longitudinal shafts and 2 cross shafts. Each takes a charge 35 ft. long, 8 ft. high and 5 ft. wide.

Mr. McAdam: If charge included several sizes of timber, wouldn't the schedule be affected?

Mr. Wright: If possible, separate sizes should be kept differentiated.

Mr. McAdam. Could you overcome that by a removable fan?

Mr. Wright: We have considered that, and we have also considered a unit which would comprise stationary fans but a movable heater. We have even considered the possibilities of fabricating a unit which would comprise a heater with a fan behind it, perhaps in sections, which could be lifted by a lifting truck and so progressively moved as required. Coupling for steam connection would be made through a heating system comprising a steam line running along each side from each end. The most attractive possibility is, however, stationary fans with a movable heater: we would then have a simple return circulation with no worry about ducts and all we would have to do in that case would be to move the heater along at intervals. It would not involve a great deal of expenditure to have a flexible coupling for steam.

For the sake of speed in operation the portable deflector was made very light. It comprised plywood on a simple frame in 10 ft. x 6 ft. sections. That had considerable drawbacks as the flexibility and lightness defeated its own end and satisfactory junctions were not obtained. We feel an improvement would be to make a portable deflector in 2 lengths, each 30 ft. on a rigid frame: this would give much faster movement.

5. TIMBER MECHANICS

(a) Report on F.A.O. Conference, Geneva, June, 1948 Sub-Committee on Mechanical Testing of Timber

Mr. Kloot: In June this year, a meeting of the United Nations F.A.O. Sub-Committee on Mechanical Wood Technology was held in Geneva. This meeting was attended by representatives of timber testing laboratories of U.S.A., United Kingdom and a number of Continental countries. Fortunately arrangements were able to be made for Mr. Cooper, Officer in Charge of our Timber Mechanics Section, to attend as the accredited Australian representative.

The prime object of this conference was to discuss ways and means of establishing an international standard for the mechanical testing of timber. It is perhaps not necessary to enlarge on the desirability of such standardization. The following example however should suffice to indicate its need.

During the war, a considerable volume of spruce was tested to the British aircraft specification at the Division of Wood Technology and at what was then known as the Munitions Supply Laboratories. Later with the co-operation of these laboratories, we had the opportunity to analyse the results of their tests. It was found that the average compression strength for the material was about 15 per cent. higher than the figures obtained for the species by Madison. There was no doubt regarding the adequacy of the sampling, Madison's results were based on specimens from 25 trees and ours on thousands of specimens.

It has since been almost conclusively proved that at least two-thirds of the difference was due to the difference in the rates of test used. Whereas the A.S.T.M. specifications demand a constant rate of strain to be used in this test, the aircraft specifications specify a constant rate of application of load. Such a difference obviously cannot be dismissed lightly even in minor utilization problems and in aeronautical design it would be of the first order of significance.

Besides the rate of test, another problem on which it was hoped some agreement would be reached was the question of size of specimen. Madison have always used 2 in. x 2 in. as the basis of their specimen size, and laboratories in other English speaking countries have followed suit. On the other hand, many of the Continental countries use the French standard proposed by Monnin based on a 2 cm. x 2 cm. specimen. Some of the reasons put forward for this smaller size are (a) the better selection obtained (b) the speed with which moisture equilibrium can be obtained and (c) the possibility of drawing samples from mill waste. Such waste is usually in 27 mm. thick boards.

Prior to the war, attempts were made at a compromise on the basis of a $2\frac{1}{2}$ cm. x $2\frac{1}{2}$ cm. i.e. 1 in. x 1 in. specimen. Whilst Princes Risborough was and still is apparently willing to compromise, Madison has been loathe to make any change. Their attitude can be readily appreciated. After all they have spent many years and put a lot of money into an intensive survey of the properties of American species. Similarly the French laboratory has many years of work behind it based on the smaller specimen and so it is not anxious to change to the large specimen.

The difficulty in regard to specimen size is due to the difference in results yielded by clear specimens of different size of the same species. Generally it has been observed that the smaller the specimen the higher the apparent strength value. At present the only alternative to standardization, other than the discovery of why specimen size affects results, appears to be the determination of size factors for converting results. As these would have to be determined for practically all properties, it would not only be a very costly procedure but unsatisfactory in other ways.

We have not as yet full details of the results of the Geneva Conference, but Mr. Cooper has informed us of two points of interest. Firstly, virtually no agreement has been reached on standardization and secondly, Australia has been asked to share in the research considered necessary to provide a more adequate scientific background as a prelude to further attempts on standardization. We have been asked to prepare papers on such questions as methods of sampling, effect of specimen size, moisture and temperature relations with strength and the effect of different rates of test. Actually none of this work will be new to us. Much of it is already in hand as we had anticipated, earlier in the year, that much of this would be required whether agreement was reached at the conference or not.

One positive result of this conference has been the excellent contacts that Mr. Cooper has been able to make with other laboratories, particularly on the Continent. The interest shown in our work is not only gratifying but also indicates that in spite of our geographical isolation, our status as a first class laboratory has been recognized.

(b) Report on Empire Forestry Conference, Ottawa and Madison, September, 1948

You are all, I think, aware that currently with this conference another, which Mr. Cooper is attending, is being held at Ottawa. This meeting arises from a recommendation made at the 1947 British Empire Forestry Conference to set up a Forest Products Committee to be convened as as circumstances warranted. It was hoped that Mr. Huddleston as the Officer in Charge of the only State Forest Service timber testing laboratory would have been able to attend, but unfortunately owing to staff shortages the necessary approval could not be obtained.

The agenda of this conference is not materially very different from that of the Geneva conference. The main item for discussion is the methods of timber testing. The main objective is to attempt standardization of testing technique amongst the laboratories of the British Commonwealth. As their methods are largely based on American methods, Madison is also represented at the conference and the last part of the proceedings will be held at the Madison laboratory. Although, as I have already said, the methods as used by the various laboratories are based on the American practice, there have been variations made from time to time. For instance, the present B.S.I. standard differs in some tests from the A.S.T.M. specifications. Up to 1938, these recommendations, published in 1935, of a special reviewing committee the B.S.I. standard was re-issued in 1938 with several variations from the American standard. Another example is in impact tests, where there are three types of impact test in common use, the Hatt-Turner hammer drop, Madison toughness test and the Izod test. The necessity of allowing for the effect of temperature on strength properties either by air-conditioning of laboratories or the use of correction factors is also an important point to be discussed. The agenda which has been circulated amongst you is the best indication of the scope of this conference.

Besides taking an active part in general discussions, Mr. Cooper has offered to lead discussions on certain topics. To this end, Forest Products has contributed

7 papers, a copy of each of which is available here for the perusal of members of this conference.

Mr. Huddleston: I think we should all give a clear recommendation to our own representative in future discussions on the ideas of various laboratories. My own feeling is that the tendency to adopt the standard method of testing with a constant rate of strain gives unreliable results. We have found that we have to vary the rate of strain from that specified in the British Standard Specification as our timbers are too stiff and the rate of load becomes too large. I feel if anything is to be done to bring about standardization of testing, we should adhere to the 2 in. x 2 in., and also change from the constant rate of strain to a constant rate of load which is more suitable for actual conditions.

Mr. Kloot: These specifications were based on Madison experience, and at that time Madison, to the best of my knowledge, was equipped with screw driven lever type machines, and many of those machines are difficult to convert to the other type. As far as the whole problem is concerned, I think it is desirable to find out why there are these differences. We are actually starting to work along these lines.

Chairman: Would you be in a position to share in the work allocated to Australia Mr. Huddleston?

Mr. Huddleston: I will be next year.

Chairman: We could see what work we have to do in Australia.

Mr. Huddleston: In that regard I feel that an investigation to find out why we get a variation in test results obtained from different sized specimens is going to open up a very wide field. The investigation is connected with basic design data. The basic assumption in static bending tests for example is that the material is isotropic and homogeneous, which does not apply to timber, and whilst that assumption can be made in regard to material like steel to within a reasonable approximation, once we start making it with timber this approximation goes to pieces. I think research into the relation between results obtained with 7/8 in. square specimen and those obtained with 2 in. square specimens is going to open up a very wide field of investigation and may involve the developing of a more complete design theory meeting the actual measured stress more closely.

Mr. Kloot: Recently I heard of a "statistical theory of failure". I understand that it is mainly used at the moment in regard to the strength of fibres, but we are looking at that particular theory with the idea of testing its application to the effect of specimen size on the strength of timber.

Chairman: Mr. Gordon went to F.A.O. and was with them for 15 months. When he returned we got an official request that they would like to make some recognition of his services. Consequently, he was appointed a member of the Sub-Committee on Mechanical Technology of Timber. There is not much opportunity of his attending the conferences, but we felt it was a good idea to have someone in Australia on the Committee. Dr. Cohen is likewise a member of the Sub-Committee on Wood Chemistry and we took advantage of the presence of Mr. Semmens of A.P.M. Ltd. while abroad for him to act as proxy on the Committee. We think it is highly desirable to keep in touch with the activities of the Sub-Committee.

6. GRADING INSTRUCTION

Mr. Turnbull: The status of grading has been duscussed at previous conferences and in 1947 it was agreed that steps should be taken to inaugurate instruction in grading. In the trade at present grading appears to have generally lapsed, partly because the active demand for timber enables the producers and distributors to market ungraded timber, partly because the principles underlying grading are not fully appreciated, and partly due to the absence of a trade organization that could train graders and promote the application of standard grades.

Standard grading rules can implement the results of studies on the quality characteristics of Australian timbers. Many studies have been carried out and draft grades have been prepared for and discussed intensively by grading committees representative of most interests concerned with timber utilization. Unfortunately a corresponding effort has not been expended to ensure that grading is practised in the timber trade. The Standards Association of Australia, the Division of Forest Products and the State Forest authorities have no powers for enforcement of standards. The consequential result in the engineering profession and the building industry is that sizes of timber considered to be required for safety when only ungraded timber is available continue to be specified. This is wasteful utilization. A further disturbing aspect is that the Handbook of Structural Timber Design, the Pamphlet on Building Frames, Timbers and Sizes and the associated standards which are logically based on standard grades, tend to become regarded as impracticable when graded timber is not procurable.

To ensure benefit from our improved knowledge of timber, we must strive for adoption of consistent grading practices. Instruction classes are believed to be a most urgent, desirable step to that end, and it is hoped that State Forest Services can include such classes in their immediate extension activities. The first draft of a proposed course is submitted for consideration and discussion. The Utilization officers of the Division of Forest Products will be glad to assist with the preparation of subject matter for a draft syllabus.

SYLLABUS FOR GRADING CLASSES

Lecture No. and Title	Subjects
Lectures Nos. 1 and 2 Timber Supply	(a) Principal timber producing species. (b) Nomenclature of Australian timbers. (c) Sources of supply. (d) Imported woods. (e) Production and consumption in Australia.
Lecture No. 3 Timber Forms	(a) Round timbers, logs, piles, poles, pulpwood. (b) Sawn timbers. (c) Hewn timbers. (d) Split timbers. (e) Veneers, peeled or sliced.
Lecture No. 4 Methods of Sawing	(a) Quarter sawing. (b) Random sawing. (c) Tolerances or size allowances. (d) Dimensional sawing.
Lectures Nos. 5 and 6 Defects in Sawn Timber	(a) Sloping grain. (b) Bow and/or spring. (c) End splits. (d) Checks. (e) Gum veins. (f) Gum pockets. (g) Sound knots. (h) Unsound knots.

SYLLABUS FOR GRADING CLASSES (Cont'd.)

Lecture No. and Title	Subjects
Lectures Nos. 5 and 6 Defects in Sawn Timber	(i) Knot holes. (j) Pin-holes. (k) Borer holes. (l) Termite galleries (m) Decay. (n) Stain. (o) Heart. (p) Shatter.
Lectures Nos. 7 and 8 Seasoning Methods	(a) The determination of moisture content in wood. (i) The effect of moisture content on properties. (ii) Equilibrium moisture content. (iii) Basis of expressing moisture content. (iv) Methods of determining moisture content. (b) Conditions necessary to dry timber. (i) Essentials for drying. (ii) Temperature considerations. (iii) Humidity considerations. (iv) Circulation considerations. (c) Air seasoning. (i) Principles of stacking practice. (ii) The stacking and air seasoning of boards. (iii) The stacking and air seasoning of crossarms and squares. (iv) The stacking and air seasoning of poles.
Lecture No. 9 Influence of Defects	(a) Appearance grades. (i) Natural finish. (ii) Painted finish. (b) Strength grades. Weakening effect of various defects singly and in combinations.

SYLLABUS FOR GRADING CLASSES (Cont'd.)

Lecture No. and Title	Subjects
Lectures Nos. 10 and 11 Specifications	(a) Sawn products. (i) Unseasoned dressing quality. (ii) Structural. (b) Milled products. (i) Flooring, lining and weatherboards. (c) Manufactured products.
Lecture No. 12 Objects of Grading, Present Status of Australian Timber Standards	Future work.

Mr. Taylor: The syllabus seems to be fully covered. Most of the ground is already covered at the Sydney Technical College. Much of the material that we use could be included in this course. We originally had one lecture set aside for the grading of timber. This has since been extended to three 2-hour lectures. The students we have in our classes may not necessarily be the type to need grading courses. It may be better for us to institute special course, using parts of the existing course, which would be more suitable for people interested in grading alone. We would be only too happy to co-operate in any way with Forest Products in instituting a course in N.S.W.

Mr. Ellis: I would like to make the Queensland position known. Grading classes may be good in N.S.W. and Victoria, but in Queensland it is generally felt that no purpose is served by teaching people the elements of grading rules because timber today is sold on the basis of being 100 per cent. first grade.

Mr. Moulds: What class of people do you propose to reach? How will you get them into the classes?

Mr. Clarke: This conference may care to draw attention to the need for grading classes and support for extending them. Until there is more training by the people in the industry it is going to be very difficult to raise grading standards.

Mr. Huddleston: I cannot see that any good objective will be reached by the training of operatives to grade timber because my experience has been that no matter how efficient an operative is in the application of standards to grading, his efforts are nullified to a great extent by yard managers, etc. who will not accept his grading. It seems to me we should endeavour to build up organizations throughout the industry similar to the Sydney Tallyman's Association where men can be certified by some authority as competent graders. These men could issue a certificate in regard to any particular class of timber, such certificate to be binding on all parties and should be a condition of the contract. We must have some body responsible for the examination of the graders, issue of certificates and cancellation of the certificate if necessary. The best body would be the National Association of Testing Authorities. This work was not originally contemplated by them, but I see no reason why it should not be made a branch of their activities.

Mr. Taylor: In discussions this year many students stated that the application of grading was very much tied up with price control. Grading will not be applied unless there is a satisfactory price incentive.

Mr. Turnbull: A great amount of work is wasted if there is no means of training these graders and enforcing standards. The whole basis of structural timber design and the whole code of building frame sizes depends on the segregation of the timber produced into various strength classes and quality groups.

Chairman: The position has arisen in Victoria where architects and builders are the arbiters of grading because the timber industry has taken no action and there is no recognized grading training. In Victoria we have been trying to get the Melbourne Technical School to start a course of wood technology and the course will begin as soon as the necessary lecturers are available.

Mr. Huddleston: We must educate executives as well as operators. We need some organization such as N.A.T.A. prepared to license timber yards as they propose to do with testing authorities.

Mr. Taylor: N.A.T.A. is purely a voluntary organization and executives would probably not be interested in applying for registration as suggested. I feel it would be hard to get the machinery working to have this service widely used. In the meantime it would be worth starting grading classes. It seems to me that some executives are beginning to take notice of the Wood Technology students in our present course. Grading classes would be a start in getting industry to accept principles of grading.

Mr. Payne: Education would have very limited results at the present time with the market in existing condition. In Tasmania sawmillers for the first time are displaying an interest in grading due to a developing interest in overseas markets as an outlet for our best quality hardwood. Managing Directors are not slow to realize that export trade must be built on goodwill and good material. There has been some discussion with the Commission about the desirability of an independent body such as the Commission being the inspecting authority to make certain that timber leaving Tasmania is in accordance with the specifications. Extension of grading must depend upon the feeling of a real need on the part of the people producing the timber.

Mr. Elliot: In other industries what has the Standards Association done to enforce their rules?

Mr. Turnbull: The way it operates is to bring all the people together who are interested in the subject. The Association has enlisted support of Government departments throughout the Commonwealth and many are pledged to adopt standards when they are issued. The Association is, however, purely voluntary and there is nothing in the nature of policing activity. It is left to the industry concerned to decide what degree of application a standard will enjoy.

Mr. Irvine: Cannot it legally enforce its standards?

Mr. Huddleston: Some standards have been written into Statutes, e.g., S.A.A. Wiring Rules and the Crane and Hoist Code, but that is more a matter for Parliament than for the industry.

Mr. Turnbull: Some larger Government departments do often include existing standards in their specifications, but there is no power of enforcement in our constitution. The position in U.S.A. and Canada is rather different because of the strength of the trade organizations. On the Pacific coast there are Lumbermen's Associations who prepare and issue grading rules and whose inspectors visit the respective mills seeing that the gradings are uniformly adhered to. Grading is widely accepted and the whole structure of the timber trade rests on grading.

Mr. Weston: In Western Australia grading rules are adhered to and a careful inspection of timber is carried out by our inspection branch, which has been working for many years. Prior to the war our Inspectoral Branch dealt with possibly 80 per cent. of timber produced, including nearly all export timber. At the present time we can sell anything, but that position will not last indefinitely and we have the opportunity now to get everything into working order and to put the position on a sound basis. In the application of grading rules our Inspectoral Branch works very smoothly. The timber merchants and sawmillers work in very well with the Branch as they find that the inspection of their timber is a safeguard for themselves. Grading rules are accepted in Western Australia and are revised from time to time in collaboration with the C.S.I.R.

Mr. Huddleston: We have had an inspection service in the N.S.W. Forestry Commission for many years. Practically all timber for export or supply to Government departments is inspected by that service. The service will inspect for private buyers on request, but apart from the export and Government orders, advantage is not taken of that inspection service today.

Chairman: There appears to be some doubt as to whether you want to go any further with this.

Mr. Huddleston: As far as instruction in N.S.W. is concerned, the Technical College has gone as far as it can with present staff.

Chairman: We would like to see something like that in Victoria. We feel that industry should help to get these classes going.

Mr. Irvine: In Victoria it is not quite as bad as in Queensland. The sawmillers have put out a price list on back of which certain specifications and grading rules appeared, but their members don't use it. The problem is not one so much of training operators but of the personnel position in the sawmilling industry. I think the question of adequate grading of timber must be solved, but it is very difficult with the present cycles of variations between the sellers' market and the buyers' market.

Mr. Turnbull: I feel that we should do the next step now.

Mr. Ellis: I do not regard the position as hopeless. Standards' rules are not related to trade rules in relation to price lists and should be re-examined.

Chairman: Somebody should approach N.A.T.A.

Mr. Huddleston: It would be desirable to approach S.S.T.I.S.

Mr. Ellis: I agree with Mr. Huddleston's suggestion.

Mr. Huddleston: I move that the attention of S.S.T.I.S. be drawn to the need for grading timber to secure its most efficient utilization.

Motion seconded by Mr. Taylor. Carried.

7. UNIFORM BUILDING REGULATIONS

Mr. Ellis: Building regulations in Queensland are a matter for local authorities. Does the same position exist in the other States? The whole question of uniform building regulations needs to be examined on an Australia wide basis. I understand that some local authorities are satisfied with a design based on 40 lb./sq.ft. of floor area for domestic buildings whereas others insist upon a loading of 120 lb./sq.ft.

Chairman: I understand that at one time the Standards Association intended to get out uniform building regulations, but that was not found practicable. The work that they did was taken as a basis by the B.I.C. who brought out uniform building regulations for Victoria. These were subsequently covered by regulations under an Act of Parliament. There is also a Building Regulations Committee in Victoria whose function is to interpret or to make any necessary interpretation of the regulations when necessary.

Mr. Huddleston: As far as the Standards Association is concerned, a specification has been prepared and published giving recommended sizes for domestic buildings. There is no power to compel adoption of these sizes by Councils. The position in New South Wales is that the Local Government Act, and only that Act, deals with minimum requirements for buildings erected in certain areas. We have taken up the question with the Building Regulations Committee. It is still competent for the local building inspector to have other sizes adopted as a minimum. Legal advice is that the Council would have difficulty in insisting on a higher standard than that laid down in the Act if the person concerned likes to force the issue. Apart from that we still have the local inspector with the power to increase sizes to meet local requirements.

Mr. Pearson: The C.S.I.R. Pamphlet No.112 "Building Frames" is incorporated in the Victorian Uniform Building Regulations, and gives the minimum permissible sizes. Recently the Building Regulations Committee requested Division of Forest Products to extract from the Pamphlet a schedule of the sizes of members for building frames for the most frequently used spans and spacings. This schedule would be included in the Regulations and as it would cover most building conditions would, in the opinion of the Committee, simplify administration. Pamphlet No.112 would still be the authority for other conditions. We sent with the schedule a note giving our reasons why sizes appropriate to standard grade material are adequate but we expect some discussion on that point.

Mr. Turnbull: Mr. Pearson's remarks illustrate that progress with uniform building regulations is bound up with grading and standards work. Pamphlet 112 and Australian Standard 0.56 to which it relates are schedules of building frame sizes for different strength groups of timbers in different standard grades. A few members of Building Research Committees who are in intimate contact with the building industry state that Australian Standard 0.56 and Pamphlet 112 are being disregarded because timber cannot be obtained in graded conditions. A Sectional Committee on Codes for Structural Timber has been set up and one of the items in its programme is a code for single storey domestic buildings. When this is prepared it might be very useful as a basic part of uniform building regulations.

Building Research

Mr. Turnbull: Forest products research workers may be interested to learn of new arrangements that have involved the formation of two committees to take active interest in building research.

Building Research and Development Advisory Committee

This Committee, set up under the Department of Works and Housing, is to advise the Commonwealth organizations concerned in building research and development on the technical problems of industry and advise where research investigations, development work, or technical liaison activity is required. It will also assist in the dissemination of knowledge of the activities of the organizations undertaking research in building and development work. Its membership is composed of technical men associated with buildings, construction and allied industries together with the departmental officers involved. The Chairman is Professor Mathieson, Dean, Faculty of Engineering, Melbourne University.

Building Research Committee

This Committee is responsible to the Executive Committee of C.S.I.R. Its personnel includes senior officers of the research, development and liaison organizations together with the Chairman and one other member of the Building Research and Development Advisory Committee. It will review the research programme proposed by each organization participating in its activities, and will prepare for the advice of each participating organization a research programme taking into account the recommendations of the Building Research and Development Advisory Committee of the Department of Works and Housing. The Chairman is Mr. I. Langlands, Officer in Charge, Building Research Laboratory, C.S.I.R. The Division of Forest Products is represented by the Chief, Mr. S. A. Clarke. At the initial meeting of this Committee held in August, 1948, the current and proposed programmes of the Building Research Laboratory, C.S.I.R. and of the Commonwealth Experimental Station, Department of Works and Housing were reviewed together with those projects that relate to building materials in the programmes of the Division of Forest Products, and the Division of Industrial Chemistry, C.S.I.R. The Committee endorsed these programmes.

. The interest of the Building Research Committee in the aspects of Forest Products research that affect building is worth noting, as from time to time its comment or recommendations may affect the co-ordinated Forest Products' programme.

Mr. Hartigan: It seems that we have here a Committee which might be interested in examining our statistical survey of pest damage in housing. This Committee could examine the results we collect.

Chairman: It is very interesting to know that you are carrying out that work, but how can we keep our Committee informed of the work on the building side.

Mr. Huddleston: We can make sure that you receive copies of our reports in this connection. I might explain for the information of the conference that officers of the Department of Works and Housing are continually carrying out inspections of a large number of houses for insect and fungus attack. Advantage was taken of these inspections to obtain more reliable information of the evidence of attack and its importance in and around the Sydney area. It is now proposed that the results be collected together and analysed instead of remaining as isolated reports in official files

Chairman: I think the next meeting of the Research Committee is early in December. If anyone has anything they would like to bring up we should be glad to have it before this date.

8. MILL STUDIES

Mr. Ellis: Much time has been spent in Queensland on mill studies. We have completed studies of thirteen mills and we aim to cover about four or five mills every year. Generally speaking, we work for two weeks at any one mill, usually during the University vacation periods with extra staff from under-graduates who are required to do some work of a practical nature in industry. The matter of the technique of mill studies, which came up at our last conference has been considered, but to a large extent our approach is different from that of the Division of Forest Products, and I feel that we would benefit by a general discussion concerning technique with officers of the Division of Forest Products and of the N.S.W. Forestry Commission, but circumstances, staff and time do not always permit our getting together when studies are being planned. Mr. Leslie (Biometrician, C.S.I.R.) came to see whether we could simplify our field and office work but his report is not yet finished. This year we intend to make special studies on cypress pine, particularly in regard to yellow doze. It might be of general interest if I explain our procedure in the mill. For this work we use a standard form (Form No.M.S.S.17) which we have found particularly useful.

Mr. Wright: In practical application of mill study technique one difficulty is that of keeping track of material from given logs after it has passed No.1 bench or No.2 bench and got down as far as No.3 bench. That bench is much slower than earlier benches and there is a great risk of material there being thoroughly mixed up. I would be glad if Mr. Ellis could indicate his method of overcoming this problem.

Mr. Ellis: We have met the problem in either of two ways. If we decide to mark each board an extra observer is generally required for the extra work involved. Alternatively, we aim to keep the product of each log separate in each operation in the mill. This latter procedure is not entirely satisfactory.

Mr. Wright: Like us, it appears that you have difficulty in keeping track of the logs. It may be of interest to mention that we use three different coloured crayons, namely, red, yellow and blue, on the ends of logs. We use these according to the colour of the timber, and to determine sequence.

Mr. Ellis: In our study on plantation timber at Passchendaell we did not keep a time record of logs individually, but merely took the overall time for groups of logs which had first been sorted into girth classes.

Mr. Wright: We have this year been doing mill studies on operative factors in Western Australian jarrah mills. We hope to have some information for distribution in another month or so on this particular work. The study brought forward two factors for observation, first the efficiency of equipment, and secondly the way the mill is run. From both aspects we were able to make some rather interesting observations. We propose to commence studies in a few weeks' time on the performance of a portable mill which has been observed by Mr. Clarke, and from which it was felt that useful information may be obtained. It is very pleasing to know that Queensland people are continuing to do mill studies. I think that we all agree that it is an important field of work.

Mr. Ellis: I understand that in N.S.W. mill studies do not come under the Division of Wood Technology.

Mr. Huddleston: They are not being done at the moment.

Mr. Ellis: It would be of general interest to other States represented at these conferences if a statement could be prepared by N.S.W. officers concerning the mill studies carried out in that State.

In connection with our work in Queensland there is one point I should like to raise for discussion. Our practice has been to record the time taken by each mill hand for each log and from these times, to calculate the wages cost against each log. I am not sure that this approach is the proper one. In mills which have not been "balanced", one particular operation - say the No.1 bench, may not be able to keep mill operators constantly occupied for the full working day. In such a case, the crew of the No.2 bench would work at varying rates of production, the rate for any particular log depending upon how much flitch material happened to be on the skids leading from No.1 bench. For this reason it is suggested that it would be sufficient to accept the time figures of No.1 bench as indicative of the cost of the overall milling operation.

Another point of interest arises in assessing the "efficiency factor" of any mill as regards utilization. It is a relatively simple matter to calculate percentage recovery of a net or gross hoppus basis, and it might be assumed that the mill which shows the higher percentage recovery would be the more efficient - that is if logs of the same general quality were being milled. The difficulty arises, however, that it is practically impossible to assess accurately the volume of defective or pipe material that any log might contain. A more direct attack on this problem would be to determine the volume of sound wood which is thrown out as waste or as fuel at the docker.

Mr. Wright: Mill studies cannot be done solely from a mathematical consideration of the problem: much depends on experienced observation. Parts of the studies can be carried out by measuring time and in this a fair degree of mathematical accuracy can be got. It must be recognized, however, that the efficiency of a study largely depends on the observation of the individuals. A competent observer can usually see whether the personnel are working well or not. I find that in practically every case the reverse is the case with the men generally working effectively and efficiently. With regard to waste, the study provides for the measuring of sawn sizes, so that by calculation of the volume of sawn timber and sawdust produced, a single subtraction from log volume gives the quantity of other waste which goes through the mill. If you find from your final comparison of graphs that Mill B has 50 per cent. less waste material than Mill A you get a pretty good idea of their relative efficiency.

Mr. Ellis: The Forest Officer may make say a 16 in. pipe allowance for any particular log but it might so happen that that allowance has been too generous, and that the allowance should have been only 14 in. or 12 in.

Mr. Wright: In any study it is of vital importance to have experienced people in the log yard, so as to obtain a true record of log quantity and size coming through. We keep a record not only of log dimensions but also with regard to extent of degrade, presence of decay, estimate of lost size in logs, all logs being checked by the person in the log yard.

Chairman: Wouldn't it be possible to measure the amount of material to go out in pipe. Pipe is cut out in square timber which may be measured.

Mr. Ellis: Not altogether. A log might appear to have an 8 in. pipe and the sawyer would then endeavour to cut out defective wood on the basis of an 8 in. pipe. However, when the log would be opened up, it might well be that the pipe extended to a 12 in. rot pocket so that the defective material could be calculated only by a reassessment which is rather difficult, particularly with irregular pipes.

Mr. Moulds: Might I enquire into the use of mill studies in Queensland, is it for variation in log grades and price approval?

Mr. Ellis: We have examined the studies to date to the stage where we have calculated manufacturing costs per 100 su.ft. solid sawn, and these figures have been used by the sawmill organization in their approach to Price's Authorities. We have found a big variation in labour cost from mill to mill as will be seen from the figures for labour cost over a number of hardwood mills:-

Mill A	-	4/2	per 100
Mill B	-	8/-	" "
Mill C	-	7/1	" "
Mill D	-	12/7	" "
Mill E	-	7/1	" "
Mill F	-	7/10	" "

While such figures have been very useful, as a Department we are probably more interested to determining the effect of girth and of defect on milling costs. When these relationships have been accurately determined, the Department will be in a sound position to lay down standards of utilization which at the moment may not be sound from either the miller's or the Department's points of view. At the present moment we require millers to take logs showing a certain amount of pipe depending upon the girth of the log concerned. It may be that we should insist upon logs with a greater amount of defect being taken by the mills.

We have not yet attempted to define log grades for hardwoods beyond "optional" and "compulsory". Our studies may ultimately indicate that more precise grades are practicable. Unfortunately our field work is very far ahead of our office work and it will be a considerable time before we shall be able to answer questions on grades.

Mr. Wright: Mr. Ellis is doing a grand job under great difficulty. I feel that a lot of the troubles he is at present experiencing will disappear when he has time to analyse his data and results are graphed or otherwise compared.

Mr. Ellis: We have been carrying out studies for 3 years and are about 5 per cent. along the way. I am envious of the progress made by the Division of Forest Products in their reports on mill studies. Their reports on cypress pine studies are an excellent piece of work which has proved of great value to us in many directions.

Mr. Bryant: How long does a mill study last?

Chairman: The longer the better, but in practice about a fortnight of working days.

Mr. Bryant: Does the observer affect the workers?

Mr. Wright: We have done a number of mills, but in only one mill, I feel, was our presence felt, and that was, if anything, to speed up the work.

Mr. Moulds: Small studies are being made of Eucalyptus areas in the vicinity of Melbourne, but they haven't gone very far yet.

Mr. Ellis: We regret that our results have not been available to all authorities here represented but should any organization like to see our studies or take part in them, we would be glad to have them along.

9. TESTS ON FLOORING TO DETERMINE MINIMUM THICKNESS

Mr. Ellis: In a report issued February 1948 by the Division of Forest Products on mechanical tests carried out on floor sections constructed with Pinus radiata 6 in. x 13/16 in. and 4 in. x 13/16 in., a small reduction in thickness or an increase in joist spacing is recommended.

Similar work was carried out on Victorian mountain ash some time ago and a similar recommendation was made with respect to this timber.

We had requested the Division of Forest Products to include Queensland species in the series of tests, but it had been decided to defer the tests on Queensland timbers for the time being until results of tests on other species had been concluded.

The majority of the Queensland timbers being used for flooring would generally be much stronger than the mountain ash of Victoria, and on the reports issued so far it would appear reduction in thickness of Queensland timbers for flooring could safely be effected.

What action can best be taken by this conference to make use of the economy permitted by these tests?

Mr. Kloot: The findings up to data have been virtually incorporated in the Standards Association Standard No. 0.56, in that for all timbers of strength groups, A, B, C and D certain specified sizes are given for floor thickness and joist spacing. We have covered nine species which we feel is a good cross section of the timbers used in flooring and it is now only a matter of knowing the mechanical properties of a timber to be able to calculate corresponding floor thicknesses and joist spacings.

Mr. Huddleston: The size of flooring is the subject of a great deal of discussion. Tests and calculations have shown that in cases where wear is not important certain minimum thicknesses would be satisfactory. Only experience will tell just how long the floor will remain satisfactory. In the case of covered flooring the sizes shown by test can undoubtedly be used but in uncovered floors more timber may have to be provided to allow for wear.

Mr. Kloot: There is a slight margin for wear.

Chairman: For floors in certain types of buildings, such as assembly halls, tenements, flats, etc., it would be necessary to take wear into account but not in cottages.

10. DURABILITY TESTS

Field Tests, Laboratory Tests and Tests on Hardwoods of Different Rates of Growth

Mr. Hartigan: It has been finally agreed to make this project a Commonwealth wide one with field tests conducted by State organizations under the aegis of the Division of Forest Products Preservation Section.

The test we envisage is a speeded up field test.

Stakes six feet long and cut from truewood and sapwood of selected species will be set up in randomized groups at selected sites which will cover in an approximate way the condition likely to be met throughout the State in regard to rainfall and soil conditions.

As far as possible we want to avoid termite damage because we are only considering the effect of decay.

We propose inspecting these stakes at quarterly intervals, and by applying a force proportional to the modulus of rupture of the timber concerned by means of a spring balance, determine the period over which the stakes withstand such a load.

With 100 species of timber, six sites and allowance for statistical significance, the number of stakes required is 9000.

I am inclined to think that if we considered only half this number we would be doing very well indeed.

Mr. Tamblyn, I believe, favours a large stake, say 6 ft. x 2 in. x 2 in., on the ground that such a stake is a better compromise between really large timber and laboratory test fragments. I do not see anything wrong in this, although certainly it will prolong the test fairly considerably.

This project, then, if all parties are agreeable, is really a matter of organization at this stage.

I would suggest that it be entitled a joint project between the States and the Commonwealth and that the work of planning, erection and examination be done by a committee comprising the 3 States most interested i.e. Queensland, New South Wales and Western Australia with the Division of Forest Products member as Chairman of the Committee.

I think this project is sufficiently important to warrant its treatment in this way, since upon the results of our findings will rest the future of a lot of structural hardwood utilization.

Such work will also be the basis for computing gains offered by timber preservation and the value of re-forestation in certain areas.

In short the questions of natural durability is inextricably bound up with economic forestry, utilization and preservation.

We need authoritative results based on tests in place of opinions which are often contradictory.

For laboratory tests to have any significance in this type of work many samples are needed and adequate staff is required to handle these. In addition, a properly equipped laboratory is essential. Since locality is not important in this matter it would be more convenient to centralize this work at D.F.P.

The main object of laboratory tests is to see how far lab. tests, either with Kollé flasks or soil jars and with known strains of fungi, follow results of field tests.

Assuming that a relationship can be established, it should be possible to extent the study to controlled tests on preservatives.

This work is not original in that all forest product organizations in the world have much work in progress, but it has yet to be performed for Australian woods.

Without such data we are at a disadvantage in advising in preservation treatment, and our aim must always be to stock ourselves with information which has a bearing on greater utilization of native species by means of appropriate preservation treatment.

The difficulty usually encountered with laboratory scale experiments is that they are not statistically significant because small errors in technique have a disproportional effect in the final result to what would occur under practical conditions. Thus we have recently examined a series of panels which had been exposed on the roof top of this Division for 10 years. This was a test for weathering, but because the panels were on ledges which kept water in contact with the end of the panels decay has affected many of them badly. In such a test, to be significant, many more panels are needed and the technique, simple that it is, must be examined more carefully.

If the Division of Forest Products feels that we may be of use in such laboratory tests in some way by attending to small matters which arise out of the tests themselves then we are, of course, only too willing to assist in every way we can.

Questions of technique in the Leutritz method are tricky. One does not know, for example, to what extent we are justified in using a starter block of one species of timber to encourage a fungus to grow on the test block of another species of timber.

Then the relation between growth in constant humidity and temperature rooms and natural conditions of heat and cold, light and dark are not well understood.

A few weeks back I accidentally obtained a very fine fructification of a Plaurotus sp. in a test tube containing malt agar which had been broken and left in a sink for some days. I am now trying to repeat this phenomenon with the same strain.

<u>Mr. Tamblyn</u>: The central theme of our project is the testing of durability by laboratory methods. Quite a considerable amount of work has been done on the Kollé flask and soil jar methods with the object of standardizing technique and we are almost ready to start large scale comparative testing.

I have listed 107 Australian timbers which we consider are important enough to be rated for durability. Some of these are already classified in the "Timber Handbook", others are sufficiently well known for some reasonable estimate of durability to be made, but many are difficult to place in a durability classification on the meagre records available. In our tentative plan we propose subjecting all these timbers to routine laboratory tests using 2 or 3 methods (Kollé and 2 variations of the soil jar technique) and a number of different test fungi. The work will be spread over perhaps 10 years but will give an increasingly precise quantitative measure of durability to decay under standardized conditions. We have staff ready to start this work and we are building a large temperature humidity controlled room which will permit up to 6000 tests each year. The main difficulty will be to secure representative material for each species to be tested and here we hope for the co-operation of the State Forest Services without which the work cannot really succeed.

In planning this work, we have the following objects in view.

1. To compare Australian timbers of commercial importance according to decay durability as determined by wood block laboratory tests.
2. To arrange for termite durability tests with the Division of Economic Entomology for timbers not already tested or listed for test. The material for termite and decay durability tests will be matched.
3. To set up field tests of a representative number of species (say 25 selected from the 107) to establish the relationship between laboratory and field tests for decay and termite durability. Field test material will be matched with laboratory test blocks.
4. By testing a number of trees from each species selected from localities representative of its growth range, to determine the variability within a species.
5. To include a number of durable overseas timbers in all tests to act as an international yard-stick for durability ratings.

6. To arrange co-operation in these tests with overseas forest products laboratories so that some parts of the test can be of an international character. In this connection I have written to Princes Risborough asking if they will be prepared to act as the central organizer for an international durability test in which each country co-operating will field test its own timbers against a selected set of samples which include some Australian timbers.

Further I have asked the Princes Risborough Laboratory if they would be interested in doing Kollè flask tests on the international field test set of timbers for comparison with our results from the soil jar and Kollé technique with the object of standardizing on a laboratory method which best reflects the field test results. Princes Risborough is particularly interested in this subject and was responsible for the British Standard Specification on durability testing. Some other laboratories (Canada, Madison etc.) are interested in durability testing by the soil jar method and may be prepared to co-operate. By this means we will ultimately, I hope, be able to standardize on a testing technique eventually acceptable to everyone. Our tests will include comparisons of various techniques using matched material.

7. As an extension of this work we propose later to investigate durability pattern within a tree for some of the more important species and also to include tests on material grown under different conditions - i.e. fast grown, slow grown, timber from treated forests.

8. The fundamental aspects of durability will be covered ultimately in the tentative plan. Each specimen tested will have cut from it a spare piece which will be available for chemical examination when time permits a study of the reasons for durability.
9. Finally we will shortly be in a position to test timbers from New Guinea and the Pacific area generally if durability ratings are required. This is a corollary and not an object of the tests as planned at present.

Re Mr. Hartigan's remarks, the method of field testing is relatively immaterial. The scheme we have in mind is to place emphasis on laboratory tests, as it would be impossible to carry out field tests on a sufficiently large number of species. The object of a field test is simply to confirm the results of laboratory testing. We would not eliminate termite field testing as proposed by Mr. Hartigan but whether or not we use long specimens or small specimens is immaterial at this stage. The suggestion that work be co-ordinated by a committee is an excellent one and would give ample scope for all services to co-operate in an inspection of field tests.

Mr. Hartigan: The aspect of making the laboratory test the important one and the field test the subsidiary test is new to me and is open to argument. Laboratory tests being on a smaller scale any variation in technique gives widely divergent results unless you take very large number of samples.

Mr. Tamblyn: We propose testing 10 trees of each species by 3 methods until satisfied with the durability rating to decay of each species.

Mr. Ellis: We would like tests on fast and slow grown timbers included. With regard to Mr. Tamblyn's proposals, could we get some indication at this stage what are the pros and cons of laboratory tests v. field tests. I gather from reading that the overseas tendency is for accelerated field tests as they give a more practical indication of the tie-up in the finished job. Would it not be possible for Mr. Tamblyn to include accelerated field tests as part of the whole set-up if acceptable to the Division of Wood Technology.

Mr. Tamblyn: We did intend using 2 in. x 2 in. specimens for field tests, and were going to base our final conclusions on the results of the selected set of field test specimens. Provided these agree with the results from the corresponding laboratory set, we would accept all laboratory results without further field test. I can see no better test than the laboratory test. Field testing is difficult, as you must select a test site which is representative of an area and realize that results may differ from one area to another. With a controlled laboratory test you get a picture of relative durability to decay against the actual organisms you test under entirely standard conditions. Field testing is not so satisfactory as you have changing conditions on the actual site itself over a number of years. Laboratory results can be guaranteed to be reproducible and also the testing method is easier in manipulation in that you use very small specimens. Also it is necessary to separate durability to decay from durability to termites and to do that effectively you have to do it by laboratory test.

Mr. Hartigan: Could we compromise and use field tests as part of the main plan, making the N.S.W. test for field durability for a limited number of timbers - no more than 20?

Mr. Tamblyn: Quite an excellent idea to have parts of the test repeated for confirmation of result.

Mr. Hartigan: Tests could be repeated in other States. In the soil-jar method several fungi may interact. Also constant temperature of the laboratory is not a natural condition.

Mr. Tamblyn: That would be covered.

Mr. Bryant: I think, with Mr. Tamblyn, that the only way to tackle the problem is to correlate field tests with laboratory tests, but make the laboratory tests the main ones.

Mr. Cokley: The problem with field tests is that observations will be made in each State by different observers and our experience has been that different observers report different results. This does not happen in laboratory tests.

Mr. Taylor: One member of D.F.P. could be present at all inspections.

Mr. Tamblyn: I would like to see several people inspecting field test specimens. Most people will arrive at the same conclusion as regards relative durability, but not as to when a specimen has failed. It is relative durability only that we want.

Mr. Hartigan: The spring balance technique was to eliminate the human factor.

Mr. Clarke: Will you take as your criterion the period elapsing before you get collapse under standard load.

Mr. Huddleston: Not under standard load, but of 25 per cent. of M. of R. of initial strength.

Mr. Clarke: Do you consider it would be reasonable to get large quantities of specimens 6 ft. x 1 in. x 1 in., perfectly straight grained.

Mr. Huddleston: In N.S.W. species, yes - brush box may be an exception.

Mr. Clarke: Jarrah and karri are out then?

Mr. Huddleston: Most of the timbers we are concerned with here are not greatly interlocked.

Mr. Clarke: What about attachments for ends of specimens?

Mr. Huddleston: We proposed to use an iron ring near the end. The distance from the ground to the attachment being such that there is a constant load on the balance for all specimens.

Mr. Clarke: How would you get on in different classes of soil, e.g., wet loam, clayey soil?

Mr. Huddleston: Conditions would be different, but we would have duplicate sets on each type of soil.

Mr. Taylor: We are already arranging a collection of samples for the Division of Economic Entomology in connection with the termite test, and sending offcuts to the Division of Forest Products. Would that give you the matched samples required?

Mr. Tamblyn: Yes. Queensland have supplied matched material from all specimens sent to Canberra, probably amounting to some two or three hundred specimens by now.

Personally, I think the idea of the spring balance test is a good one if you are going to make the field test the main one, but will require much attention. Also termite attack would invalidate this method if the specimens become nibbled at ground line.

Mr. Clarke: Would it be possible to work on the deflection technique?

Mr. Huddleston: It could be done, but would depend on soil conditions. The various points raised by Mr. Tamblyn have been considered, particularly the question of termite attack and when we originally planned this the subject of termite attack was discussed very carefully. We actually issued instructions to foresters to select suitable sites and set out the type of soil and conditions required in each district. One was that the site must be relatively free from termites and we suggested that the site be ringed with poisoned oregon as a guard against termites. I am in accord with the proposals put forward by Mr. Tamblyn, provided we have sufficient field tests to correlate the results of the laboratory investigations with actual field conditions.

Mr. Cokley: An item I noticed in an American journal recently dealt with these tests and described how a small portable X-ray plant has been used in U.S.A. to determine the extent of decay.

Mr. Tamblyn: About 1939 or 1940 we produced a report on the X-ray method. A number of plates were taken at a time, from series of specimens selected with varying internal defects. The method did not identify the reason for change in density shown on plate.

Mr. Irvine: Laboratory tests may give much useful information but only one set of conditions is operating and all factors are not integrated. There is a prejudice by engineers, architects etc., against applying laboratory tests directly, so field tests will still be necessary.

Mr. Tamblyn: These tests are to determine relative durability not service life. For the latter field tests are desirable.

Mr. Turnbull: Allowances for weathering conditions may be desirable. Temperature and humidity variations on the sites may cause some species to check more freely than others, and so allow entrance of fungi.

Mr. Hartigan: What field tests are you going to do?

Mr. Tamblyn: Perhaps six at different sites. Each State may do its own tests, the method doesn't matter as approximately the same relative durability should be reached by each method.

Mr. Huddleston: No. Sticks of the same size will have certain relative durability at one site but it may be different at other sites.

Mr. McAdam: Or at different places on the same site.

Mr. Huddleston: We have considered site variables and Mr. Leslie is responsible for a lay-out which will randomize tests to allow for these variables.

Mr. Irvine: In soil jar tests it may happen that although everything is the same the inoculum may fail to take as the particular conditions in some way prevent attack.

Mr. Wright: There is much merit in Mr. Tamblyn's plans owing to the huge number of tests. Laboratory tests will give you the general background which can be checked by your field tests.

Mr. Tamblyn: There will be about 500 tests per species. The laboratory test, when standardized, will be a very useful tool which will give the answer in a few months.

Mr. Huddleston: I agree with Mr. Tamblyn entirely, particularly in getting international co-operation.

Mr. Clarke: Any accelerated tests will have difficulties. Both laboratory and field tests have advantages and I suggest we go ahead in the way suggested and see how we go in a few years' time when there is sufficient information available to be able to review the whole project. Does that cover the position?

Mr. Tamblyn: It will be a big job to collect the material. It must be selected at random from butt and top of representative trees.

Mr. Weston: I cannot speak definitely for Western Australia but I do not think the Conservator will be keen to take part in supplying material as we already have much information about our own timbers, not only in Australia but in other parts of the world. We are more interested in treatment methods for our non-durable species.

Mr. Ellis: It would be a pity if jarrah were not included as a standard.

Mr. Tamblyn: Jarrah will be included whether obtained from the Western Australian Forest Department or obtained from the open market.

New South Wales, New Guinea, Queensland, Victoria, South Australia said they would co-operate.

Mr. Payne: In Tasmania it would depend on the magnitude of the task. I would like to see material for all tests collected at the one time if possible.

Mr. Clarke: D.F.P. is going to have a collector shortly who will be of use in this matter. Does the conference want a committee to co-ordinate the project?

Mr. Huddleston: No. In New South Wales we would like to see the working plan before the work actually commences.

Mr. McAdam: I should like to see a working plan to know what material is required.

Mr. Huddleston: I think it would be desirable to have different methods of field testing in different States as that would check the method as well as the relative durability.

Mr. Clarke: Working plans will be circulated.

11. POLE TESTS

(a) Field Tests

Mr. Hartigan: Some form of interim report should be made available to the public on the results of the pole and fence post preservation tests which are now showing fairly clear indications of probable service life. These tests have been installed for 12 - 16 years or and I think I am being fair in saying that 10 years is a reasonable period from which to begin to note significant divergences according to methods of treatment.

At the 15 year stage of test it becomes fairly definite which treatments are going to be of significant value, although statistical analysis will be necessary to arrive at determination of relative merits. This is not an argument for discontinuing observations on tests which have reached the 15 year stage.

It is my contention that pole using authorities are more interested in the best treatments than in those which have some merit but are still fairly well down the scale of effectiveness.

Opinions have been formed by those who have attended pole inspections and I feel that some conclusions are a little confused, mainly because those forming them have not had before them all the evidence that has been collected.

These tests are, of course, the responsibility of C.S.I.R. and I do not want to give the impression that I am in any better position to judge the right time to make the results public than the officers who are carrying them out.

I am aware of the need for caution in making assessments, particularly when such assessments will have to stand the test of time and usage, but when all the risks that I can see are weighed, I still think that it would be better to have available a balanced judgement on these tests now in the form of a report, than for these tests to peter out unhappily over another 10 years.

As an addendum to the above remarks and as a further suggestion - if indeed I have the right to make such a suggestion - reports on pole treatments are not complete unless they include some discussion on the monetary value of treatments, also the comparative costs of such treatments.

In a scientific report it is generally the practice to avoid such discussion because costs vary such a lot from year to year. I am wondering if there is any way of including such a discussion on costs as an appendix to the report, with costs, of course, worked out on present day values.

(b) New Series of Tests

Now that we are fairly embarked on the task of testing preservatives and methods on Australian woods under native conditions there is no question of retiring from the field on the basis of the tests which are under way or nearing completion

In planning a new series of tests, the first embarrassment we meet is how to confine such tests to the irreducible minimum and still obtain the information that is required.

It would be desirable if possible to make all these tests cumulative in design i.e. series I eliminates certain lines of procedure, series II concentrates on the avenues still opening and so on.

As an example we would seem to be in safe grounds in confining our attention to creosote, copper naphthenate and perhaps pentachlorphenol as preservatives in our next series of tests.

This is, of course, open to improvement on the grounds that we have not given much attention to salt combinations of the style of chromated zinc chloride, aczol, Wolman salts etc.

For timber species we must look ahead andpay particular attention to those timbers which we anticipate will be the structural timbers available when the present naturally more durable timbers run out. In N.S.W. this must include blackbutt, spotted gum, perhaps Sydney blue gum and radiata pine.

For methods we must concentrate on the various modifications of the hot and cold bath with particular accent on ease of manipulation for on-the-job application. If we find it within our capacity we should also give attention to pressure impregnation with creosote and

Wolman salts for special constructional work - small ships, sleepers, piling in tropical waters and so on.

Then there is the question of location and care of inspection.

Pole and sleeper tests in Northern Queensland and piling tests along the northern and western coasts of the Continent and New Guinea are desirable but the question of inspection becomes almost insuperable. Even with the comparatively few locations being inspected at present it must be extremely difficult for D.F.P. officers to get around to all of them. Is there then any other way of conducting these tests which would spread the work of inspection more fairly and yet at the same time keep the tests integrated under one authority for comparison? Perhaps if C.S.I.R. superintended the setting up of tests to a common master plan the inspections might be conducted by local authorities working according to a suggested formula. Inspection by D.F.P. officers could then be regulated according to the progress of the tests as reported by these local authorities.

Mr. Tamblyn: In the first place, I thoroughly agree that the sooner we publish results of our pole tests the sooner some action will be taken. We discussed this at previous conferences and decided to fire all our shots at the most representative audience of pole authorities we could gather together. We were going to have a film showing test sites that could not easily be inspected and have lectures or discussions on the availability of species for future tests, pole preservation, and generally try to put over the results of our tests. However, the time is not opportune at present. All pole using authorities are so short of poles that of necessity they are using them green. Our treatment must be done on dry poles and it seems to me bad psychology to gather a lot of people together and tell them the treatment they must use is one that is not at present practicable. We have attempted to overcome the difficulty by circulating our pole reports very widely. We have tried to make those reports more approaching publication standard than in the past. We have included a photographic record in them and have summarized the details of the tests and previous inspections giving very definite recommendations in the summary. Mr. Hartigan's remarks re the cost of treatment are quite pertinent, but actually the cost of treatment is almost immaterial in a pole. It costs say, £20 or so to erect a pole or to re-place a pole, and it doesn't matter whether the cost of the preserving treatment is 10/- or £1 if the service life is increased by several years. If you pay too much attention to the initial cost of treatment you are apt to select a treatment which actually gives less saving in the long run. You should select the best treatment, irrespective of cost. As regards location - we are very keen on setting up a new series as soon as possible because we believe the object lesson of the pole test will have to be repeated again and again to put over the results. Every new test will probably improve on the preservation method found to be the best in the previous test. The location of the new test should, I think, be more accessible than the previous ones as they are meant to draw an audience, the individuals of which will later be supplied with a report to jog the memory. We should strive to place the new tests in the most accessible position possible so as to get the largest gathering there. As for the preservatives to be used - on present results we should include pentachlorphenol for test against creosote. Copper naphthenate should be definitely included together with fixed water solubles such as the proprietary preservatives, - Wolman salts, Bolidens, Greensalt, Alcure, etc. and the non-proprietary chromated zinc. Although tests have not been very favourable to water solubles they have the advantage of cleanliness which creosote oil does not possess and they would cheapen the chemical cost of treatment.

Mr. Huddleston: I cannot agree with Mr. Tamblyn that the time is not opportune to publicize these results. Pole using authorities are so short of poles that poles are going into the ground green but at the same time they are continuing to order ironbark, tallowwood, grey box and other accepted pole timbers. We have blackbutt and spotted gum areas, where trees of smaller pole sizes are being felled for timber stand improvement purposes. We have no market for those trees and they have to be left on the ground. If pole using authorities would agree to use those species with pressure treatment poles could be obtained by cutting slightly larger trees in timber stand improvement to the benefit of the forest, a reduction in cost of timber stand improvement, and would provide an additional supply of poles which could be dumped at central depots for seasoning. Now with regard to the new series of tests. I feel at the present time we are a little bit premature. The Hickson Timber Impregnation Co. is setting up a plant for the treatment of timber, including poles, and we are setting up the Putney plant. I feel that any new series of tests should include the timber treatments in both those plants. It may be better to go ahead and plan our new series of tests, but defer a start on them for 12 months. As far as poles are concerned, it is a matter concerning us very vitally in N.S.W. because we have big schemes of rural electrification. There is a big demand for poles which we cannot satisfy. Anything we can do to introduce the less durable species, which generally speaking are of good pole form, would materially help, not so much now but in 2 or 3 years time, when the demands seem likely to reach their peak.

With regard to the location of the sites, I would suggest that in N.S.W. they be located in the State forests alongside the 3-chain clearings that accompany some of our major transmission lines. We could put up notices facing the transmission lines - "This is a field test site maintained by the Division of Forest Products and the State Forestry Commission for effectiveness of pole treatment". Engineers are constantly travelling along those main transmission lines, and as they do so they will see the notices, inspect them and of their own free will publicize the results. We can find suitable sites in N.S.W.

Mr. Moulds: I think Mr. Hartigan's suggestion as regards publication definitely has merit, especially if species important to Victoria - messmate stringybark, silvertop ash - are showing at this stage better results than might have been anticipated. These particular species are in plentiful supply in Victoria, and in that connection I support Mr. Huddleston's remarks. Publication of work along those lines will help to prepare the pole using authorities for the final issue of the results, and it will be the first step towards the removal of certain unwarranted prejudices against the use of those and similar timbers.

Mr. Weston: I would like to support those gentlemen regarding publication. The demand all the time is for our more durable poles, and we are particularly concerned about the demand for the taller ones. In this way they take the best stock out of our forests. With preservative treatment it is possible to substitute karri or marri poles. If we have that information made available we could counter prejudice.

Mr. Irvine: Pole timbers commonly contain a certain amount of decay. If the decay is visible they are immediately rejected, or at least long butted to remove the decay. Is it possible to plan a series of tests on poles containing certain visible defects which are now causes for rejection? Some of them, I am quite sure, are of not much importance in the service life of the poles.

Mr. Weston: In our State we have introduced grading rules in line with the actual grade requirements and are able to get certain defects accepted. Gradually we were able to educate users to the fact that many of these defects were not detrimental to the life of the pole, and very often not to the appearance. In my opinion it goes to point out the necessity for having grading rules which will eventually be accepted as they have been in Western Australia. In Western Australia we work to certain standards for poles, and no supplier will supply to any other standard.

Mr. Turnbull: Suppliers have an interest in this matter, and they must realize that every unnecessary provision in a specification needlessly handicaps supply. They should be informed that there are more demands for faultless timber than our forests can supply, and that it is necessary to rationalize grades so that quality demanded is appropriate to the use. Every opportunity of this nature should be seized to make the descriptions of products fit the quality that can be procured.

Mr. Tamblyn: I believe it is a sign of weakness to set up a test to show what we already know - that certain defects, mechanical ones mostly, are not important. But where it is fairly obvious that a defect is causing early failure of the pole, that is a good reason for rejection. Ultimately the supply position will correct the fault and until it does then the buyer has a right to demand what he wants.

In connection with publication, we have in every test inspected in the last two years invited every important pole using authority in the State in which it is located. We have sent personal copies of each report to every person who attends and the distribution of the report has been in the neighbourhool of 300. I do not see how just another effort of publication with the same sort of circulation can do any better than the present reports. The only way I can see of achieving any advance is to have this symposium with the pole authorities and impress them sufficiently so that they'll really want the treatments; and we cannot do that until the recommendations can be applied - until it is practicable to get dry poles for treatment. I suggest that we print our next inspection report, and repeat the same recommendation - open tank treatment with creosote oil. One other treatment looks good - cold soak treatment with copper napthenate - but I am cautious about recommending it because the preservative used was a proprietary line containing a different vehicle from that used by Australian manufacturers. I can say no more because the formula was given us in confidence and we cannot reveal it. We are in a difficult spot with that treatment and really have only one treatment to recommend.

Mr. Huddleston: As far as the engineering profession is concerned, internal reports are unsatisfactory and suggest you are not prepared to stand by your results sufficiently to allow them to be published.

Mr. Taylor: I think there is quite a lot of merit in the suggestion that we have this symposium, and I cannot quite understand Mr. Tamblyn's objection to holding this symposium now because it is not practicable to get seasoned poles. I think if the green poles are being used, there is all the more reason for a symposium. We could point out what ought to be done, and if it is not practicable to do it, we could give an alternative suggestion as to how to get the best life out of the green poles they are using now. We are in a position to give some advice on that.

Mr. Huddleston: Many poles are left for considerable periods before being consigned due to restrictions on transport at the present time.

Mr. Tamblyn: I have discussed this with a number of pole engineers, and they have one and all raised the objection that they cannot adopt the treatment recommended because they cannot afford to season their poles in the present stress of short supply and delayed maintenance. I do think if we fire the shot too early there is a danger of losing the results of 15 years' test. You can never re-fire a shot with the same effect.

Mr. Huddleston: I move that the results of the pole tests be published as soon as possible, and that a symposium be arranged as soon as convenient thereafter.

Mr. Hartigan: I second that.

Mr. Ellis: Does that current bulletin include figures on cost? I do feel it is most important to back this symposium up with practical results - a clear, lucid statement of costs, including installation, overhead and other aspects of cost associated with it.

Mr. Tamblyn: It would automatically include costs.

The motion was put and carried. (Against:- Tamblyn and Cokley - the rest in favour.)

Mr. Huddleston: I would like to move that the publication take the form of a revision of your bulletin dealing with poles. That bulletin was published some years ago, and I think it could quite easily be brought up to date with the additional information now obtained from your pole tests.

Mr. Taylor: I second that.

Mr. Irvine: I am against the motion because a revision of a publication in many ways plays down the new results incorporated in it. The particular purpose of publication of pole test results is to highlight the successful treatments. A revision of an existing publication would tend to fail in its impact on the pole using and pole producing authorities.

Mr. Tamblyn: That bulletin was written by Mr. Cummins and is tedious in some ways. It is very difficult for anyone to revise anyone else's publication, and in the case of that particular publication it would mean scrapping large sections and completely renovating it. I am in favour of producing an entirely new bulletin and letting that one rest as it is.

Mr. Huddleston: May I suggest an alternative to the motion - that the publication take the form of a bulletin superseding the previous bulletin. Publication of pole test results could be stated clearly on the title page of the bulletin. It could be made perfectly clear that new data obtained as a result of pole tests made it necessary to revise the bulletin. I feel the publication would be more useful if some of that other data contained in your previous bulletin was brought up to date and included in the new publication.

Chairman: The publication would be a comprehensive one on poles and pole treatment.

Mr. Huddleston: Yes, that would be suitable.

Mr. Irvine: I am not happy about that.

Mr. Moulds: I feel that the bringing forward to the public and pole using authorities of these pole results after a period of 10 years should be something quite distinct from the existing matter published.

Chairman: The proposal now is to get out a new pole bulletin quite up-to-date in all respects.

Mr. Huddleston: That will not necessarily highlight the results of the new tests.

Chairman: That could be overcome. They could be published in the Journal of C.S.I.R. and incorporated subsequently in a comprehensive bulletin without rewriting them.

Mr. Payne: Is it the desire of this conference to advise the Division of Forest Products on how to publish the information? Surely your officers have not had an opportunity yet of considering this matter - they have not been fully informed - and any resolutions passed here tonight may subsequently cause embarrassment.

Chairman: We won't worry about that. We want an expression of the opinion of the conference. It is only a recommendation.

Mr: Gray: What specific matters would Mr. Huddleston like to have included in the new bulletin?

Mr. Huddleston: Service life of untreated poles and the sections dealing with identification of pole timbers.

Mr. Cokley: By the time the publication has been revised you will have the results of a further inspection, so my own feelings would be to completely ignore the other pamphlet and concentrate only on these particular tests.

Mr. Tamblyn: I appreciate Mr. Huddleston's suggestion that we should do something to bring up to date this general information on poles. But I do not feel that this other publication on the results of pole tests to date is the right publication in which to incorporate that information. I feel that the two should be quite separate, if you are going to make the most out of this recommendation. You cannot incorporate that other bulletin without making it a re-hash.

Chairman: Are we all agreed that what we need is general information on poles, publication of the results of our pole tests, and information on the cost of treatment? Those are the main points that people are interested in. We have heard all your opinions here. Will you leave it to us to chew over and see how best we can meet those requirements?

Mr. Hartigan: No-one has commented on the suggestion about treating piling in New Guinea area.

Chairman: There is no need to try out tests to justify impregnation with creosote on marine piling.

Mr. McAdam: In New Guinea steel piling is used for new wharves.

Mr. Huddleston: I move "That a working plan for a new series of tests be put in hand".

Motion seconded by Mr. Hartigan. Carried.

12. AUSTRALIAN STANDARDS: RAILWAY SLEEPERS, WIDE AND NARROW GAUGE

Mr. Huddleston: At the two previous conferences it was decided to prepare a standard specification for railway sleepers. The request has been forwarded to the Standards Association, which is beginning a specification. However, about 2 months ago, I received copies of an interim specification for a narrow gauge railway line for cane sugar. It was prepared by a body in Queensland calling themselves the Sugar Technologists Association, and was forwarded to the Standards Association for issue as an interim specification. The Association before issuing it sent it out, for comment, to all committees dealing with the timber industry. I commented that the specification was bad, that it should not be issued, and that the matter of specifications for railway sleepers, both wide and narrow gauge, should be referred to the proposed timber industries committee. The Association replied that the delay would be too great and that they proposed to refer the specification to the N.S.W. sub-committee of the timber section for comment. As chairman of the N.S.W. committee, I can only say it has not been so referred. I was a little bit concerned with the specification because I had in mind the specification adopted by the N.S.W. railways for railway sleepers, a copy of which I have here. It lists the timbers that will be accepted for sleepers and then it goes on to say:-

"They must be straight, square and out of winding, free from sapwood except on edges, where an allowance of sapwood will be accepted if it does not exceed ¼ in. on the side and 1 in. on the top, sawn from large trees, free from wane, heart, large knots and shakes. Sleepers cut from dead trees not to be accepted. The contractor to find all labour necessary for handling the sleepers during inspection, at his own cost and no inspection for the purpose of passing sleepers will be made unless a sufficient number of men be provided by the contractor for propertly handling them.

Any sleeper cut on the quarter will be rejected. All sleepers are to be passed and branded by the Departmental Inspector before payment will be made.

Sleepers are to be 9 in. wide, $4\frac{1}{2}$ in. in depth and not less than 8 ft. long."

The proposed interim specification more or less perpetuated the same errors shown in the N.S.W. railway specification, and created others, and I feel that its issue would act as a hindrance in preparing a specification for railway sleepers for wide gauge railways. Some years ago I investigated the relative merits of quarter-sawn and back-sawn sleepers using the cleavage test, and, as far as laboratory tests could indicate on many accepted sleeper timbers in N.S.W., there was no justification for the railways requiring sleepers to be back-sawn because quarter-sawn sleepers split more easily than back-sawn. Taking the cleavage test as an indication of splitting of timber, I would **expect** the quarter-sawn sleepers to offer, on the average, roughly more than 12 per cent. higher resistance to splitting than the back-sawn sleepers. As a result of that investigation, a section with quarter-sawn sleepers has been put down on the main western line. The only one of those sleepers that the railways considered to be unsatisfactory proved, on close examination, to be back-sawn. This question of direction of grain should be carefully examined when we are considering the specification being drafted by the Standards Association. I would suggest that the action taken by N.S.W. with the Standards Association on this question of narrow gauge sleepers be supported, and that all delegates urge the Standards Association to completely revise sleeper specifications, covering both wide and narrow gauge railways.

Mr. Turnbull: That same specification for the sugar mill lines also came to us and our comment was very much on the same lines. It was obviously prepared by a Committee on which timber interests or Forestry were not represented. I personally went so far as to re-write the specification, bringing it into a form that I thought could be readily supplied from Queensland. The submission is in the hands of the Secretary of the Timber Industry Committee, but whether he has taken any following action I do not know. What he promised orally to do was to contact the Sugar Industries Technology Committee and bring to their notice the actual comment that had been received and, I think, ask them to place the finalization in the hands of the Timber Industry Committee or one of its sectional committees. The Standards Association Committees have been re-formed. The specifications for sleepers have been definitely listed in the programme of work. Votes have been asked for covering all items proposed in the programme of all committees and, as far as D.F.P. is concerned anyway, sleepers will be voted first priority on the work of the sectional committee on wood technology. So that I think it now rests with the committee to be called together and get on with the job.

Mr. Weston: I would like to ask whether it is proposed to have one specification for various timbers or different specifications for different timbers. In the West we found it necessary for specifications for different timbers to differ to some extent. As an outstanding case, we did not allow karri to be used for sleepers unless treated by an approved preparation. The case of the splitting of quarter-sawn sleepers cannot be dealt with as a short-term project. Quarter-sawn timber may be satisfactory at first, but fails a few years later. With karri, we allow 5 per cent. cut on the quarter to aid utilization, but encourage the millers to cut on the back because such sleepers have a slightly better life.

Mr. Tamblyn: What species were included in the test? Were any back-sawn?

Mr. Huddleston: Ironbark, blackbutt, tallowwood - four of each. One of them was back-sawn, so we had 11 quarter-sawn sleepers in the line instead of 12. The investigation using the cleavage test as an indication of splitting of the sleeper was done on four ironbarks, two grey gums, mahogany, tallowwood, blackbutt, white stringybark, forest red gum, grey box, coast grey box, Sydney blue gum, New England blackbutt, turpentine and, as a basis of comparison, Douglas fir. The railways told me that splitting occurs when the dog spike is driven.

Mr. Tamblyn: Was the test made on small specimens or large?

Mr. Huddleston: On the standard 2 in. x 2 in.

Mr. Tamblyn: I don't think a small size of specimen reflects the results you get in a sleeper. What stops a sleeper splitting when cut on the back is the change in grain direction, forming an interlock, and this is not obtained in a quarter-sawn sleeper.

Mr. Huddleston: I have two cleavage specimens in my office which show just the point Mr. Tamblyn is raising. The two pieces were end-matched, one was tested radially and the other tangentially. The former is still hanging together and it requires an appreciable force to pull the two pieces apart. The maximum load was 1200 lb.

The one tested as quarter-sawn is in two pieces, but the failing load was 1500 lb. We then took a number of ½ in. boards and marked them out in ½ in. squares. We drove in 12-gauge nails, starting at one side 3 in. back from the end and going up in steps. The first nail in the back-sawn boards caused splitting, but in the quarter-sawn boards splitting only began when the nail was near the end. Admittedly the split in the quarter-sawn was long and extensive, whereas in the back-sawn the pieces still hung together. But the point I am making is that a dog spike is loosened immediately you get a split.

Mr. Turnbull: In reply to Mr. Weston's question, in all standards work when specifications are prepared different characteristics of different timbers are recognized. They have been handled to date by issuing specifications in various parts. For instance, Flooring Specification, Part 1 might relate to timbers of S.A., Part 2 might relate to timbers of Queensland and northern N.S.W., and Part 3 might relate to some other region in Australia. My understanding is that a similar treatment will be at least considered for sleepers, and I do not think any action will be taken to cut across the standard that has already been prepared and approved for W.A.

Mr. Huddleston: Would it not be correct to say that the Standards Association Committee dealing with the problem suggests this? First of all, there is the possibility of preparing one comprehensive specification to include all species. If it were found that species require special treatment they would be eliminated and covered by separate specifications.

Mr. Turnbull: Sleeper requirements in the near future are likely to very nearly double the present figure.

Motion, proposed Mr. Huddleston, seconded

Mr. Turnbull, "This Conference requests the Standards Association of Australia to prepare as a matter of urgency adequate specifications for sleepers for both wide and narrow gauge railway lines". Carried.

15. SILVICULTURE

(a) Effect of silvicultural treatment on properties

Mr. Kloot: It will be recalled that at last year's conference, Mr. Cooper discussed the shortcomings of the working plan for the study of the relationships between mechanical properties and silvicultural treatment. He mentioned that the use of standard or near standard size specimens as required by the working plan largely defeated the purpose of the project due to inclusion in such specimens of not only growth rings laid down in the period under review but also many other growth rings, particularly in relatively slow-grown material. The over-all effect of this inclusion of extraneous material would be to subdue any possibly significant correlations and this is probably what has happened; no data of any significance have so far been obtained.

The requirements of a modified working plan are therefore obvious. Such a plan must involve the isolation and testing of only the growth laid down in a single cycle of silvicultural treatment or if possible only a small portion of this growth, e.g. one growth ring or part of it. Two separate lines of investigation have been followed over the past year to try to achieve this aim.

Firstly an attempt was made to laminate slivers from a selected portion of the tree's growth to form a specimen of near-standard size. This involved the problem of gluing green timber and although some measure of success was achieved, the results are not sufficiently good to justify further work. The second line of attack which now shows considerable promise has been the preparation and testing of very small specimens. The first investigation along this line was an attempt to test in static bending specimens 10 in. long and 5/8 in. x 1/8 in. in cross-section, cut from within the growth rings of fast-grown immature mountain ash. However, one of the difficulties encountered was the lack of suitable apparatus of the right capacity for the routine testing of this type of specimen. Whilst this difficulty was not insurmountable, further work on this test was temporarily dropped. In the next investigation Izod specimens approximately $3\frac{1}{4}$ in. x $\frac{1}{2}$ in. x $\frac{1}{4}$ in. were cut from within the growth rings of mountain ash and tested in a machine of 2 ft. lb. capacity. One advantage of this test is the speed of testing which would allow a great number of replications to be tested in a relatively short time. However, there are several disadvantages. Not only do the specimens require very careful preparation, but also it has been found that the Izod value does not correlate very well with static properties such as modulus of rupture and tensile strength. The values obtained would be comparative only (which is not a great disadvantage) and would only be indicative of quality.

The decision to drop investigations on both the Izod and static bending tests finally hinged on the difficulty of preparing specimens completely free of late-wood or alternatively free of early-wood. It will be appreciated that in such small specimens containing in many cases only a part of a growth ring the orientation of the late- and early-wood bands within a specimen is extremely important and therefore every attempt was made to eliminate one or other of the bands. Not only were the machining difficulties considerable but also it was not particularly easy to determine whether any trace of say a late-wood band was present in a specimen supposedly all early-wood.

Current investigations which give most hope of a practical solution involve the tensile testing of specimens only $1\frac{3}{4}$ in. long, 1/16 in. wide and about 1/500 in. thick. As will be obvious, these specimens are cut on a microtome and the difficulty of obtaining only early-wood or late-wood no longer exists. The present apparatus being used is only a mock-up, and early work suggests great possibilities for this instrument, not only in this field, but also in other fields of fundamental research on timber. It is too early yet to say whether this test will form the basis of the modified working plan, but we feel sufficiently confident to proceed with the design and manufacture of the apparatus and when this is completed a systematic investigation will be carried out to decide the efficacy of this test for achieving the object of the project.

Mr. Ellis: There is nothing much we can do until the Division of Forest Products is ready. Will a machine for tensile tests be available shortly?

Mr. Kloot: The machine is being constructed. It is small, 15 in. long, and can be screwed to the table of a microscope. It should be ready in a month or two. If the investigations with the new testing machine prove a suitable basis for the new working plan, the amount of material required will be a very small fraction of that required for the old working plan. It may even be possible to obtain the necessary material from the standing tree, as it appears likely that a block 3 in. x 2 in. x $\frac{1}{2}$ in. from each tree will be sufficient.

. Mr. Elliot: It is the purpose of investigations in this field to elucidate as many of the growth characteristics of various species of commercial Australian timbers as possible, and as an example may be cited the completed study of the growth characteristics of *Eucalyptus gigantea* grown in the Australian Capital Territory.

Two methods of approach may be used - the first by obtaining access to a regeneration area of young trees of even age, felling three each month, cutting discs from ground level, breast height and half height, and microscopically examining the outer ring or region of the discs. By this method a statistical approach to the problem may be made and, by virtue of the relatively large number of trees examined (36 per year), the general growth characteristics of the species on that particular area may be determined. This was the only method employed with *E. gigantea*. The second method consists of examining small blocks of wood removed at monthly intervals from the superficial layers of old trees, the blocks being cut to a depth of about ¾ in. into the sapwood. Care must be exercised in selecting samples to ensure that the wound damage from any one sample does not affect the area from which the next month's sample is taken. This method is being used in studies of the growth of certain Queensland timbers.

One difficulty of these studies is to obtain a suitable microscopic reference point in relation to which samples from consecutive months may be conpared. In *E. gigantea* from A.C.T. there is no difficulty. Each year of growth is marked with pronounced bands of early- and late-wood and the resurgence of cambial activity is marked by a sudden increase in the cross sectional area of the fibres. Other species, however, do not exhibit such marked sudden changes, and recourse has to be made to the minute growth checks, abnormal tissue, parenchyma bands with some identifiable characteristic and so on, which the vagaries of climate at the time of formation have implanted in the structure of the tissues.

By counting the number of cells in radial rows from a particular reference point to the outside of the stem, a measure of cambial activity from month to month may be determined. Thus in E. gigantea ex A.C.T., each cambium cell cuts off about 170, 210 and 230 new fibres per annum at ground level, breast height and half height respectively. Growth commences vigorously in early September to early October, the resurgence of activity being earlier the higher the level in the tree. By the end of the year, at least half of the annual ring is matured and in February $\frac{3}{4}$ of the total year's growth is complete. Then follows a period of decreasing cambial activity until in the later part of August growth ceases practically altogether.

The gradual progress of the growth stimulus down the trunk of the tree is a notable feature of E. gigantea. Whereas growth was observed to commence in the first week in September at half height, it was not until the first week in October that a similar resurgence was observed at ground level - the growth stimulus thereby taking a month to traverse a distance of some 6 to 7 feet. However, when growth does commence at ground level it does so with a burst of activity much greater than at higher levels, where a characteristic lag period is apparent while growth is getting under way.

Another feature of growth in the A.C.T. stand is that the first elements maturing are fibres, and vessels are not produced immediately on resumption of growth, but are delayed until some 20 new fibres are laid down, i.e. until approximately 1/10 of the growth ring is matured. In other samples of E. gigantea from other localities, e.g. from Tasmania, vessels are produced immediately, indicating that vessel production is dependent on an interplay between genetic and environmental factors, or that there are varieties within the species with different genetic combinations.

Maximum growth rate is determinable in studies such as this, and in E. gigantea its magnitude is about 10 new cells per week, occurring later in time with increased height in the tree. Thus maximum growth rate is achieved within a week or two after the commencement of growth at ground level, whereas at half height the peak is not reached until about 3 months later. After attaining a maximum, the growth rate gradually falls off. Late-wood is produced during June - July, and growth probably ceases in late August. Evidence has been obtained to indicate that there are three distinct processes or stages in the maturation of fibres which are differentially sensitive to environmental changes.

a. The rate of cambial division,

b. increase in size of incipient fibre,

c. thickening process in cell wall.

The time of maturation and type of fibre appears to be dependent on the differential influence of external factors on these three stages in development, and further work will be necessary to elucidate mechanisms. One marked effect is that, when growth rate is rapid, relatively thin walled shorter fibres with large cross sectional area are produced. As the season progresses and growth rate falls off, the fibres become thicker walled, longer and of smaller cross sectional area. Within the one growth ring, the late-wood fibres may be as much as 50 per cent. longer than the early-wood fibres.

The average radial diameter of fibres in any one growth ring decreases as the level from which the sample is taken becomes higher.

Whether any such characteristics as these are common to other timbers, or even other species of Eucalypts will form the subject of future investigations, and at present such studies are being conducted on _Eucalyptus regnans_ from Victoria and _Elaeocarpus grandis_, _Beilschmiedia bancroftii_, _Endiandra plamerstoni_, _Flindersia bourjotiana_ and _Tarrietia peralata_ from North Queensland. Arrangements are made for similar studies to be done on various species from South Queensland, and it is felt desirable that representative commercial species from Western Australia, Tasmania and New South Wales should be included to obtain as much information as possible under a wide range of Australian conditions.

(The Conference decided to cover further details of growth studies by correspondence.)

Mr. Tamblyn: The effects of silvicultural treatment on durability and possibly on treatability with preservatives are the aspects of interest to my section.

The effect of rapid growth rate on durability may be extremely important for species which have high durability when grown under normal forest conditions. As discussed in a previous session, we will be in a position to undertake this type of durability rating in conjunction with accelerated laboratory durability tests of Australian timbers.

However, we must have tested, or be testing simultaneously, naturally grown timber of the species before the effect of silvicultural treatment can be judged. The project is, therefore, dependent on, and should be included with, the main durability tests on various Australian timbers.

We have hopes of devising a test which will permit very rapid durability rating and which could be applied to a single growth ring. This test would be made on sawdust or wood flour which would be used as a growth subtrate for an indicator fungus. The retardation in growth rate of the fungus appears likely to be correlated with durability from the small number of tests we have made to date. I am not guaranteeing this method of test, but mention it as a possible laboratory tool which would give an even more accelerated result than the small wood block test method.

The other aspect - treatability with preservatives - should not involve any difficulties as it is a routine mechanical type of test. I would like to hear the opinion of the Conference as to whether these tests are considered desirable in addition to examination of mechanical properties.

Mr. Ellis: If Mr. Tamblyn can handle the work it should be done.

(b) Utilization of Eucalyptus Thinnings

Mr. Ellis: Systematic thinning of softwood plantations is a regular forestry practice. The situation is fast approaching in Queensland where on areas of denser naturally regenerated Eucalypts, similar systematic thinning will have to be practised. In such timbers as rose gum and blackbutt, no problem arises as thinnings are being used satisfactorily for fruit cases. With other species, such as ironbark and red stringybark, we have not been successful in finding markets. To start with, we propose to have several thousand super feet of such thinnings converted into house building sizes and to study the economics of the milling and degrade that occurs in seasoning and dressing operations.

Mr. Huddleston: We are having the same difficulty here.

Chairman: Would there be any possibility of Broken Hill Mines or any other mines adopting the system used by Johannesburg Mines?

Mr. Huddleston: The quantity of timber that Broken Hill would use is small compared with the timber available, but we would like to get Broken Hill Mines to take up that system. We are looking to the development of pulping industries.

Mr. Kloot: I would like to mention that some years ago we carried out tests on young mountain ash thinnings. The results appear to indicate that the properties of the young material is only about 2/3rds of those of the mature mountain ash trees. Therefore, I suggest that if we go on with that plan Queensland should allow us to test that material independently from the older material.

Mr. Ellis: I think that is quite satisfactory as far as it goes, but I had in mind also that special observations should be made on collapse and such like.

Mr. Wright: From the seasoning side it might be worth mentioning that collapse is likely to vary very much with species in young timber. Spotted gum stands up to size very well, but young blackbutt was found to collapse very badly.

16. UTILIZATION OF SAWDUST

Mr. Wright presented a paper on "The Use of Sawdust and Synthetic Resin to form Boards". As full details will be reported elsewhere, a summary only will be given in these Proceedings.

Many different bonding agents and forming conditions have been proposed from time to time to utilize sawdust as a building board, but the economic success of this type of board is at present limited. Nevertheless, the obvious advantages associated with being able to turn a freely available and widely distributed waste product into a useful building material makes such an investigation of obvious merit.

The conversion of sawdust into a pulp or fibre for board production is associated with certain difficulties in regard to fibre length, pulping treatment, etc., and these conditions make it appear useful only as a diluent or filler to higher quality fibres for board production. The low quality of the material does not, in general, justify the high transport costs involved in freighting it to large central pulping plants.

With special chemical treatments and/or partial hydrolysis, boards can be produced varying from soft insulating types to boards somewhat like bakelite in appearance, but in this latter case costs are very high, and the product is hardly a building board. Examination of the use of sawdust in its natural form with some simple adhesive is naturally tempting and it is along these lines that work was commenced at the Division last year.

In attempting such work it must be appreciated that to be successful the final material must be competitive with low-priced, fibre-based hardboards, and that the cost of the adhesive per square foot must be very low indeed to make the board economically sound. This leads to the necessity of selecting either a very cheap adhesive or the use of an expensive one in very small proportions. The adhesive should be suitable for bonding wood, and should be waterproof, or at least water resistant. In addition, the adhesive should be readily available, preferably from local sources. Some degree of flexibility in the final product also appears to be important, and of several resins available commercially, the cresylic type of resin seemed of definite promise. The urea resins, which have received attention overseas, especially in Britain and the United States of America, do not appear, for the time at least, to maintain their relative price margins in Australia.

The expensive type of adhesive was selected as the more promising, but the method of distributing the small proportions evenly in the mix presents some problems. It was decided to avoid the use of a solvent, for the time being, in the initial laboratory work because of the drying problems involved. Most of the work to date has, therefore, been carried out on powdered resins.

A serious factor in the use of sawdust is the tendency to lack of dimensional stability in the board. In the pressed board the sawdust particles have a more or less random orientation, and when they retain their natural hygroscopicity and are able to move without restraint, the board moves freely with changes in moisture content and is likely to buckle appreciably in use.

The low adhesive concentration and tendency to low dimensional stability led to the choice of experimental conditions under which the adhesive should be used efficiently to bond the particles and assist in restraining movement. Under the relatively high temperatures and pressures which will be used considerable plastic deformation will occur and this should produce an effective stabilization of the wood particles.

In the work carried out so far, some 150 small samples of approximately 20 square inches in area have been made in a special die in an electrically heated Carver laboratory press, and a technique has been developed for close temperature and pressure control and observation. Temperature observations within the boards have presented very considerable difficulties, and as these are proving to be of prime importance, close observation is essential. In most boards so far produced, a screen has been used to permit escape of vapour but it is hoped to be able to overcome this by improvement in technique.

In addition to the work on the Carver press, consideration has been given to the development of a method for the production of larger size specimens, and a simple preforming technique has been developed for laboratory purposes which avoids the need of expensive forming equipment.

The results obtained to date are not in any way final, but we are now able to proceed with a much closer understanding of the variables involved, and it is hoped to produce a board of adequate physical properties with resin concentrations below 10 per cent. by weight.

A few of the results to date in respect of several of the known variables are summarized below.

In the preliminary assessment of properties, the values for bending strength are based on measurements of ¼ in. thick and 2 in. wide specimens over a 4 in. span. Stability has been evaluated by measurement of the thicknesses of small samples subjected to a one hour steaming treatment.

Mountain ash sawdust, using forming pressures of 500 lb./ sq.in., was used as a basis, and in the results below it can be assumed that where a variation in one factor has been considered, other factors have been held constant where not specifically mentioned.

Bending Strength

The modulus of rupture ranged from about 1,500 lb./sq.in. for $2\frac{1}{2}$ per cent. resin concentration to some 6,000 lb./sq.in. for 15 per cent. resin concentration. Over this range of concentration the strength change has been approximately linear.

Pressing time has, of course, a marked effect during the curing period but beyond this, at least up to about 27 minutes, there has been little effect at a 10 per cent. resin concentration.

Particle size of both sawdust and resin has very marked effect, and at 10 per cent. concentration the finer grades of resin have given best results. Sawdust passing screens of 460 μ opening but retained on 260 μ has given the highest strengths to date.

Temperatures within the range of 320 - 420° F. appear to have little effect on modulus of rupture provided resin cure is complete.

Stability

The stability is very sensitive to the effect of resin concentration. At $2\frac{1}{2}$ per cent. resin concentration the increase in thickness of small specimens was nearly 70 per cent. after steaming for one hour but fell away to about 15 per cent. with 10 per cent. of resin. The improvement was much more gradual between 10 and 15 per cent.

Pressing time has a marked effect on stability and a steady improvement appears to occur up to about 15 - 18 minutes with temperatures of 300 - 350° F. Tests up to 27 minutes duration do not appear to effect much further improvement but longer times have yet to be examined.

Finer sawdust grades (passing 460 µ opening) appear superior to the coarser grades.

Temperature has a marked effect and best results have been attained at the highest temperatures used (a little over 400° F.) where thickness increase can be controlled to less than 6 per cent. with 10 per cent. resin concentration.

Density

Under the pressing conditions of 500 lb. and 10 per cent. resin concentration with mountain ash sawdusts the specific gravity varies little from 1.0 over a large range of variables. This, of course, places the board in the hardboard group.

Mr. Bryant: I would like to ask Mr. Wright whether or not any worthwhile work has been done on animal or vegetable glues. Also whether the sawdust received any pre-treatment other than drying down to 5 per cent. moisture content.

Mr. Wright: With regard to the question on the pre-treatment of sawdust I should mention that both the Eucalypt sawdust and the radiata pine sawdust were used without pre-treatment, and in a normal dry condition only. With regard to the use of casein or animal glues, we have not carried out any studies in that field because these adhesives involve a wet mix. This brings in a considerable number of troubles not only in evaporating the moisture, but from subsequent shrinkage in the product upon drying.

Mr. Bryant: Has the animal glue been used in the same way as you are using the resin? That is by mixing it dry and allowing the moisture in the sawdust to react with it.

Mr. Wright: We have not carried out any work in that field.

Mr. Irvine: Working qualities of the boards?

Mr. Wright: The working properties appear to be similar to, or much the same as for, Masonite. The material can be sawn readily and nailed, provided the nails are not too close to the edges. It would probably be necessary to bore for screws.

Mr. Ellis: What is the price of resin in the United Kingdom and U.S.A.?

Mr. Wright: I regret that I cannot answer that question.

Mr. Ellis: What is the price of resin in Australia?

Mr. Wright: In Australia, the cresol resin we have been using is priced at about 2/- per lb. I believe it is appreciably cheaper in England than in Australia.

Mr. Bryant: In England they are using urea resin.

Mr. Huddleston: Any estimate of the present cost of the board?

Mr. Wright: I am afraid I cannot give you an estimate. So far we have only been able to carry out studies on small laboratory samples and are not yet sure if we have found the optimum conditions for manufacture. When we have we will probably endeavour to make some boards of large size and attempt to get some idea of cost. If we can get down to a figure of about 9d to 1/- a lb. for resin cost we may start to become competitive.

Mr. Huddleston: On present prices I calculate that the cost of resin would be 4/- to 5/- for a 6 x 3 x 3/16 board. The price of sawdust in Sydney would be 30/- per ton and if it is not more we might be able to work within the present limit more particularly as the prices for 3/16 in. plywood which obtain on the N.S.W. market are 10/- or 11/- per sheet and several times that amount through the black market. I feel that a manufacturing process requiring a selling price of 18/- per sheet would produce a material which could sell under prevailing market conditions. That is less than tego bonded plywood and there is no trouble in selling tego bonded plywood in Sydney.

Mr. Bryant: Do you envisage any difficulties in making this process a continuous one?

Mr. Wright: A continuous process probably could be applied successfully. Some form of tracked roller could possibly be used. At this stage we have not been really considering the ultimate economics. That will come later if we feel we have developed a product satisfactory in other respects.

Mr. Ellis: Does D.F.P. intend to carry out similar tests on all species or are they going to leave this to the States?

Mr. Wright: We will carry out a series of tests on other species to determine any necessary variation of technique, but I cannot say how far we will go on each species.

Mr. Huddleston: N.S.W. is particularly interested in this work, as we have an operator in the country using dried sawdust who is more than interested in taking up similar manufacture immediately we inform him of the final technique adopted. He would use mixed sawdust and should be able to produce jobs such as this within the range of price I have indicated.

Mr. Wright: I do not think species will have a large effect.

Mr. Gray: Boards of susceptible sawdust may be very liable to termite attack. We find that the presence of urea resins does not confer resistance against termite attack, but cresylic resins do.

Mr. Wright: As refinements in manufacture one could add toxic materials and colour perhaps.

Mr. Bryant: Boards of cypress pine sawdust should be resistant to termite attack.

Mr. Ellis: Do prolonged temperatures or pressures affect veneer colour very much?

Mr. Wright: Yes. Increased temperature will darken the board.

Mr. Pinches: Was the radiata pine tested free of particles of bark?

Mr. Wright: Yes. But a number of boards of quite attractive appearance can be produced from chips of all sorts and sizes, those containing the larger particles giving a terrazzo appearance.

Mr. Pinches: Would bark affect the actual properties of the board?

Mr. Wright: I do not think greatly, but cannot say definitely. I think a board composed wholly of bark could be manufactured successfully.

Mr. Turnbull: In that regard, a manufacturer in U.S.A., making hardboards on a small scale, found that, where bark is incorporated with sawdust, some bark particles were corky in nature. During the pressing operation these particles tended to be depressed, but as soon as pressure was released, they sprang back above the surface and were liable to be brushed out, thus giving a pitted sheet rather than a smooth one. Therefore, I think a degree of caution is necessary.

Mr. Wright: I agree, but I think our barks are different in character to American ones. At present we are eliminating that factor.

Mr. Turnbull: That is so as far as eucalypt bark is concerned, but radiata pine bark might be similar to types of American conifers mentioned.

Mr. Bryant: We are very interested in this as we have been in touch with Dr. Bayon in England, who claims he can make a satisfactory hardboard from certain waste material at a cost of 6d per sq.ft. This board is not so thick as the usual run of such boards. Another man, Mr. Foster, also brought in some samples recently which were very good in appearance - one similar to Caneite, another a board similar to Masonite. He claims that he has developed a new synthetic resin which is very cheap, and that he can make a board for very much less than any other manufacturer - about 3d. per sq.ft. We do not believe him. As far as we can see he is using animal glue, which might produce a suitable board for interior use, but he claims it can be used for outside purposes as well. He says he has a pilot plant operating at home and hopes to go into operation in about 12 months and we will certainly follow this up. We have had a visit also from a representative of English interests, who indicated that these interests were about to make a survey of conditions in Australian states - N.S.W., Queensland, Victoria - with a view to manufacturing hardboard from sawdust. I mention these instances to indicate that there is a considerable amount of interest in the manufacture of these boards.

Chairman: I think it is very desirable that we should exchange information about these people. We must guard against the possibility of a process rejected in one State being accepted in another State. I cannot stress too much the importance of our co-operation in this matter. There is one process based on rotten wood which D.F.P. will not approve as it does not seem a reasonable basis. Another man is about to start in Tasmania, but does not appear hopeful. Sawdust boards are going to have a somewhat limited use in Australia. The problem is to find a cheap binder and a cheap process of manufacture which can be applied on a commercial scale. The pulping process is very suitable for mass production, but binding sawdust is not so flexible. I think the biggest possibility will be in the production of small components - curved backs of chairs, etc. We have got to be particularly careful about chip boards as they are very difficult to produce on a commercial scale. I do not know whether the impact of board making on the resin industry has been considered. It has been suggested that we might be able to convert all sawdust in Australia to board. Figures show that sawdust production in Australia totals three quarters of a million tons, which would require somewhere about 6,000 tons of synthetic resin. This also brings up another point. Some people have processes in which the binder is some new synthetic resin. If a synthetic resin will produce a suitable hardboard it will also have many other applications in industry, and the hardboard industry will have to compete for it with all other users of resin.

Mr. Bryant: It would be a good idea if this Division forwarded to D.F.P. the details we have of Dr. Bayon and Mr. Foster.

Chairman: I suggest that you circulate this information through all other departments.

Mr. Huddleston: I entirely agree with Mr. Clarke, but many approaches are made to us of a confidential nature and we could not disclose the substance of the approach without breaking a confidence. I think we cannot lay down any practice that information must be exchanged as a matter of routine. Each organization must decide what information it feels it can provide.

Chairman: That is a very important aspect, but there is still one point remaining. In most of these suggestions there is nothing new and we would not be obliged in any way to refrain from circulating information that is not new.

Mr. Huddleston: I agree, but I have in mind those representatives who have made statements and who may want information from N.S.W. They might not want competitors to known about their plans.

Chairman: Information of this nature can be circulated in a general manner, and would be of interest to people in other states. We must be particularly careful that people do not take advantage of our confidence.

Mr. Moulds: This would put an extra responsibility on the States in turning down a proposition. A proposition might be turned down in one State for local reasons which would be acceptable in another State.

Chairman: The reason why it is turned down should be indicated.

Mr. Huddleston: We do not turn down a proposition. We refuse to help, which is a different matter altogether.

Mr. Payne: In Tasmania we have a government organization set up for the encouragement of new industries. Through that organization the State goes so far as to advance considerable sums of money for the establishment of these industries. It could happen that a direct approach is made to this organization in Tasmania without any reference to the technical department concerned, and if we knew in advance of the results of similar efforts in other states it would help us in our dealings.

Mr. Ellis: Queensland is in the same position in that regard. We would particularly like to get information as soon as it is available.

Mr. Elliot: There is no reason why D.F.P. should not keep all States closely informed on their work and approaches made to them.

Mr. Wright: I agree. If we exchange information it will put us in a much stronger position. I also agree with Mr. Clarke that we should endeavour to prevent the hawking of "Discoveries" from State to State - e.g., the vacuum drying process, which was turned down in Victoria, enmeshed many people in Tasmania.

Mr. Ellis: I think we should record our appreciation of D.F.P.'s work on this subject.

Chairman: We should be particularly careful not to stress, in the form of a resolution, any part of the work to the detriment of other aspects of the work which may be more important.

Mr. Bryant: This Division raised the question of the uses of sawdust as an agricultural aid at the 1946 Forest Products Conference. It was decided at that Conference to approach the Waite Institute with a view to having some propertly controlled experiments carried out. D.F.P. approached the Waite Institute but the reply from Professor Prescott was not favourable and as far as I know nothing further has been done in that direction. The Queensland Forest Service has supplied the Division with information on the use of hoop pine and red stringybark sawdusts as a mulch. I quote from a statement by the Under Secretary of the Queensland Department of Agriculture and Stock:-

"A considerable amount of work has been done by officers of the Horticulture Branch of this Department, on the value of sawdust as a mulch. Two types of sawdust were used, namely hoop pine and red stringy bark, and the main findings were as follows:-

1. The mulch is of considerable value in the matter of the retention of soil moisture and suppression of weed growth.

2. To be effective against weed growth the mulch must be more than two inches deep and apparently ideally should be about four inches deep. It was found that six inches was no more effective than four inches.

3. The immediate effect on the mulch being incorporated in the soil is a locking up of certain nutrients particularly nitrogen and apparently, to a lesser extent, phosphate; thus when being used on short term crops it is advisable to add extra nitrogen and phosphate to compensate.

4. Top dressings of inorganic water soluble mixture may be effectively applied on top of sawdust mulch.

5. It is very valuable as a mulching material for ginger, providing the conditions as regards nutrients are observed.

Work on this material is being continued by the Nambour Experimental Station."

This Division still regards as most important that more of this work should be done on Australian sawdusts. We have interested the Division of Plant Industry of the New South Wales Department of Agriculture in doing some work along these lines and I have their working plan of an experiment still proceeding on lettuce which was commenced in the Spring of 1947. This is available for examination by Delegates. So far they have found - and I quote from a letter by a Departmental Agronomist -

"That hardwood dust produced symptons of severe nitrogen deficiency, namely yellowing and stunting, which is not greatly reduced by the use of either lime at 2 tons per acre or applications of sulphate of ammonia even 6 months after the application of the sawdust. Investigations are now proceeding to determine whether sawdust can be satisfactorily used in conjunction with side dressings of nitrate of soda and by first composting the material."

We have persuaded the Roselands Golf Club to use a mixture of hardwood sawdust and soil on some of their fairways, with the object of improving the springiness of the turf. This work was commenced about a year ago and so far does not appear to have made any difference to the nature of the fairways. On behalf of this Division I would strongly urge all States to endeavour to persuade their respective Departments of Agriculture to carry out properly controlled experiments of this nature.

The Division can claim some credit for the initiation of a wood flour factory at Coopernook, near Taree, on the North Coast of New South Wales. This plant is producing about 10 tons per week of wood flour from mixed hardwood sawdust from blue gum, myrtle and brush box, which is obtained for nothing from a nearby sawmill.

The person who established this mill - a Mr. Hammond, is selling his output to Beetle Elliotts. I have just had a letter from him and he informs me that he has about 100 tons of wood flour which will not pass through his 80 mesh screens and which he does not want to put through his plant.

I would be interested to know if anyone can obtain a market for this material.

The only other aspect of sawdust utilization which I wish to deal with here is in the matter of the essential oil of white cypress pine sawdust. We have distilled and distributed many samples of this oil to firms in most States and to some overseas firms. So far the result has been most disappointing. The outlet that we were hoping to obtain for the oil as a perfumery ingredient did not materialize and we feel that we cannot construct a distillation plant at a sawmill without first being assured of a market for the oil.

The Division has interested the Sydney Technical College in work on the oil and two papers have been published from that College on 16 esters prepared from the main acid in the oil and on some minor constituents.

Recently with the dollar restrictions on cheap pine oils from America there has been a revival of interest in cypress pine oil and a large Sydney firm is now interested in its production and is at the present investigating production costs.

The Chemistry Section of this Division has been fortunate in obtaining additional staff recently and work has commenced on the electrolytic reduction of the citronellic acid in the oil to its corresponding alcohol citronelol. This work is still in its early stages and it would be premature to say anything further about it.

Mr. Turnbull: The suitability of sawdust for fertilizing purposes has been considered, and the indications are that sawdust has a low content of the chemical elements essential for plant growth, that it may for some period after spreading rob the soil of nitrogen, that bacterial action in soils dressed with sawdust may be greater than in normal soils, and that sawdust improves the physical condition of some heavy soils. Possibly some of the beneficial characteristics of sawdust in association with the soil might be advantageously utilized, if sawdust could be used in greater quantities for stable and dairy floor coverings, and subsequently spread over pastures, as from these sources the nitrogenous content would be high. Laboratory work has been proceeding on sawdust cement and sawdust resin compositions. Some thought might be given to encouraging the use of sawdust for grape packing. Further work on the physical, chemical and other properties of sawdust is projected, and a working plan has been written.

In view of the generally unsatisfactory fuel position in Australia, with liquid fuels rationed, and coal in continually short supply, the importance of wood and sawdust as fuels should not be overlooked. There is scope for much wider adoption of sawdust burning furnaces at Australian sawmills. The Diesel and other internal combustion engines seem to be growing in popularity, but as Diesel fuel supplies are vulnerable in times of war, and may at any time be rationed, the increasing dependence of the industries' power upon them has some dangerous aspects. No doubt there are many real advantages in the self-contained and mobile internal combustion power units, including their ability to operate on dry sites, their running without a certified attendant, and their safety after hours. There is, however, a probability that the salesmanship applied to the internal combustion field is lacking in the steam field, and may result in the advantages of steam being overlooked. In their extension activities, the States should give as much attention as possible to steam engineering to improve the status of its application in the sawmilling industry. There are numbers of satisfactory step grates, Dutch ovens, etc., in use, and their advantages should be more widely appreciated.

Mr. Elliot: Sawdust in dairies may cause difficulties with the health authorities but may be a useful means of using it.

17. SAWMILL ENGINEERING

(a) Plantation operations

(b) Machinery - end matchers, log flitchers, radial arm benches

Mr. Ellis: I was wanting to report the success in Queensland of log flitchers. Two such mills are now operating andtheir results have been very satisfactory. They have more or less followed the design of Swallow's mill at Bright. I understand that the principle of the log flitcher has not been universally accepted as being a good one and would be interested to have the view of Conference delegates on this point. I believe that the milling cost with a log flitcher breakdown would probably be 50 per cent. or less of the cost with a conventional mill. The Queensland Forest Service has conducted a number of studies on conventional small plantation mills, and a paper on P. radiata thinnings was published in the Australian Timber Journal. The labour cost of sawing small logs (12 in. C.G.) was 241 pence per 100 sup.ft. N.S.S. compared with 120 pence per 100 sup.ft. N.S.S. for logs of approximately 30 in. C.G. These figures are very significant to all foresters and I feel that it is our job as Forest Products Research workers to secure reliable and exhaustive data on such matters. Our work in Queensland is to be continued.

Mr. Turnbull: There is a need for writing up these results systematically. We hope to write up some in the Monthly News Letter.

(c) Training of operators

Mr. Turnbull: The Division of Forest Products has encouraged timber firms to send members of their staffs to the laboratory to study forest aspects of utilization, and to become familiar with the information available and each objective relative to some production problem. The Division has also prepared notes for technical school instructors and has delivered lectures to students and visitors. Recently a comprehensive course in wood technology has been planned and submitted to the Melbourne Technical College for consideration. In this, it was proposed to cover sawmilling fairly intensively.

N.S.W. and Queensland have been conducting courses in wood technology for some time and it has been noted that the Queensland lectures particularly have received wide publicity through being printed in the trade journal, "Building and Manufacturing". The Australian Forestry School, Canberra, has a lecturer in forest engineering subjects, including sawmill engineering.

The continuation of this extension work is most desirable, and every effort should be made to build up the courses to the highest possible standard. We believe that material should be prepared covering the whole subject from an Australian's point of view. To that end all lecturers might get together to review each others' courses and leading sawmillers might be invited to improve the treatment of various parts of the course. Some practical sawmillers might even be approached to deliver workers to secure reliable and exhaustive data on such matters. Our work in Queensland is to be continued.

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Mr. Huddleston: Training courses in N.S.W. and Queensland have been taken over by the Technical Education Branch. A direct approach should be made to the Department of Education. Lecturers at the Technical College are officers from this Division who are working in a part time capacity at the Technical College. They have to work to a syllabus and to get this changed we would have to get the Education Department authority to approve and this might be achieved by inviting these authorities to such a conference.

Mr. Turnbull: Could you make approach to an Advisory Committee and bring mill studies, etc., under their notice?

Mr. Ellis: This is a matter for Technical Education authorities but most of us want the facts in which we are individually interested, We should get these and perhaps prepare a handbook with the information coming from Forestry Departments and Division of Forest Products.

Mr. Turnbull: I feel that something more comprehensive should be prepared from an Australian point of view and out of this lecturers could use what they required for their local conditions.

Mr. Ellis: Would Mr. Turnbull be prepared to prepare a publication?

Chairman: We will keep it in mind.

18. PAINTS AND LACQUERS

Mr. Hartigan: We want to acquire a working knowledge of the best preparations that can be used in special bases. Such information would be of value to the general public, paint manufacturers and also tradesmen.

The late Head of this Division, Mr. Marcus Welch, began a series of tests with BALM on the painting of cypress pine weatherboards. One of the major difficulties encountered was the tendency towards "crazing" of paints over knots. Various treatments were tried on cypress pine panels set up on the roof of this Division, where they are exposed to extreme conditions of sunlight, heat and rain. A little later a similar set of tests was set up on a more elaborate scale to test various undercoats and prepared paints put up by BALM. Treatments of hardwoods with colourless lacquers, wood varnishes and clear finishes were set up also. Tests were inspected at 3 monthly intervals by BALM representative and officers of this Division. This work has been reported in part but some alterations are necessary before these reports can be published. The drawback about all these tests is that the proprietary lines which were tried are in most cases no longer available. It would seem, therefore, that in any future tests along these lines an attempt should be made to standardize the preparation according to well defined trends in paint mixtures, rather than to use commercial preparations.

To meet the numerous enquiries we receive in this subject we are endeavouring to produce a pamphlet which will set out for the handyman the simple principles of painting woodwork, the pitfalls which are likely to be encountered and the ordinary measures which can be taken to obviate them.

A painters' trade manual will of course cover such matter in a general way, but we have in mind paying particular attention to housing timbers and the special problems connected with wooden finishes. In these days of high labour cost this has become an intensely topical matter.

Mr. Cokley: In Queensland at present our problem is one of getting paint rather than painting. I have heard no complaints about cypress pine, but on the whole we do not get many enquiries on this matter. I can well imagine that the suggested work will be of great importance.

Chairman: Any other States interested?

Mr. Irvine: Other than observing that paint continues to peel rapidly under certain conditions on houses in Victoria, I am not aware of the problem in Victoria.

Mr. Tamblyn: We refer all our paint problems to Defence Research Laboratories. I think this points to the need of a central authority to which all the States could refer all problems of paint. This central authority should have sufficient expert staff to be able to handle all the separate problems of the States.

Mr. Payne: The paint problem in Tasmania is mainly one of durability. We have found durability of local paint is most unsatisfactory; it may depend on species to some extent. I refer enquirers to Defence Research Laboratories.

Mr. Bryant: Quite often the success of French polishing depends on the timber. There is a good deal required to be done in this respect.

Mr. Huddleston: A lot depends on treatment of the timber used. For weatherboards of cypress we must find a way of stopping the knots. Our previous recommendations are useless now. Someone must do more work on this. The Division of Wood Technology is not equipped to do it.

Mr. Rischbieth: I think we would like to but it is mainly a question of how much we can handle. The quality of paints is the important point. Since the war a number of manufacturers have sprung up who don't know, and sometimes don't want to know, how to manufacture a satisfactory house paint. Another important point is the shortage of raw materials. I think it is very doubtful whether any investigation can overcome these problems. Once a satisfactory formula is found, by what means can we ensure that it is used? Raw material research may lead you somewhere, but to be able to get anywhere on the wood paint programme involves at least two years' exposure test. By that time the raw material position will probably have changed again.

Chairman: Could you tell us the extent of the research activities of your laboratories?

Mr. Rischbieth: The Paint Section at Defence Research Laboratories is carrying out work on the preparation of specifications for paints and allied materials suitable for use under Australian conditions and on specification testing of paints, but, since the end of the war, an increasingly large proportion of the staff has been engaged on research and investigational projects. In the selection of these projects we have endeavoured to maintain a balance between work that will fulfil an immediate need of some section of industry, whether it be for the paint manufacturer or for the user, and work of more fundamental and long term character. Programmes of work that are in hand at D.R.L. include

(a) Investigation of the utilization of locally produced drying oils and of others that could be produced locally, such as candlenut, safflower, grape seed and makita nut.

(b) An investigation to determine the relative severity of weathering conditions on paints as between Melbourne and Sydney, and to determine the relative severity of various methods of exposure over different seasons of the year.

(c) An investigation of formulations of paints for iron roofs.

(d) An investigation of the fineness of grind gauge for paints.

A number of minor investigations is also being carried on.

Work that, it is believed, will be of particular interest to the Conference includes two programmes, one already in progress and the other projected. The first is an investigation of the Paint Holding Properties of Various Australian Timbers and the second is an examination of the relative merits of various Priming Paints for Wood.

Paint Holding Properties of Australian Timbers.

The purpose of this investigation is to determine the paint holding properties of selected Australian timbers with two points of view in mind. Firstly to ascertain the most suitable timbers for use as standards for the exposure testing of paints, and secondly to accumulate information which might be of interest or value to the timber industry of Australia.

With the first point in mind timbers specified in A.S.T.M. Standard D358-38 for use in weathering tests on paints were procured from the United States. These three timbers, namely western red cedar, white pine, and southern yellow pine, the paint holding characteristics of which are known, are being used as comparative standards for the evaluation of the selected Australian timbers. Western red cedar is representative of a class of American timbers having good paint holding properties, and southern yellow pine is one of the most difficult timbers to paint, while white pine is intermediate between them. The selection of Australian timbers for use in the project was governed by two main considerations, namely (1) that the timbers selected should be representative of those commonly used for exterior constructional work, particularly weatherboards. The timbers selected under this classification were:-

State	Timber	Annual Cut Million Super Feet
Queensland	Hoop pine	100
New South Wales	Blackbutt	80
Victoria	Mountain ash	60
Western Australia	Jarrah	80

In practice hoop pine and jarrah are generally available in both edge and flat grain, and panels of both types are being tested. Mountain ash and blackbutt,, however, are usually cut as edge grain, and are being tested in that form only.

Secondly, the paint holding properties of the timbers selected should represent as wide a range as possible.

The timbers selected under this classification were chosen so as to include those which, though widely used, are not used specifically for the purposereferred to in (1) above. They were -

Timber	Annual Cut Million Super Feet
Cypress pine	50
Spotted gum	30
Radiata pine	70

The spotted gum panels were cut as edge grain, and the cypress pine and radiata pine as flat grain. The latter was free from knots.

Cypress pine is a hard, oily, knotty timber, and therefore probably presents a difficult painting problem. Spotted gum is one of the denser of the eucalypts, and has a "greasy" feel; it should provide information as to the effect of density on the paint holding capacity of such timber. Radiata pine is a typical resinous softwood, more in line with the type of timber generally used in U.S.A., and is coming into general use in Australia for building purposes.

It may be asked why a larger number of timbers was not included. The reason for this was that the programme had to be kept to a reasonable size for convenient handling. In view of the variations in timber cut from different trees of any one species, it was thought that triplicate panels cut from planks taken from different trees should be used in order to give a more truly representative idea of the properties of the timber. Again the number of different formulations of priming paint for wood that can be made is multitudinous and it is not sufficient to judge the paint holding properties of a timber on one painting system alone. In order to cover this aspect to some extent, four different types of primers were used - (1) an orthodox white lead linseed oil based wood primer, commonly known as "Pink Primer",

(2) an aluminium pigmented spar varnish primer, (3) a so called non-penetrating primer reported to give good results on American timbers, and (4) a red lead-linseed oil based primer, which according to American work, would be expected to give poor results, but which is never the less widely used in Australia. Two linseed oil based finishing paints of moderately good durability were used, one which is expected to show a tendency to failure by chalking, and the other in which failure by cracking, and ultimately by flaking, is expected. Finally, the performance of painting systems on timber may depend to some extent upon the climatic conditions under which they are exposed, and this aspect has been covered as far as possible by duplicate exposure of the complete programme at Maribyrnong, Victoria, and Villawood, N.S.W. In addition, a portion of the programme has been exposed at Bendigo, Victoria. In all the total number of 6 in. x 12 in. painted wooden panels exposed is 602.

The exposure tests have now been in progress for slightly over twelve months, but differences exhibited between timbers are so far not such as to enable any conclusions of note to be drawn. Some observations that may be of interest have, however, been made:-

(1) Many of the American southern yellow pine panels are showing extensive longitudinal wood cracks from which the paint film is tending to flake away.

(2) Some of the cypress and American white pine panels are showing longitudinal wood cracks extending in two or three inches from the ends only.

(3) Pore holes have opened upon most of the mountain ash panels, and checking of the paint films is commencing at some of these holes.

(4) Some of the blackbutt and spotted gum panels have pockets from which gum has exuded, cracking and lifting the paint film.

(5) Jarrah, hoop pine, radiata pine and western red cedar panels are showing no wood defects.

Priming Paints for Wood. The object of this investigation is to determine the relative merits of various types of wood primer with respect to the durability of the painting system as a whole.

A. Timber. In order to keep the programme within reasonable proportions, it has been necessary to restrict the number of timbers used to three, which were selected bearing in mind their present or probable future use in the building industry. The three timbers selected were mountain ash, radiata pine, and Queensland hoop pine.

(a) Mountain ash is the most extensively used hardwood for general building construction in Victoria, and is being used also for weatherboards. The panels available are generally of good quality.

(b) Queensland hoop pine. The use of this timber is for reference purposes. Being the standard wood used at present for paint exposure work at D.R.L., it will provide a direct comparison of performance of the various formulations used.

(c) Radiata pine, generally used for rough work, i.e., packing cases, crates, etc., is similar to the Baltic type of wood formerly used as weatherboards. A trend towards the use of this wood for weatherboards appears to be imminent. The panels available are knotted and are representative of poorer quality softwood.

It is proposed to use panels of radiata pine which contain one or two wood knots. This will serve a double purpose in that, beside showing priming performance, it will show knot-sealing performance of the formulations.

By marking the knot position on the backs of the panels and then clear varnishing the backs, failure attributable to the knots may be easily observed.

3. Primers. It is proposed to cover as complete a range of types of wood primers as possible, but it must be realized that, owing to the very large number of possible variations in the composition of the pigments and vehicles, and of the relative proportions of the pigment and vehicle, a full investigation of each type of primer is not possible in a programme of the size contemplated.

Five types of primers have been selected, and fairly broad variations of pigmentations and vehicles within these types have been decided upon. It is hoped in this way to distinguish the types of primers according to their effectiveness and point generally to the desired pigmentation, vehicle composition, and pigment-vehicle ratios. A continuation of the programme should lead to more detailed differentiation within each group.

The types of primer are:-

(a) White lead based linseed oil primers with and without admixture with other white pigments and extenders.

(b) Non-lead based primers. These include zinc oxide, lithopone and titanium dioxide as the main white pigments either alone or in various mixtures and with extenders.

(c) Oil based primers containing red lead. These cover a range from normal pink wood primer (white lead and 5 per cent. of red lead) to 100 per cent. red lead, and include zinc oxide - red lead pigmentations.

(d) Aluminium pigmented primers. Four types of vehicle are proposed. These are :-

(i) bodied linseed oil,

(ii) ester gum varnishes,

(iii) phenolic varnishes,

(iv) alkyd varnishes.

Variations of viscosity of bodied oil vehicles, and of the oil lengths of varnishes will give a wide range of available vehicles.

Non-leafing and leafing aluminium powders, together with variations in pigment-vehicle ratio, are to be used.

(e) Non-penetrating primers. The effect of controlled penetration of the primer on the durability of the painting system is to be investigated. A means of controlling penetration is by varying the amount of bodied oil in the vehicle, and it is proposed to do this with the primers of categories (a) and (b).

C. Undercoating and Finishing Paints. The primers will be exposed in a three coat painting system in which the undercoat will consist of the appropriate finishing paint suitably thinned down. Two finishing paints will be used, namely, (a) A white lead - zinc oxide pigment oil paint for application over white lead primers, and (b) a zinc - titanium oxide pigment oil paint for application over non-lead primers. Some of the primers, for example the aluminium primers, will be exposed with both finishing paints, while a few panels with mixed lead - non-lead systems will also be included as a matter of interest.

Test panels will be exposed in singlicate facing north on sloping racks at Maribyrnong, Victoria, and the total number of panels will be about 350.

In conclusion I would like to say that, within the limits of our capacity, D.R.L. will be pleased to carry out any work that the Conference may recommend in connection with the painting of timber, and that we would be prepared to undertake such programmes either on our own account or in co-operation with other interested parties. Moreover, as we have no specialized knowledge of forest products, we will welcome any comments and suggestions in our present programme.

Mr. Cokley: May I ask if factors like high temperatures, high humidities are to be taken into account in these tests?

Mr. Rischbieth: We are not in a position to do any work like that at present as no exposure stations exist in areas of high temperature or high humidity. There are difficulties, of course, in servicing such stations, but we would be very happy to co-operate with anyone who wants work done on this matter.

Mr. Hartigan: I am particularly interested in the work done by Mr. Rischbieth. This is the style of work on which to build up a publication, but it does not answer the immediate problem we have of having some ready information to give to the handyman which I mentioned. I am wondering if there is any possibility of us having some co-operation, through Mr. Rischbieth, to carry on with this particular aspect.

Mr. Rischbieth: To me it seems that the immediate problem is not the painting of timber or what is the best formula to use. That is fairly well established. It is known that the ordinary pink primer made on the correct formula will give reasonably satisfactory results on reasonable quality timber, but it comes back to the present state of the raw material supply position and the fact that certain manufacturers are not very concerned whether they supply good quality or not.

Mr. Huddleston: Ordinary pink primer of good quality can be used satisfactorily on good quality timber. I think everyone will agree with that. But we do get problems where timber cannot be regarded as good quality as far as painting characteristics are concerned - cypress pine and rose mahogany, for instance. Sweating of timber is the defect which you get both in painting and polishing of rose mahogany. That is the particular type of problem cropping up every few weeks. It is preventing the use of rose mahogany in high-grade plywood because you cannot finish it off, and that and other problems where timber is not of average quality but contains some extra or definite problem, are what we want to answer. I would like to see either arrangements made for the Defence Research Laboratories to undertake problems of that nature as they are referred to them, or else some other organization set up by this Conference, to farm the work out and deal with problems.

Chairman: Your point is, variation of species as far as painting is concerned, and the particular precautions that should be taken with different species.

Mr. Huddleston: Quite correct.

Mr. Rischbieth: I think there is considerable work of that nature. However, I think a lot of troubles are caused by poor quality paints brought about through those two reasons which I mentioned, and no matter how much research you do it will not solve the poor quality paint side of the business.

Mr. Huddleston: Can we say what a good quality paint is?

Mr. Rischbieth: We are not necessarily in a position to say what a good quality paint is, except as a result of outdoor exposure tests.

Mr. Turnbull: Can Mr. Rischbieth say if the paint industry has its products covered by standards. To what extent does he feel the industry can put its own house in order by getting out proper and adequate standards?

Mr. Rischbieth: Standards have not been generally accepted by the paint industry and that is one of the things on which we have spent considerable time. The industry is more co-operative than it was, but there is still much room for improvement.

Mr. Turnbull: Action can be initiated in two ways - by the people with the products to sell or by the people who have to use them. There must be a body of the public, presumably the building industry would be the outstanding one, who want some assurance that good quality products are available and can be supplied by paint manufacturers and distributors. Could they not be urged to make a definite request that a standard be prepared for paints?

Mr. Rischbieth: There are a number of standard specifications in existence now, but manufacturers show considerable reluctance to make to those standards for the general public. I would say there is not one firm who markets paint to the general public to a specification. Specifications are, however, used in connection with many Government tenders.

Mr. Payne: In each State there is now a housing trust of one kind or another which presumably can specify a standard and which uses a sufficient quantity of paint to make it worthwhile for manufacturers to supply to that standard. So I think they would have a considerable influence on the general question of standards for the building industry generally.

Mr. Rischbieth: There is not to my knowledge any housing commission in any State which purchases its paint against a specification. The Victorian Housing Commission is discussing the matter with us now. The reason is, they have had considerable trouble over the last few years with poor performance of paint and so they realize something must be done.

Mr. Turnbull: Would any useful purpose be served by asking the Housing Standards Co-ordinating Committee to concern itself with this matter?

Mr. Rischbieth: I understand they have already approached the Standards Association in regard to paint standards.

Mr. McAdam: There might be a way of spreading the service tests in the field over a wider range. There are two aspects not taken care of by the Defence Research Laboratories programme; individual timbers in the various States and the various climatic conditions they are exposed to.

Chairman: The proposal is that the number of stations should be extended, and the number of species should be extended to cover a wider range of Australian timbers, plus certain species of interest in certain States.

Mr. Rischbieth: We had something of that nature in mind to follow on from this first programme. As you can see from my description of our research programme, we have dealt with only seven timbers, and that has involved us in 600 panels in two stations, 300 panels per station. The reason is that it was necessary to include a number of different formulations for priming and finishing paints in order to gain a reasonably reliable view on the performance of the timbers. In fact the 600 panels only covered quite a small range from the number of possible variations in formulation. I do not know how many timbers there are of interest in each State. If it runs into 3 or 4 in each State we would have to have assistance from the various people interested in the States, particularly facilities for exposure and assessment of the results. We are, of course, only able to devote a proportion of our staff to timber problems, but we would be very please to co-operate as far as possible.

Chairman: The first problem is the collection of material. We might get the States to help on that. The second problem is the preparation of panels. You would be in a position to do that?

Mr. Rischbieth: Yes.

Chairman: The third problem is setting up the panels in the States. And the fourth problem is periodical inspection of the panels.

Mr. McAdam: I would suggest on that last point that if the Defence Research Laboratories could, in the early stages of the experiment, send men dealing with the problem round to the various States to do the initial setting up and to instruct the people who are going to be observers in the various States, we will get more uniformity of results.

Chairman: What States would be interested in a proposal of that type?

Mr. Weston: We would be quite happy to supply you with further supplies of jarrah, and also marri, which we hope to use more and more. I think some investigational centre is advisable, in the early stages at least.

Mr. Huddleston: N.S.W. will be interested in the proposal.

Mr. Ellis: I think it is possible as far as Queensland is concerned that the Forestry Department, State Housing Commission and others might be able to raise issues which Mr. Rischbieth has not considered in his present programme. Therefore, I would like to suggest, if Mr. Rischbieth will accept it, that he send copies of the present programme to Queensland Forest Service, who would arrange to have that question discussed by interested parties in Queensland.

Mr. Rischbieth: I will be happy to do so.

Mr. Payne: I favour the suggestion made by Mr. Ellis. The Forestry Commission could well act as a body which approaches the other Departments to get their opinions, not only in the matter of exposure tests, but also to correlate comments on the nature of research involved and have suggestions for expansion.

Mr. Pinches: As far as S.A. is concerned, I am sure that the building people, such as the Housing Trust and State building authorities, would welcome any investigations of that nature.

Chairman: What is the possiblity of setting up a corresponding committee on this? We would know then who to get in touch with in other States. The position here is that the people most interested are not members of our Conference and are not vitally interested in purely forest products work.

Mr. Rischbieth: What we need first is a statement of the problem in the various States, and secondly assistance in the carrying out of the programme from the point of view of facilities for exposure tests, supply of timber and examination of the tests. I think some form of committee would be desirable.

Mr. Elliot: I move "that there be set up a co-ordinating committee comprising representatives of the Defence Research Laboratories and the Divisions of Forest Products and Wood Technology for the purpose of planning and co-ordinating investigations into painting problems connected with wood utilization, having regard to requests received from individual States with respect to their particular problems.

Motion seconded by Mr. Huddleston. Carried.

Mr. Huddleston: I move that "this Conference expresses appreciation of the investigations into paint work being undertaken by the Defence Research Laboratories, and considers that, insofar as such investigations have a direct relation to wood utilization, the investigation should be extended to cover a wider range of problems and specific problems which arise from time to time".

Motion seconded by Mr. Hartigan. Carried.

Mr. Irvine: There is available in the Defence Research Laboratories a vast amount of information on the successful painting of wood. That information is not yet available to us as people interested in forest products. It would be useful if that information could be printed or set up in some form. I have seen copies of "Paint Notes" prepared by Mr. Rischbieth's Section, and I would submit for his consideration that either the Defence Research Laboratories staff or members of the Paint and Oil Colour Chemists' Association should prepare, either for separate publication or for publication in "Paint Notes", the existing information on the painting of wood. Once we have that existing information we are then in a much better position to recommend or offer a suggestion as to which timbers should be examined for their painting properties.

Mr. Elliot: I think we should try to keep two aspects quite distinct in our minds - painting procedure and painting characteristics of specific timbers. The first one is the one which calls for some published material which can be made easily available, and the other one is a subject which calls for definite investigation.

Mr. Hartigan: I suggest a series of articles. I think the Defence Research Laboratories, through their representative today, have committed themselves to providing that information, and I can assure you, insofar as N.S.W. is concerned, we will be happy to take advantage of that information and will be watching for it.

Mr. Wright: Mr. Hartigan brought up the question of N.S.W. preparing a publication. Is that suggestion to be adhered to?

Chairman: We will take it up directly with Mr. Rischbieth who may wish to refer it back to the committee. I would like to thank Mr. Rischbieth very much indeed for coming along. His contribution has been a particularly valuable one indeed. If there is ever anything we can do to help, we will be only too glad to do so.

20. PRESERVATION

(a) Surveys

(i) Railway sleepers

Mr. Tamblyn: The survey of causes of failure of sleepers in service in Victoria was discussed at the two previous Conferences. It directed our attention to the importance of mechanical failure and led us to exclude the possibility of using water soluble preservatives. It has also convinced us that under Victorian conditions the preservative used should be an oil type designed more to reduce mechanical troubles than to prevent decay.

The work on sleeper treatments is now approaching the stage where we can turn attention from Victoria to the problem in other States. I would like to know whether co-operative sleeper surveys in other States are desired.

Mr. Ellis: At the present moment the Queensland Railway Department is prepared to collaborate in investigating this problem. We are not yet in a position to make a satisfactory survey, and we would be very happy if Mr. Tamblyn or one of his officers could come to Queensland to discuss the whole matter with the railway authorities and ourselves.

The Railway Department is prepared to put down from ½ to 2 miles of track in one location to test some of the "non-durable" timbers that in the past were not accepted. They are also prepared to test methods of preservation which might be suggested at this stage. It has been left to the Forestry Department to bring this matter forward.

Mr. Payne: The Tasmanian Forestry Commission will be very glad to co-operate with Mr. Tamblyn in any work necessary in Tasmania.

Mr. Weston: Mr. Tamblyn's statement may lead some of the delegates present to think that these tests and records are confined to Victoria, whereas in W.A. we have had many plans worked out in conjunction with your Division. We have in the past gained a great deal of information from those joint projects. We have certain projects which are ready for inspection now but we will wait until Mr. Tamblyn can come over, because we want to continue to co-operate in the projects. We also have several hundred sleepers ready for further tests.

(ii) Cross arms

Mr. Tamblyn: Some two years ago the Chief Engineer's Branch, P.M.G., (Melbourne), approached us on the subject of preservative treatment of cross arms. With the lesson learnt from the rail sleeper survey, we suggested that a cross arm survey throughout Australia should be made to determine causes of failure, before recommendations on preservative treatments were made.

Some 10,000 printed cards were despatched to P.M.G. depots so that full particulars could be filled in for each arm as recovered and stored pending our inspection.

Inspection of arms was made in Western Australia at the end of last year and has almost been completed for Victoria. So far, however, we have not inspected in the other States because collection has been unduly slow. However as soon as the depot can be stirred up to collect sufficient arms (Tasmania has collected 82 arms in 2 years) we propose making the inspections and suggest that officers of the State Forest Services concerned might like to co-operate by being present at the inspections.

Mr. Huddleston: We would like to be present at any inspection to be carried out.

Mr. Ellis: I accept the offer with appreciation.

Mr. Moulds: Have any arrangements been made for Victorian officers to be present?

Mr. Tamblyn: It has been discussed with Mr. Bond. I don't know if any details have been worked out.

Mr. Weston: Is it always easy to find out how long cross arms have been in service?

Mr. Tamblyn: No, it is not, but if you can find the reason for failure and suggest a treatment to retard it, you should lengthen the average life of the cross arm without the additional information being essential.

Mr. Weston: We want to find out why some cross arms fail after only a few year's service.

Chairman: We hope to cover some of those features at a later stage. We have started off with surveys and certain faults have been disclosed as important. Afterwards we will probably have a special investigation to get the information that you want.

Mr. Weston: I have already been present at one of those inspections in W.A. and I will be glad to co-operate again at any future ones.

(b) Treatments

(i) Treatment of mine timbers

Mr. Taylor: Before going on to describe the work done, I would like to briefly review events leading up to this work.

About four years ago this Division was asked to visit collieries in Cessnock district to investigate complaints by the miners that borers from the pit-props and other mine timbers were biting them.

At a depth of about 1200 ft. Lyctus and Xylion, mainly the latter, were found to be very active in spotted gum round props. A similar case was investigated about two years ago.

In each case the symptoms described were not indicative of biting by the borers, but rather suggested the presence of mites, and Pediculoides was found on the props in both collieries examined.

A second problem existed, namely that insects described as "flies" were causing a serious nuisance by flying into the miners' eyes. These flies were small phytophagous beetles and apparently were breeding on mould which grew on the starchy sapwood of spotted gum.

No dioxy was complained of or seen, although we did not look closely for it. The question of failure of the props did not appear to worry the mine owners in any way. Where necessary they merely replaced failures. However a preservative treatment would overcome the two problems mentioned, by controlling the borers and the fungus which in turn would control the "flies".

Until recently the colliery owners were not interested in preservative treatment but they are now finding timber difficult to get and are more interested in getting longer life. Mr. Morcom is following this up and will probably be getting preservative treatment under way.

Last June Mr. Morcom set up a preliminary test in a colliery where Lyctus and Xylion and the "flies" are all active. Mr. Morcom confirms that Xylion does bite. The test comprised a limited number of samples. Preservatives tried were sodium fluoride, zinc chloride, chromatedzinc chloride and sodium fluorosilicate. Test pieces were boiled for 3 hours and then cooled overnight, and he appeared to get pretty good impregnation. There were some control specimens, but no detailed measurements were made. It was just a rough and ready preliminary test, and he only asked us to come up there to assist him in putting the work in hand, so we would know what happened when future inspections are carried out. Mine water, supposed to contain a certain amount of sodium fluoride, was used as one treatment. In this case props were boiled for 3 hours and then immersed in cold water. Test specimens were placed in 3 different situations in the mine, (i) in the intake air duct, (ii) in the return air duct and (iii) in portions of the mine where the air was still. Mr. Morcom has asked us to be present at future inspections. He will make available the results of those inspections to members of this Conference. I mention this experiment because I think it is a move in the right direction. Through Mr. Morcom we are getting colliery proprietors interested in preservation, and it might have far-reaching developments in time.

Mr. Hartigan: Last year, when I visited the northern coal fields on another matter, in the course of conversation with Messrs. Morcom and Brown, proprietory representatives, I found that they were both interested in the problem of pit preservation. I mentioned the possibility of using our plant at Putney for some experimental work, and they indicated they would be very interested to do so. I am quite confident we could carry out some co-operative work with these people. It is important in that it is to my knowledge the first attempt by local industry to carry out some preservative treatment on its own initiative.

(ii) Dip treatments against surface moulds and sapstains on radiata pine and scrub woods

(iii) Use of chemicals as anti-stain agents for fruit cases

Mr. Hartigan: We receive a large number of enquiries and complaints during the summer months from case manufacturers and their customers.

Many of the complaints concern radiata pine, but hemlock, scrubwoods and even hardwoods have caused trouble to case manufacturers.

It is undeniably true that if case timber is brought to below 18 per cent. moisture content and kept in that condition then there will be no trouble, but shortage of timber and present labour conditions make good practice hard to enforce. Open trucks often mean that timber arrives in a sapstained condition. Block storage of wet timber at factories where there is little space often results in bad moulding.

These defects are not serious in themselves, but workmen complain about handling excessively mouldy timber and customers are not impressed when they receive drab, bluish timber for packing.

We experimented with straight dips in various concentrations of phenyl mercuric acetate and sodium trichlorphenate at the mill - the dipping tanks being placed opposite the docking saw.

According to last season's results, a concentration of 0.16 per cent. sodium trichlorphenate concentration has been successful in preventing mould growth. This will be verified in the coming season.

We have been interested too in the effect of sodium pentachlorphenate and borax dips for radiata pine shipped in a green condition from New Zealand. If this trade should increase, such dipping may become standard practice.

A contentious matter which arises from this problem is our attitude to the arguments between private exporters and the Department of Commerce over the interpretation of inspection rules. Is there some way in which we can examine the regulations without over-stepping our province and determine whether present procedure is satisfactory?

<u>Mr. Tamblyn</u>: We have taken it up in principle once or twice. It is very difficult to suggest to the Department of Commerce that, on theoretical grounds, they should change their practice. Their argument is just about as good as ours. A conclusive test is needed and we have been expecting the State Services to arrange those tests.

<u>Mr. Hartigan</u>: We cannot approach Commerce

authorities and tell them their methods are wrong. We don't believe that. Each individual case will have to be dealt with on its merits. I do not see how we are going to go about it.

Mr. Huddleston: The attitude adopted by this Division is that the solution of the problem lies in seasoning of the case shook. As far as our radiata pine is concenred, we allow a rebate of the royalty for seasoning in an endeavour by the Commission to enforce drying. We have had several requests from case manufacturers who have had large parcels of cases rejected because of mould growth and they wish to give them some treatment to make them satisfactory to the Department of Commerce. In each case we have refused to take action, pointing out that the remedy for the trouble lies in the initial seasoning. But they cannot see any reason why seasoning should be carried out, particularly among brushwoods, and for that reason they are loath to do a great deal of work which would allow a departure from the existing practice.

Mr. Tamblyn: Seasoning is the ideal answer, but there are other aspects to consider before the mould problem is solved. Most case users take the view that if a little mould or stain occurs before the case dries, it is not detrimental provided the case does not get wet again. That is the point on which we fail always to convince the Department of Commerce who claim that bluestain can be the cause of Government cases of eggs going bad or butter being contaminated. The bluestain occured when the timber was green, though the case is now quite dry. Without some test - quite an extensive one - it is difficult to make progress in this argument.

Mr. Cokley: A problem has arisen in Queensland in the application of secondary timbers and pine thinnings (Pinus taeda and caribaea) to fruit case manufacture. Staining and mould growths have in a number of instances caused rejection of a number of cases. This is of particular importance for pine cases which form the bulk of the product of one mill., A further aspect upon which data is required is the type of plant suitable, particularly for mills in the country. Timbrols Brisbane agent has informed us that his firm is developing an odourless fungicide D.D.M.

Mr. Huddleston: We have not designed a plant suitable for a country mill because, apart from the specialized application to the banana industry, it is a matter which we did not consider to be of importance. As regards tests adopted by this Division, the practice has been to test the case for moisture content immediately it is sent in, and if the case is seasoned we have advised the Department of Commerce through our supplier that the case is affected by bluestain but that, apart from appearance, it should not be detrimental unless the case is again re-wet, and in every instance the case has been accepted. So we have no trouble in N.S.W. in that regard, but we definitely do favour the seasoning of the shooks before the case is made up.

Mr. Wright: The seasoning approach primarily would be to kiln dry in the shook. These timbers kiln dry in about 12 to 15 hours so that, with respect to staining, there is no problem to my mind. I would like some further details from Mr. Oakley regarding the trouble with some of the Pinus taeda and Pinus caribaea. I would also like to point out that most specifications for case stock involve a moisture content clause stipulating that the material shall be dried to 18 per cent. or less. That is amply covered by a kiln drying treatment but not covered by dip treatment with preservative: furthermore kiln dried material is immediately usable.

Mr. Cokley: Our major difficulty is that most fruit cases are sold to neighbouring farmers, and so they do not pass through an inspection.

Mr. Ellis: Under certain Brisbane conditions in well-designed seasoning sheds under cover, bluestain will develop in Pinus caribaea. Therefore we are down to the problem of kiln drying and in small sawmills running on diesel oil, kiln drying does not seem to be a proposition. I have not quite given up hope, however, for we may be able to use your electric drier, or something in the nature of furnace kilns.

Mr. Huddleston: We had the same problem at Orange with radiata pine. No trouble was experienced with bluestain when the shooks were spread out on a huge pile of sawdust dumped on spare ground. Apparently decomposition was taking place and sufficient heat was being generated to dry the shooks.

Mr. Turnbull: S.A. has been through this very problem. During the first world war a few mills started to cut the small quantities of radiata that were available at the time, and the cases from them went through this very same cycle, not only becoming extremely badly bluestained, but also it was alleged that the stain affected the fresh fruit contents of the case and the reputation of the species was nearly spoiled. The position was only retrieved by careful adoption of seasoning. A lot of the trouble you state you experienced with the Department of Commerce is very definitely linked with unseasoned cases. On every occasion when I meet any of them, both in the Department and outside, they miss no chance of quoting the instances where they have experienced damage to fruit and rusting of tins and all the other ills that accompany the use of unseasoned cases. If we could kill these two birds with one stone - the stain trouble on the one hand and the unsatisfactory quality of the case on the other - it would be one step forward. I think that is the best action this Conference could support.

Chairman: It is a standard practice in some places to give a dip treatment first, at least during the bad months. In N.Z. a pentachlorphenate and borax mixture is generally used.

Mr. Tamblyn: It is not always practicable to dry untreated timber which is susceptible to mould or stain so quickly that it is entirely clean.

Mr. Ellis: Yes, but in this case, we were disturbed that the Department of Commerce refused to accept case materials which had blue stained on the log over a period of a prolonged railway strike. The timber was perfectly sound apart from bluestain..

Mr. Finches: The position in South Australia is that our timber is not carried in shooks so the difficulty has been overcome.

Chairman: Do the States want to take the attitude that it is possible to season without any stain?

Mr. Huddleston: No. In N.S.W. we must be guided by the Department of Commerce and so far they have not rejected a box if the box has been seasoned.

Mr. Tamblyn: That conflicts with information from the Department of Commerce, Melbourne, who told me they would definitely reject any case showing signs of mould growth.

Mr. Huddleston: They probably have a different interpretation of mould growth. I think in N.S.W. it only refers to live mould growth.

Mr. Hartigan: I think we all agree that if the casewood is dip treated at the mill it should be all right, but would there be any trouble later on about smell if trichlorphenate were used?

Mr. Tamblyn: Dr. Wiley said he would not agree to use of any treatment for butter or egg boxes until comprehensive tests were made.

Mr. Turnbull: Yes, but that authority only covers dairy exports.

Mr. Cokley: It depends on the food. Recently there was a case of tainted cheese. It was found that the taint came from pentachlorphenate. It is known too that sweating fruits will pick up this smell. We have a problem here and in that connection I was wondering if D.D.M. has any odour. This is a preparation recently put up by the General Dye-Stuff Corp. in U.S.A. under the name of Preventol. Its chemical name is Dichloro-dihydroxy-diphenyl-methane. The manufacturers say it checks slime formation in paper mills. It is non-toxic with a slight phenolic odour and it is stated that 0.1 per cent. is effective. If Mr. Tamblyn has any further points we can take them up in correspondence.

(c) Taxonomy: classification of wood-destroying fungi based on Cunningham's work in N.Z.

Mr. Hartigan: The validity of identification of wood destroying fungi solely in the macroscopic characters of the fruiting bodies has for a long time been a source of argument amongst mycologists.

It is argued that many of the macroscopic features used for identification are not constant but are apparently subject to the vagaries of variations in environment such as location, humidity, temperature and light. This is particularly confusing when an attempt is made to differentiate certain members of the genus poria and polyporus. Size of fructification and the presence or absence of a stipe in brackets are extremely variable. There is a tendency under such conditions to create new species, because specimens do not accord in all points with the described ones.

G. H. Cunningham of the N.Z. D.S.I.R. has recently suggested in a series of published bulletins a new approach to the problem of taxonomy of these higher Basidiomycetes. He attempts to reverse the process of species differentiations on minor grounds and groups many species and even genera together under new headings.

We have been planning to collect some porias to see if we can confirm his work and further see if we can satisfy ourselves that such a classification is sufficient for differentiation. Building up an Herbarium is an essential part of forest pathology work and where possible it is desirable to have mycelial samples corresponding to the fructifications.

It is essential that all specimens should be named correctly for descriptive work in articles and also of course for the purposes of carrying out tests on wood durability. It is to be expected that there will be major differences in the fungal flora in this country as compared with the Northern Hemisphere.

Miss Balmain: I suppose that the Forest Departments have copies of Cunningham's pamphlets. The classification of Polyporaceae is of primary interest to forestry, since this family encompasses the wood scavengers. Earlier mycologists have based this work on de Fries, who started as far back as 1821. His nine genera have been modified and extended by many workers using macroscopic features as their criterion. This leads to great confusion. One of your Fomes specimens may have a stem, the other lacks it; furthermore, it may or may not have its pores arranged in layers. There are also the inconsistencies in colour of fructification, in location of pored surface. In fact we find examples as in the case of one polyporus species, which has been placed under as many as 6 genera. Cunningham was not the first to use microscopic features. An earlier worker had observed hyphal systems and differentiated the fungi according as they had one, two or three of the three different kinds of hyphae.

We are keen to do some systematics based on Cunningham, and are wondering if D.F.P. will collaborate with us on this project. We could hope to get a system of identification working so that we can made a quick check on our collection specimens. We would be taking some steps towards independence of overseas herbaria.

Mr. Tamblyn: We have discussed that with Dr. Cunningham and he has indicated that he may be able to assist with identifications. However, he is a very busy man with his New Zealand work and I do not think we should expect too much help from him. In his taxonomic work he makes use of the microscopic features of the context hyphae and while I think it is of considerable importance I do not think it will solve our Australian taxonomic problems which are largely related to the fact that we have very few types or co-types available here. It would be necessary to go to the original types and determine their hyphal systems according to Cunningham's scheme before we could employ the method to full advantage.

Mr. Hartigan: I would be very please if we could have an herbarium collection in Australia as it is an essential part of forest pathology work. It is to be expected that there will be major differences between the fungal flora of this country and the Northern Hemisphere.

Mr. Irvine: Based on 7 - 28 day cultures on 2.5 per cent. malt agar at 24° C. Miss Kathleen Smith and others of the Commission's staff working in the Botany Department, Melbourne, under the direction of Associate Professor Ethel McLennan have developed a punched card key for the identification of wood rotting fungi. Present indications are that comparisons cannot be made between hyphae characters of the sporophores and of the cultures. I suggest that we do not hold any detailed discussion of methods now.

Miss Balmain: It seems to be a satisfactory system but we want to avoid having a number of different systems of classification. Cunningham's technique is quite simple, involves a most effective aniline blue-lactic acid stain and should be within the reach of any forestry laboratory. We could come to some decision after a little preliminary experimentation on our Australian species has been carried out.

Mr. Hartigan: I would like to know whether the Victorian Forests Commission will be willing to work on an herbarium collection.

Mr. Irvine: Certainly.

Mr. Tumblyn: We have actually discussed it already with N.S.W. and have agreed to exchange fruiting bodies but little has happened so far. I do believe that we should attempt it. I should suggest that we leave the identification or the method we will use to obtain identification to future discussion.

Mr. Clarke: This could be brought up before the next Australian and New Zealand Association for the Advancement of Science.

Mr. Weston: W.A. would appreciate it if Mr. Tamblyn's work on mycology could go further as many practical points could result.

21. VENEER AND PLYWOOD

(a) Substitute glues made from rennet casein and soya bean, sago starch, peanut meal, blood albumen, caustic substitutes.

Mr. Cokley: In Queensland, the position of cold-setting adhesives has deteriorated over a number of years and has now reached a stage where the normal materials used, viz., lactic casein and soya bean are now in such short supply as to warrant extensive work upon suitable substitutes. Of these the most promising appear to be:-

1. Rennet casein
2. Starch glues
3. Blood albumen
4. Other vegetable glues

Rennet casein

This material has already been extensively used in local plywood mills. The original formulae supplied by the manufacturer were found to be unsatisfactory in mill practice due to the long period (45 min.) required in mixing. Substitute formulae have been developed both by this Department and local mills resulting in satisfactory glues both with rennet alone and with soya bean. This material appears to be the most probable substitute for lactic and as such it is felt that investigation should be concentrated thereon.

Starch glues

Tests were carried out upon sago starch by this Department in co-operation with a local plywood mill. In these it was found that no great dependence can be placed upon a number of formulae contained in standard reference literature. Adhesives were found to have too high a viscosity for satisfactory flow. Variations by increase of the water ratio were found to give satisfactory viscosities but a difficulty was found to result from the effect of this upon gluing. Moisture content showed as a major effect. Recent work by the Division of Forest Products upon the addition of electrolytes may have solved this difficulty.

However, the major objection to this type of glue is found in the high concentration of alkali required. This is not promising in view of the great shortage of suitable sodium salts.

Blood Albumen

It was hoped that blood albumen may have been of use. However, enquiries revealed that no soluble albumen was produced in Australia, a situation which although not insurmountable, was not promising.

Tests have been made and are being made upon dried blood meal but results to date are far from promising and I feel that unless the abattoirs are prepared to manufacture the soluble form, no relief can be found in this quarter. Even if such an arrangement could be made, extensive work would need to be carried out to develop a satisfactory "cold-press" glue because many of our plywood mills are not equipped with hot press equipment capable of treating the quantity of plywood that would result.

Other Vegetable glues

Soya bean, in Queensland, is in sufficient supply to carry the industry until March next, with a possible betterment in quantity after that time. Discussions have been held with officers of the Queensland Department of Agriculture and Stock with a view to developing local supplies, but with disappointing results.

The same position applies, as far as we can see to peanut meal, tests of which have already been made by the Division of Forest Products.

It is suggested that action be taken by the Division of Forest Products to develop extensively economic substitutes for lactic casein using where possible a minimum of alkali.

Mr. Elliot: The major suppliers of lactic casein for glue manufacture by plywood firms have advised the Australian Plywood Board and ourselves that in the future only very limited supplies of lactic casein will be produced, but that reasonable quantities of rennet casein will be available.

In consequence investigations on a number of materials regarded as possible substitutes for lactic casein are being continued.

1. Rennet casein

A formula supplied by James Bell Machinery Co. to the Plywood Board has been investigated and results compared with regular lactic casein mixes and a formula for use of rennet casein employed during the war. Satisfactory glues have been prepared using both formulae for rennet casein. There is little difference between the glue making properties of rennet casein treated with either sulphuric or hydrochloric acids before mixing. Some variation ($1\frac{1}{2}$ - 4 hours) in working life according to source of casein has been observed in glue mixes using the same formula. Recent experiments suggest that acid treatment may be omitted provided addition of the silicate to the mixture of casein and lime is not delayed too long.

Note: At the Australian Plywood Board meeting just held it was suggested that lactic casein supply was improving. All plywood manufacturers reported troubles with rennet casein. It is proposed to try and trace factors causing troubles.

2. Peanut meal

American research has shown that peanut meal is comparable with casein in adhesive properties for gluing wood. Samples of peanut meal from two sources have been received. Both samples were badly contaminated with earth and shell. A series of investigations on the first sample has been carried out whilst the second is under test. Adhesive properties of peanut meal used alone were not fully satisfactory, but better adhesion was achieved with fine flour than with the coarser meal. Glues made by blending up to 50 per cent. peanut meal with casein were acceptable.

A series of tests using blends of peanut meal with rennet casein is about to be made.

3. Safflower

Investigations on the use of safflower as a casein substitute failed to provide a reasonable adhesive. The use of safflower meal as an extender for casein has not been followed.

4. Blood albumen

Preparatory to commencing practical work on blood as a basic source of protein adhesive a survey is being made of the literature on the use of blood as an adhesive." Although large quantities of blood are potentially available for glue manufacture from abattoirs and slaughter-houses, it must be appreciated that a number of practical and economic changes will be necessary before the use of blood in glue becomes feasible in Australia.

5. Soya bean

Soya bean flour is already recognized as an important plywood adhesive in Australia, but some difficulties have been experienced in its use with certain pored woods.

In addition to testing soya bean glue mixes with a number of pored and non-pored woods, investigations have been carried out to determine the optimum proportions of caustic soda and lime in wet mix soya bean glues. In tests carried out on two species, it was found that variations in the amount of caustic soda produced significant differences in bond strength and the optimum quantity was different in the two wood species tested. On the other hand the proportion of lime was less critical.

6. Starch

Investigations on hot and cold mixed starch glue formulae and the preparation of casein - starch blends have been made. Reasonable adhesion and dry test results achieved with potato and sago starch, but water resistance was considerably lower than with casein glues. The viscosity especially with sago starch of the mixes which gave reasonable adhesion was considered to be too great for commercial application. However, there is a possibility that the addition of certain electrolytes, such as common salt, which considerably reduce the viscosity, may make feasible the use of starch adhesives if otherwise considered acceptable for plywood manufacture.

Fairly satisfactory results were obtained with some starch - casein blends treated with cold caustic soda in low concentration. Availability of sago starch may be a limiting factor as the firm requesting investigation has not been able to supply further material in the past several months.

Sodium silicate substitutes

Availability and cost seem to be limiting factors. Our tests have shown that neutral sodium silicate can be used to replace alkaline silicate and that sodium carbonate, sodium fluoride and sodium phosphate may be used. Tests with sodium sulphate were unsatisfactory. Recent enquiries showed that the order of cost per sodium unit ran from sodium carbonate, silicate, fluoride, tri-sodium phosphate to di-sodium phosphate with a ratio of about 1:7.

Chairman: The position regarding rennet casein seems worsened by the enormous amount of variation. Some of the rennet caseins give satisfactory results but others are entirely unsatisfactory.

Mr. Cokley: That confirms our experience of variation in the rennet casein. In the same material we found variation from 40 to 60 mesh, but this difficulty could be overcome by solution in the alkali instead of in the acid. We traced gluing troubles in one plant back to low temperature of mixing. The weather was fairly cold and the glue had gelled before the veneer had time to take it up. We have advised the firm to work on the minimum of 70 to 80° F. for their mix, which they have done with good results. Is it possible for this Conference to do anything about the shortage of caustic alkalis?

Chairman: No. There is a world-wide shortage of caustic soda which cannot be improved until more plants go up.

(b) Co-ordination of research work

Mr. Elliot: With the trend towards fundamental investigations being carried on by Division of Forest Products and the desirability for the building up of staff in the State Forest Services for handling gluing problems of a practical nature, it is suggested that programmes of work in the gluing field be co-ordinated. An indication should be sought from the States as to what staff of equipment facilities are available for carrying out investigations of ad hoc gluing problems in industry and the gluing properties of certain species.

It is, of course, undesirable that Division of Forest Products should vacate this field unless the States can made adequate provision for this to be covered.

In any discussion on the above, the question of training at Division of Forest Products of staff from the States should be included. I think we can help quite a lot in the matter of technique and to a lesser extent with plans for pressing cramps, etc.

Mr. Huddleston: As far as N.S.W. is concerned, the suggestion that the States undertake glue work is a little premature due to staff difficulties. If we leave the matter until next Conference we may be in a position to advise when we can take the work up.

Mr. Ellis: We could do some work in Queensland, but not particularly extensive without interfering with other established projects of importance.

Chairman: We could send Mr. Gordon up perhaps.

Mr. Ellis: That would be very acceptable to us, preferably next March or April.

Chairman: I suggest that this item of gluing of veneer and plywood be placed on next years' Agenda.

22. FIBRE CONTENT OF BARK OF RADIATA PINE

Mr. Pinches: I would like to ask members if they have any suggestions for the utilization of bark from radiata pine.

Mr. Elliot: Dr. Cohen considers it desirable for barks in general, to:

(1) establish a collection
(2) examine qualitatively from point of view of screening out those that do not contain much fibrous material.

Those which are promising should then be examined more fully along the lines being followed in the U.S.A. at present, e.g., for board manufacture.

Co-operation of States would be necessary in suggesting likely barks and collecting same. Division of Forest Products could then undertake at least some of the testing.

It is believed that the tannin content of P. radiata bark is relatively high. (This can be confirmed through Dr. Anderson, Tanning School, Sydney Technical College, who was to obtain samples from South Australia, Victoria and New Zealand).

If the tannin content is high, the bark would have dual purpose, namely for fibre and for tannin.

Mr. Turnbull: Allis Chalmers are marketing an interplane grinder with horizontal grinding discs - it is an attrition type of machine. Talking about fibre products in general, there have been interesting developments in U.S.A. in recent years in bark utilization. From redwood bark, the Pacific Lumber Co., Scotia, Calif., produces fibrous insulating material, a packing material and a soil dressing. From the bark of Douglas fir and hemlock, the Weyerhaeuser Lumber Co. has produced a range of industrial products, including insulating materials, cork substitutes and ingredients for moulding compositions. The Canadian Forest Products Laboratories have produced experimentally hard pressed and insulating boards from the barks of Canadian timbers.

Mr. Bryant: Coghill gives a figure of 5 per cent. for the tannin content of a bark of P. radiata from South Australia. I knew nothing of the properties of the tan.

Mr. Clarke: We will ask for bark in future collections and will consider the practical use at the same time.

Mr. McAdam: Could Dr. Cohen give any indication of the size of the samples he needs? What volume of bark would be required before it could be commercially used?

Mr. Turnbull: We should not go into this without considering the commercial application of it. The Redwood mill referred to previously cuts 850,000 board feet in 24 hours and uses all the bark from that.

Mr. Bryant: I think N.S.W. could do scout tests, but we would like to have the method from Dr. Cohen.

Mr. Clarke: Dr. Cohen would have to do some scout tests first. As far as karri bark is concerned, there is a rather difficult problem associated with it in that you have to dry it quickly else the tannin becomes insoluble.

23. USE OF RING CONNECTORS FOR SOLEBARS AND OTHER RAILWAY TIMBERS

Mr. Ellis: Queensland is trying to persuade the Railway Department to use timber connectors for solebars. At present they are using 9 in. x 6 in. timbers and we suggested the use of two pieces 9 in. x 3 in. joined with split ring connectors. They are not happy about ring connectors as they fear joining in this way will allow additional opportunity for decay to set in. At the present moment there is a possibility of their using an experimental truck. Have the other States a similar problem?

Mr. Clarke: I think all the other States have steel trucks.

Mr. Ellis: We have been advised that the Department will be making steel trucks before long.

24. TANNING MATERIALS

Mr. Cokley: This item was suggested, not so much for the purpose of reporting progress in our work in this field but rather for the purpose of learning what has happened elsewhere. Although the desirability of a complete survey of tanning materials was discussed at the last conference, we have been unable to carry out the necessary work. This has been due to two reasons,

1. lack of staff,
2. lack of interest of collectors.

In the case of the latter we have not been able to interest labour in the collection of bark, either for samples or for commercial quantities. For example, we required a 1 cwt. sample of mangrove bark for experimental purposes but found it necessary for one of our own officers to collect the material.

Although large quantities of mangroves exist in our northern areas their situation is mainly in tidal swamps and men are not anxious to work under these conditions.

Local Queensland tanners will not at present use this bark. We have found that the objectionable colour can be removed and have prepared "honey - gold" solutions from Rhizophora. The major aspects concerning such extractions have been,

1. the maximum temperature of extraction should not exceed 160° F.,
2. the pH extraction plays an important part.

In fact our present theory, which must of course be proved by further experiment, is that the red colouration is due to a transition form of the tannin molecule and not to the presence of other organic substances. We have shown that a highly acid pH, lower than pH1.1 turns the colour while a pH above 7.0 does likewise. The presence of magnesium chloride has been shown in the bark and it is possible that this hydrolyses during normal extraction processes. This is an item on which I would like other opinion.

Mr. Bryant: I want to discuss the work we have been doing on white cypress pine, black cypress pine and red gum and also to deal very briefly with a tannin survey we propose to carry out in New South Wales. We have been lucky that Dr. Anderson is available for consultation here and most of the figures I am going to quote are his. However, the Commission has appointed a chemist to the staff to do this work. He is at present working with Dr. Anderson and will shortly be in a position to carry out at this Division tannin analyses from the thinnings from our black wattle plots and survey work on the tannin content of various species.

With regard to black pine, a factory scale trial by Mangrovite Belting Co. is now almost finished and the Company has reported the bark to be satisfactory. The only trouble is that the sawmiller, who was very unco-operative in supplying the bark, appears to have collected it during the wet season. Instead of a tannin content of about 20 per cent. it only gave a figure of about 14 per cent.

The Commission proposes to suggest that future supplies should be analysed either by this Division or by the Department of Leather Technology and the price paid on the analytical results.

I propose obtaining a definite agreement in writing from the Mangrovite Belting Co. and discussing with the sawmillers personally, the supply of regular quantities of bark under definite conditions. The estimated quantity of bark that these sawmillers can supply is about 9 tons per week. Used in association with wattle bark it is entirely satisfactory for the manufacture of belting leather and has the additional advantage that it contains a considerable preparation of organic acids which means that the tanner does not have to add acid to his extract.

With regard to white cypress pine bark, the tannin content appears to be in the vicinity of 12 per cent. which is sufficient to make the rail freighting of the bark to Sydney a commercial proposition. So far as the Commission is concerned we do not see any immediate possibilities for utilizing the bark of white cypress pine in view of the small quantities available at any central position.

Dr. Anderson has carried out some analyses of red gum. These varied somewhat but 8 to 10 per cent. seems representative of the species. Also the supplies of bark are not very great so far as the requirements of an extract plant are concerned.

With regard to the survey of tannin containing materials, we have collected 30 samples of black wattle bark, ten from each of three different localities, and we propose to examine the variation in tannin content to determine whether or not high yielding areas occur on the South Coast. We propose to make a survey of other tannin containing materials and we will be very interested to hear comments from the Division of Forest Products with regard to species considered worth examination. Because this work is particularly laborious and time consuming, we propose to try to establish some correlation between hot water solubles and tannin content in preliminary work.

It is obvious that the successful establishment of an extract plant based on black wattle bark will depend on the successful pulping of the black wattle wood.

Mr. Cokley: Mr. Turner, a representative of an English firm, recently signified to us that his Company was considering the establishment of a synthetic tannin plant in Sydney. He was very keen to learn source of bark. The problem in Queensland, however, is that there is no labour to strip the bark.

Mr. Bryant: We have the same position in N.S.W. It might improve when the price of wattle bark is raised.

Mr. Elliot: Dr. Anderson, of the Sydney Technical College, is examining karri bark, fresh samples being obtained by air each month. Marri is also being examined, with the idea of using with synthetic tannins.

He is also interested in brown mallet.

Dr. Anderson is considering establishment of a tanning yard and has in mind the following additional barks:

young E. sideroxylon
E. rostrata
E. crebra (has first rate tannin, comparable with quebrachs)

He has gone into the question of Callitris glauca and E. crebra jointly. He regards them as a marginal case because of small amount available in any one place. Callitris calcarata considered too dark for sole leather but all right for belting. This could be used by tanneries as bark, not as extract. Is considering whether E. sideroxylon and E. crebra are milled together in sufficient quantities to offer prospects of extract plant. The following are suggested as a composite group for Queensland:

E. crebra, bark and wood
E. sideroxylon, bark and wood
E. paniculata, bark and wood.

Anderson suggests possibility of cultivating E. consideniana, which yields pure pyrogallol tannin.

In connection with the proposed tanning yard, Dr. Anderson is interested in quantities of sawdust and bark available from various timbers in quantity, and centralized. He is looking for 10,000 ton per annum extract plant. Where any sawdust is available in quantity, Anderson would like to work on tannins.

He points out that hydraulic barking is detrimental.

Mr. Clarke: Would N.S.W. consider the possibility of mallet?

Mr. Bryant: It was discussed with Dr. Anderson some years ago, but has never been put forward as a proposition by this Division. Whilst the tannin produced from it is very good in many ways the main need here seems to be for more wattle bark.

Mr. Huddleston: All other tannins require a percentage of wattle tannin.

Mr. Clarke: There is a world wide shortage of wattle bark for tanning.

Mr. Huddleston: It we develop black wattle we will have a major job on hand without other species.

Mr. Payne: We would be glad to co-operate in any way with N.S.W. with our black wattle, provided the work involved is in our capabilities.

Mr. Bryant: We will accept with pleasure. We only want a small sample that could be easily collected and sent by ship.

Mr. Irvine: We have received a letter from the Forest Experiment Station in Natal, South Africa, asking for seed of black wattle collected from localities showing marked variation in climatic changes. Is the same project going forward in other states? If it is we should be pleased to exchange small quantities of seed and to plant for trial seed from other states.

Mr. Bryant: It has not come to this Division yet. It seems a good idea.

Mr. Ellis: What species of iron bark was tested and why was it no good.

Mr. Bryant: E. crebra. Dr. Anderson said it was not as good as originally anticipated but he did not state his reasons.

Mr. Clarke: If bark is dried slowly then crushed, the tannin is concentrated in the fine fraction.

It might be possible to produce tannin from low grade barks by this means.

Mr. Bryant: We must have some mechanical means of removing the bark. The whole question of bark utilization depends on this.

Mr. Clarke: We can supply details of these machines. Mr. Turnbull has details of a simple rotating chain machine which is very effective.

Mr. Bryant: We should be interested to have some information.

Mr. McAdam: What is the ruling price for imported bark at the present time?

Mr. Bryant: £26 per ton.

Mr. Irvine: What is Sydney price of local black wattle?

Mr. Huddleston: The price for local black wattle ex district from where it comes is £14 per ton.

Mr. Turnbull: Does the price depend on tannin content?

Mr. Bryant: Not according to regulation

Mr. McAdam: Has a complete survey of Australian tannin requirements been made?

Mr. Bryant: As far as I know this has not been made. We have tried to get an estimate for N.S.W.

Mr. Huddleston: We cannot centralize these enquiries. It involves the question of facilities such as water supply, etc. The States have to deal with that themselves.

25. GENERAL

(a) Provision of library of educational films for forest products

Mr. Ellis: I feel that there is in Queensland a great lack of satisfactory films. Few available films are Australian and they are more concerned with forestry than with forest products. Would D.F.P. be prepared to start collecting a library of films which would be available to all organizations concerned?

Mr. Turnbull: We have had similar enquiries from instructors in wood technology, but we cannot help them much at present. If we had a free exchange of films I am sure it would place us in a much better position.

Mr. Huddleston: We have been collecting suitable films for our own library. We restrict our films to operators and projectors that we know so that they will not be spoiled. They are not available for free distribution. We have been hoping to obtain copies of local films. I suggest to Mr. Ellis that such a library should be built up for Queensland's use. We will be happy to make available copies from any master film at the actual cost of the copy. We will also be prepared to assist by advising him of any film that is being made for us. At the moment we are obtaining a film from Fox Movietone on Logging in the Cedar Forests. I think that the project of building up a film library is a desirable one.

Mr. Clarke: What would the cost of 16 mm. film be?

Mr. Moulton: I think the cost of black and white positive is 1/- per ft. but it would depend on a number of things; up to 2/6 for sound processed copy. We hope to shoot the master negative and have it processed by a commercial firm and also have them make duplicates for us.

Mr. Huddleston: A black and white film with a sound track incorporated can be reproduced at the same price as silent film.

Mr. Elliot: D.F.P. has its own sound projector. We have made only one film recently. Can a silent be made from a sound-tracked film?

Mr. Moulton: Yes. If you have the master negative.

Mr. Huddleston: All organizations should buy a sound projector, as it will also run though a silent film, but a sound film cannot be run through a silent projector.

Mr. Moulton: The difference is that in sound films you shoot a film to take 24 frames as against 16 for a silent.

Mr. Irvine: I think there is ample scope for exchange between the States if we pay the cost of reproduction of films produced by other States. Victoria owns a 16 mm. sound projector and has a small collection of films which are used, not for technical education, but for publicity. We have recently made a film Green Gold in colour and other States could have a copy for the cost of reproduction.

Mr. Turnbull: There are other bodies interested in this project, e.g. T.D.A., various technical organizations, etc. We should let them know what is available.

Mr. Cromer: The Australian Forestry School would be very interested.

Mr. Elliot: We are interested in high speed cinematographic work but have not got all the equipment. Our experience has been that production is not easy, but Dr. Dadswell will be pleased to co-operate when we get the equipment.

Mr. Clarke: There is not much possibility of propaganda films but we have been thinking of replacing some trade circulars with films. C.S.I.R. Information Service has a film unit but it has not done much.

Mr. Gay: The Department of Information is filming our activities on termite research.

Mr. Huddleston: The last conference agreed that a preservation film should be made. That can go ahead if all are agreeable.

Mr. Tamblyn: I do not think we have the necessary talent to make a film on our pole tests. We should investigate whether the Department of Information can make the film. The film was intended as part of the symposium on pole tests and as such requires to be a high class propaganda film.

Mr. Huddleston: Mr. Moulton has the talent. If we make the film we can get a proof copy and make re-takes where necessary. If would be difficult to do this if the Department of Information made the film.

Mr. Tamblyn: We want a colour film.

Mr. Huddleston: I would advise forgetting colour as the colour film available in Australia will not re-produce.

Mr. Moulton: 16 mm. film is largely regarded as amateur film in Australia, but we could shoot in both black and white and colour.

Mr. Clarke: The general feeling seems to be that we should try. I would like to see Mr. Huddleston's suggestion followed up.

Mr. Elliot: It is comparatively easy to build up a library of strip films. A strip film takes the place of lantern slides and requires inexpensive equipment.

Mr. Moulton: We have a 35 mm. strip projector.

Mr. Clarke: Strip film is good for stock lectures, but if lectures are changed lantern slides are better.

Mr. Huddleston: I move that each organization represented at this Conference inform others of any films available or in course of production.

Mr. Ellis: I second the motion.

Mr. Huddleston: If they are going to be made available to trade organizations we should retain the copyright to prevent misuse! We should only allow them to be obtained by organizations we know would use them correctly.

Mr. Payne: Tasmania has a technical film section attached to the Public Library. There may be a similar organization in other States.

Mr. Weston: The matter is developing satisfactorily in Western Australia through co-operation with the visual section of the Education Department.

Mr. Huddleston: I would like to draw to the attention of delegates that there are various film libraries, e.g. Shell's, Herschells', etc.

Motion carried.

(b) Forest Products Sub-committees of F.A.O. National Committees

(i) Representation on Committees

Mr. Elliot: Member governments of F.A.O. have been requested to form National F.A.O. Committees for co-ordinating F.A.O. work in their respective countries, for handling correspondence, obtaining information on questionnaires and implementing F.A.O. recommendations. At the Third Session of F.A.O. Conference held at Geneva August - September, 1947, when dealing with the activities of F.A.O. Division of Forestry and Forest Products the establishment within the National F.A.O. Committees of Forestry and Forest Products Sub-committees was discussed and subsequently Conference recommended that all member countries set up such Sub-committees.

Essentially the function of the Forestry and Forest Products Sub-committees is as a specialist group to assist the National F.A.O. Committee on matters relating to Forestry and Forest Products.

As I see it, this Forest Products Conference can only discuss the matter of representation against the time, if and when, the Australian National F.A.O. Committee decides to set up a Sub-committee on Forestry and Forest Products.

Mr. Irvine: In Victoria the State Committee of F.A.O. consists of representatives from the Department of Agriculture, Health Department, Forests Commission and Fisheries and Game Department. At a recent meeting it was suggested that the Victorian committee should agree to the setting up of a National Forestry and Forest Products Sub-committee to consist of representatives of the various State forestry authorities, the Forestry and Timber Bureau and the Division of Forest Products of C.S.I.R.

I take it the matters concerning the Sub-committee will be not so much those of research, but those relating to resources and production.

Mr. Clarke: F.A.O.'s interests are much wider.

Mr. Irvine: To some extent it would appear that some of the activities of this proposed Sub-committee will be like this conference but with more frequent meetings.

Mr. Ellis: Is that satisfactory from the point of view of this conference?

Mr. Turnbull: It seems to affect the conference to the extent that Australia submits an annual report to F.A.O. and we should see that matters discussed here are presented in their proper perspective and reported correctly to the F.A.O. Australian Committee.

Mr. Elliot: C.S.I.R. is represented on the National Committee by Dr. Dickson Chief of the Division of Plant Industry.

Mr. Ellis: There is some confusion in my mind as to whether the Division of Forest Products is in any way associated with F.A.O.

Mr. Clarke: Not on any Australian committee at the present time. C.S.I.R. is represented on two international sub-committees, by our Dr. Cohen and Mr. Gordon. We get information from these two members and keep forestry and forest products authorities informed of happenings. The method of selecting people for these committees is a very queer one and seems to me to be largely on a personal basis.

Mr. Elliot: The position really is that the Forestry and Forest Products Sub-committee is not yet formed.

Mr. Irvine: I doubt very much whether this conference couldeven recommend representation to the organizations concerned. It seems to be a matter for consideration by the State Forestry authorities.

Mr. Clarke: I would like to suggest that someone from this conference should discuss this matter with Mr. Rodger. Dr. Dadswell could do it.

Mr. Irvine: Mr. Moulds, the Forests Commission of Victoria, who is a representative on the State F.A.O. Committee will be concerned with this. I could discuss it with him.

(ii) South Pacific Conference

Mr. Elliot: Early this year Dr. M. A. Huberman, in the capacity of personal representative of the Director, Division of Forestry and Forest Products FAO, visited a number of countries in South and East Asia and Australia and New Zealand.

In his travel he contacted the various Governments and forestry and forest products establishments to acquaint them with the proposal that an FAO Forestry and Forest Products Conference be held in the area in 1948 or '49. He assessed generally the relative merits of various countries and the facilities available for holding a conference in the different centres visited.

Final decision on the place where the conference will be held will undoubtedly be determined as the result of negotiations between the Director, Forestry and Forest Products Division FAO and the Governments. Singapore or a city in Australia would probably be the best places so far as facilities are concerned but political and travel problems may result in selection of some other place.

It is probable that the Conference would consist of plenary sessions to open and close the proceedings, the intervening period being devoted to committee discussions.

Delegates would probably be divided into two committees dealing respectively with forestry (including soil conservation) and forest products.

Forest products matters would include questions of increasing production, discussion of methods for obtaining maximum utilization, economic problems, utilization of new or little used species, surveys of production and requirements, availability for export and factors limiting development or exploitation. Attention would be given to fuel, logs and various manufactured products.

Mr. Clarke: We have asked Dr. Huberman about the part Australia might play in the conference proposed. He felt that the research side could easily be an important side of the conference. He also felt that South East Asian countries would be likely to look to Australia for training people and possibly for carrying out some experimental work here. So far as we were concerned we could not generally commit ourselves. We have been helping and so far have taken two graduates from Nanking University to do post-graduate work with us. I think that aspect of research might play a part in the conference. I think it is extremely desirable that we have forest products representatives from each State.

Mr. Ellis: I take it that nothing has been decided yet as to who should bo invited to this Pacific Conference.

Mr. Clarke: No.

26. CO-OPERATION

(a) Publications

Mr. Elliot: The Lyctus publication has been circulated for comment. This is the first publication that has been done on a co-operative basis following the decision at last year's conference. We want to know if the title of that publication is satisfactory.

Mr. Ellis: The situation might be better met on the title page with "has been prepared in collaboration with ...."

Mr. Clarke: It seems to me that you are playing yourself down.

Mr. Huddleston: I think we make everything perfectly clear in the foreword. It is quite satisfactory to me.

Mr. Gay: There is an incorrect use of the word "available" I would prefer "based upon research done and information supplied by".

Mr. Tamblyn: I was not responsible for framing the title page and was a little perturbed when I read it. I think all the States should receive recognition on the title page.

Mr. Clarke: Do you want more Forest services included?

Mr. Huddleston: So far as N.S.W. is concerned, we prefer the existing title page.

Mr. Payne: I think the people who are being played down are D.F.P.

Mr. Huddleston: The paragraph may be better if it went something like "the solution of the Lyctus proofing problem has been brought about as a result of research work by the Division of Forest Products and the application of the results of such work by the Division of Wood Technology".

Mr. Bryant: That would be more correct.

Mr. Clarke: What about the Division of Economic Entomology?

Mr. Gay: I think it might well be omitted.

Mr. Clarke: We could say the circular has been critically reviewed by all States.

Mr. Irvine: Victoria does not come into it very much. We did little work and therefore can't approve or reject.

Mr. Tamblyn: If the State services approve let us say so on the cover page.

Mr. Clarke: We could add "and endorsed by".

Mr. Turnbull: "Endorsed by" should be sufficient.

Mr. Huddleston: I don't think it makes any difference.

Mr. Clarke: Will you leave us to make the alteration and resubmit it?

Mr. Huddleston: I think that is the best way to do it.

Mr. Ellis: There has been a move to form a Wood Technology Association in Queensland. The time might be opportune to consider that in relation to Australia, not only Queensland. I am particulatly concerned with the publication of results. There is no publishing body to which reports on forest products can regularly be sent for publication. The Australian Timber Journal will publish reports but they are in the nature of popular reports and trade reports. I think there is a demand in Australia for publication of technical reports in an appropriate technical journal, such as that issued by the American Wood Preserving Association. A Wood Technology Association might be the channel whereby technical reports could be issued periodically. Alternatively, the Australian Timber Journal might be persuaded to issue a quarterly supplement devoted to a collection of papers compiled by authoritative research workers in Australia. There is much work being done in Australia which is not being published. The D.F.P. has an adequate publishing service, but the State services generally have no such facility.

Mr. Huddleston: Our experience in N.S.W. with general forestry publication and technical notes is that we have found considerable difficulty in getting the officers concerned to contribute papers. For that reason, the issue of those periodicals is a difficult matter. I think the same would apply if you formed a Wood Technology publication.

Mr. Hartigan: I support Mr. Ellis in this matter. We have been approached by different people who are interested in forming what they describe as a Technologists Association to discuss problems. Mr. Lembke is very enthusiastic about this, and promised we could use the Timber Development Association room for holding such meetings. It would not be necessary to run such meetings with any great degree of formality, but members would have the opportunity of meeting to discuss their problems in their own time.

Chairman: There is an enormous amount of work involved in the starting of such an association.

Mr. Ellis: Let the matter rest for the time being. Within the next 12 months this problem will have cleared in Queensland. When we meet again next year we may be able to get down to tin tacks on the subject.

Mr. Ellis: Last conference we agreed that there should be an exchange of working plans and reports between the States. Queensland has fallen down on the job largely because we have not the staff to type these reports. The typing situation is bad and I do not see how we will be able to give you all the information we would like you to have. It has occurred to me, however, that the Division of Forest Products might be willing to do some roneoing of reports to help us out.

Mr. Elliot: I think at the present moment that it is quite impossible for us to help Mr. Ellis. The only way we could help would be to build up our staff, and

I don't see how we could do that.

Mr. Clarke: We appreciate the difficult position Mr. Ellis is in, but it is the same everywhere. If you could let us know when your most urgent reports are being held up we may be able to help in some way.

Mr. Turnbull: The only solution I can suggest is that a public roneoing firm do the job. Would the Public Service Board allow this?

Mr. Ellis: They might, but it does not seem probable to me.

(b) Assumption of Applied Work by State Forest Services

Mr. Elliot: Certain types of applied work should be taken over gradually by State forest services. We have made one advance in that direction. During the past year Mr. Huddleston got in touch with us and, referring to the question of box testing, which up to now has been carried out in our Division, asked if it would be possible for us to help him by making available to the Wood Technology Department our box-testing equipment for 2 to 3 years. We were very happy to accede to that request. Mr. Huddleston sent one of his officers to Melbourne for training in the technique of box testing and general information on box testing. Mr. Way spent 3 months with us. As far as we are concerned, when Mr. Huddleston has carried out the work he wants to get done, that equipment will be passed on to the next State that would like to undertake work of that nature.

Mr. Huddleston: The position as far as New South Wales is concerned is that the Division of Forest Products is making its box testing drum available to us for 2 years. At the end of that 2 years it will review the position and if some other State wants to borrow the equipment it will be made available. If the position warrants continuation of work in New South Wales we will copy the design and install equipment on our own account.

Chairman: We are very happy about that development, and hope that the example might be followed in other applied branches of work.

Mr. Payne: Tasmania at last year's conference gave an assurance that it would do what it could to engage an officer for this applied work. During the past year I have brought to the notice of the Forestry Commission, in an informal way, on many occasions the desirability of us employing someone for that work. Apparently the informal approach is not a very effective way of doing things, and I propose on my return to Tasmania to submit a formal case to the Commission, which they can consider and either accept or reject. I express regret that we have not been able to help the conference by relieving the Division of Forest Products of some of the burden they have had to carry with regard to the question of extension work in Tasmania.

(c) Timber Bank for Research Purposes

Mr. Turnbull: We believe that our fundamental work should be carried out on the most important species of Australia rather than on odd timbers that happen to be at hand when experiments are started, as the result of the work will then increase our knowledge of the important timbers.

We desire to establish a stock including approximately 20 of the most important Australian timbers. Questions of availability and properties have been considered and the consensus of opinion is that the first 12 species to be obtained should be:-

Eucalypts	Other pored timbers	Non-pored timbers
E. pilularis	Tristania conferta	Araucaria cunninghamii
E. marginata	Syncarpia laurifolia	Pinus radiata
E. maculata	Nothofagus cunninghamii	
E. microcorys		
E. grandis		
E. obliqua		
E. paniculata		

Orders for initial supplies of the above have been placed.

Each section of the Division will be interested to some degree in the material that comes to hand and each will take test specimens in various dimensions from each shipment. We will endeavour to simplify the collection by covering the requirements of all sections at the one time. A specimen 6 in. x 6 in. x 10 ft. will cut out satisfactorily but the dimensions are not unalterable and if it would be easier to procure wider, thicker or longer pieces under some local circumstances, the Division is prepared to consider the alternatives as the offers arise. For some purposes a section across a diameter is required and, for others, a whole log.

It is important that the principles of random selection shall apply, and this will be discussed by speakers under sub-sections (d) and (e). The trees must be true to identity and a representation covering butt, intermediate and top positions is desired. The actual requirements will be covered in orders as they are placed.

Mr. Huddleston: Some years ago I pointed out that the timber we had at Balmain could be regarded by you as a D.F.P. bank. We even provided you with a set of our stock cards showing what we had in hand. That offer still stands.

Chairman: Thank you, Mr. Huddleston. We have not taken advantage of your valuable suggestion to a great extent in the past due to practical difficulties. It makes it easier for an officer to plan his research work if he sees the timber before him.

Mr. Taylor: How am I to get that representation. I have been given the job of arranging the collection of material, and I do not know how to go about it.

Mr. Turnbull: The answer to that question will become clear when the next items are discussed.

(4) Selection of Material

Mr. Pearson tabled a paper on "The Effect of the Variability of Timber upon the Choice of the Sampling Plan". As this was distributed to delegates, the following summary only is included in these proceedings.

The variability of many of the properties of timber is such as to require the testing of a relatively large number of specimens to determine its effect and obtain a reasonably accurate estimate of the mean value of the properties. Many Australian species are inadequately, or not, tested, so it is important that the size of sample adopted should give sufficient information in the shortest possible time. The size of sample to be tested depends on the variability of the species and the purpose for which the results are required. If the variability is unknown, as is the case for a species which has not previously been tested, it must be estimated before a sample size may be decided on. Such an estimate may be obtained by considering the known variability of other species, and it is hoped to publish a paper on this subject shortly.

From an analysis of existing test results it was possible to determine values relating size of sample to the standard error of the species mean. These values were plotted and the resulting curves enable the size of sample to be read off for any desired precision of estimate of the species mean for the static and impact strength properties. The curves revealed that much greater accuracy is attained by sampling more trees than by taking more samples per tree. For example, 1 specimen from each of 30 trees gives as precise an estimate of the species mean as 20 specimens from each of 15 different trees.

It is proposed not to determine the variation within trees as it is of little commercial importance, but to allow for its effect by selecting the material at random from within the tree. In addition, the trees will be sampled at random from the forest as far as practicable. Randomness in fact is the basis of the proposed sampling plan and is essential to its success.

c) Collection of Material

Mr. Aloot: I have circulated a draft collection plan for the scout testing of Australian species for your comments. The number of important species of Australian commercial timbers on which we can give adequate information is extremely small. This plan has been devised to enable us to test a large number of species in a relatively short time, the average properties of each species being determined to a pre-selected degree of precision. Previous working plans have involved not only sampling a number of trees but sampling within the tree, so that the variation in a tree can be studied in addition to obtaining the average properties of each species. We are planning to dispense with the study of the variation within the tree and take one specimen from each of a number of trees. I have calculated that, allowing for a reasonable proportion of the working time in our laboratory, we can test 100 of the minor species of Australia per year, or alternatively 20 major and 20 minor species. Where we think that the variation in a particular species within the tree is of importance commercially or for research purposes, we will treat that as a separate project and obtain special material and study that variation.

This plan provides for the Forest Services planning beforehand the random sampling of the species to overcome the conscious or unconscious bias of the collector. To be specific, in collecting any particular species, it is hoped that the Forest Service will first of all randomly select certain areas as set out in this plan from the localities in which the species grows. They will randomly select some point of the compass within that area - north, south, east or west. They will then instruct one of their forest officers to go and get a tree in that particular part of his area. Now that tree which we have suggested is to be randomly sampled should be the first felled when the officer arrives in the district. I will welcome any questions or suggestions as to the way in which this plan should be carried out.

Chairman: We hope to have a collector appointed to our staff in the near future. We propose to carry out some trials with this method of collection and to arrange for that collector to visit the various States and discuss with them principles of collection and any modifications that would have to be carried out to overcome practical difficulties. However, the gains to be made by the random selection method are so enormous we feel it will be worthwhile to spend money collecting the material.

At the suggestion of the chairman, it was decided that a discussion of this subject should be held at the end of the plenary session by all interested members. A resume of the discussion follows.

Representatives of the Queensland Forest Service, Victorian and Tasmanian Forests Commissions, New South Wales Division of Wood Technology, New Guinea Forests Department and Division of Forest Products were present at the further discussion of the draft Instructions to Collectors for the scout testing of Australian species. The State Forest Services represented agreed to co-operate with the Division of Forest Products in the implementation of such a plan. As the draft had only been made available at the commencement of the Conference, some of the delegates requested time to give the plan more detailed consideration. It was also suggested that the request for assistance of the Forest Services in the selection and collection of material should be taken up in correspondence between the Division and the Forest Services.

Certain items such as the method of selection and the data to be recorded were discussed at length and several suggestions were made for incorporation in the Instructions. It was apparent that differences in procedure between States as regards log recording and other points of general administration might require slight differences in details of the Instructions from State to State. It was tentatively suggested that the Collector to be appointed to the Forest Products Staff should at the appropriate time visit each State Service and discuss the details of the collection of material and in collaboration with each Forest Service modify the Instructions to suit the conditions obtaining in each State.

Arrangements for Next Conference

It was agreed that the next Conference be held in Melbourne in October of next year.

Conclusion.

Chairman: I would like to thank Mr. Huddleston and his officers for the very kind reception afforded delegates to this Conference. Nothing has been too much trouble for our hosts and they have done everything they could to make the Conference a success. I think the success of the Conference has been due in no small measure to their great thoughtfulness for our comfort. I would like you to show your appreciation by acclamation.

Mr. Huddleston: Mr. Chairman, in reply to your kind remarks, I would like to say on behalf of my staff and myself, that it has been a great pleasure to have you with us. It has been particularly beneficial to us in that we have been able to have quite a number of the staff present during most of the discussions. I must personally disclaim any great responsibility for the organizing of the Conference. I have a keen staff, and the major work which evolves on this Division in connection with the Conference has been carried by Mr. Taylor, Mr. Bryant and Mr. Hartigan. Anything that has been done for you, the entertainment which has been arranged, has to a very large extent been initiated by those three officers, and to your remarks I would like to add my appreciation of the way in which they entered into the Conference and the necessary arrangements for it.

APPENDIX I

FOURTH LYCTUS CONFERENCE

WEDNESDAY 13TH OCTOBER, 1948

PROGRAMME

2:15 p.m.

1. Sapwood and Truewood Differentiation.
2. Boric Acid Treatment.
   - (a) Price and supply position of boric acid and substitutes.
   - (b) Substitutes for boric acid.
   - (c) Re-examination of toxicity of boric acid and borax.
   - (d) Incorporation of fungicides in borax.
   - (e) Dip treatments against surface moulds in boric acid tanks.
   - (f) Use of unlined concrete structures in the construction of preservation vats.
   - (g) Effect of initial moisture content upon the steaming/cold quench process.
   - (h) Cold soak treatment of spotted gum and susceptible timbers.
   - (i) Australian Standard Specification for boric acid treatment.
3. Lyctus.
   - (a) Susceptibility lists and publication.
   - (b) Laboratory breeding and testing techniques.
   - (c) Legislation.
4. Anobium: susceptibility of radiata pine.

FOURTH LYCTUS CONFERENCE

1. Sapwood and Truewood Differentiation

Mr. Cokley: In the past we have been carrying out schedule tests, basing the results on the starch determinations, but we are not happy with that method. We have tried many suggested treatments, for example, benzedine and sodium nitrite. In the case of pine we have had some success, but not with scrubwoods. In fact, we have reached the stage where even in our schedule testing we are very doubtful of the absolute matching of our samples. Just what practical significance it may have I do not know, but it would be desirable to know our samples were true sapwood only or true truewood only. Perhaps members may be able to help us.

Mr. Elliot read a paper on "Sapwood and Truewood" prepared by the Section of Wood Structure as follows, omitting details of the method of collection of samples as the paper was distributed to delegates.

SAPWOOD AND TRUEWOOD

During the early stages of the work on sapwood and truewood an indicator was found ($NaNo_2$) by the use of which the truewood of colourless eucalypts could easily be differentiated.

A similar indicator has been devised by Koch and Krieg and is in use in the U.S.A. for differentiating between sapwood and truewood in certain softwoods. Unfortunately no satisfactory indicator has yet been found which can be used on brush timbers, but work on this is being continued.

In connection with work on the development of truewood a study was made of the effects of wounding.

The wood formed around the injury was found to be similar in many respects to truewood. This work has been confined to species of Eucalyptus and Acacia and has not been applied to brush species.

Meanwhile the problem has also been tackled from the standpoint of the anatomy of different types of timber and this work suggests that the condition of the ray cells determines the transition from sapwood to truewood.

A correlation has been found between the anatomical structure of the wood and the blocking of the truewood vessels by tyloses and/or gum. Tyloses occur almost exclusively in woods in which the vessel/ray pitting is coarse and irregular, with very wide apertures and narrow borders. In the woods with small or minute bordered vessel/ray pitting the blocking of the vessels at truewood formation is by gum. (Project W.S. 16-1, Progress Report No. 1.)

Further investigation has shown that in normal circumstances both tyloses and gum are produced by the ray cells and not by the vertical wood parenchyma, even in woods in which the vessels are partially surrounded by wood parenchyma. (Project W.S. 16-2, Progress Report No. 1.)

From this it appears that the rays may play a more important part in the formation of truewood than has hitherto been suspected. Further work on the ray tissue is planned in order to find what part the different types of ray cell play in the metabolism of the tree, how long they live, and whether truewood formation causes their death, or results from it.

The hypothesis upon which future work is planned is that the first changes that appear in the ray cells occur when the vessels contiguous with them become air-filled. From this point on, the metabolism of the ray is upset, though the cell may not die at once. Truewood results from these changes in the ray cells which, when they start to die, use up the starch reserves, which are not replaced, produce gum and tannins in excess, and may even show their stimulated activity by the formation of tyloses.

From this hypothesis certain questions arise:-
1. While the ray cells are alive, and acting normally throughout the sapwood, the starch content shows seasonal variation, as it is used up by the needs of the tree, or replaced during periods of photosynthetic activity. At the time of truewood formation this starch disappears for good and all. Is it used up in situ for the altered metabolism of the dying ray cell?
2. Some trees appear never to make truewood at all, and are called sapwood trees. They may grow to a great size and yet contain starch right into the pith. On the other hand they may have one part of the trunk full of starch while other parts are free from it. Are these sapwood trees ones in which the centre doesn't dry out, and so the whole sequence never starts and the ray cells remain alive? Or are they ones in which the centre does dry out, but as few of the rays touch the vessels, their metabolism is less affected? Both these conditions may occur in different species, but until we know more about the moisture content of living trees we cannot say.
3. Rays are anatomically different in different timbers. Do these rays all behave in the same way at truewood formation?
4. What part does the vertical parenchyma play in the metabolism of the tree, does it act differently from the ray tissue?

5. What - if any - is the difference between the truewood of trees that have a dark truewood and those in which it is almost the same colour as the sapwood? In other words are there degrees of truewood development, or is the difference one of actually different substances deposited?

In order to try to answer these questions a technique has been worked out for fixing the ray cells in freshly cut green wood, so that by studying the state of the nuclei the longevity of ray and parenchyma cells may be assessed. For this purpose sections cut from freshly felled green material are "fixed" in Carnoy's solution or formalin - acetic - alcohol, and stained to show the nuclei. Where the material cannot be brought to the laboratory for immediate sectioning, cores extending into the truewood are removed from living trees by means of an increment borer. These are fixed on the spot and left in the fixing agent until they can be sectioned in the laboratory. Co-operation from the forest services in collecting material in this way would be much appreciated.

Data on the moisture content of the sapwood and truewood at the time of felling would also be very useful, and especially details of moisture content of discs from sapwood trees, giving moisture contents from pith to bark in large trees.

Mr. Tamblyn: From this report I think it is quite plain to all that the differentiation of sapwood and truewood is a difficult problem. Dr. Dadswell's section is working on it and ultimately we may be able to provide that simple method of differentiation. In the meantime, we in the Preservation Section are using the starch test. We realize that it is a quite arbitrary method which does not necessarily give true distinction. Dr. Dadswell is trying to differentiate between sapwood and truewood on a true fundamental basis, but until he can do so there seems no better method from the boric acid treatment aspect than to use the starch indicator, or possibly when applicable the sodium nitrite method.

Chairman: Technical people are losing some standing with the industry because our definitions seem to indicate that by sapwood we mean the narrow light coloured band in logs, whereas they have found that as soon as they start testing for starch in quite a number of the timbers the starch goes well in towards the centre of the log, and they feel we don't know anything about it. We feel we should meet that position and, although we had an article on it in our newsletter not long ago, at the moment we are preparing another one, making it quite clear that sapwood can be quite extensive in some species. The whole log may be sapwood, even in quite a large tree. We feel we should get that information circulated as quickly as possible with the idea of restoring our status with the industry.

Mr. Huddleston: We are losing status also by our practice when issuing results to the industry of showing samples as probably sapwood and probably truewood. It has been put to me by one member of the industry, "Don't you blokes know which is sapwood and which is truewood?"

Mr. Taylor: If there's anything we can do to help D.F.P. we'll be only too pleased.

Chairman: Our Australian standard definition of sapwood is rather an unfortunate one. It speaks of the outer layers of the tree, but we do not define what we mean by the outer layers. We could say the outer layers are everything but the pith but that does not alter the fact that it does convey the impression that we are referring to the narrow portion on the outside.

Mr. Irvine: There are two reasons behind the necessity for the distinction between sapwood and truewood. The first is that dealing with the lyctus problem and the second is a straightout preservation problem where it is desired to impregnate sapwood with a preservative against decay or termites. It seems to me that, leaving the fundamental question aside, for Lyctus only the starch test is good enough for practical purposes. If it is for impregnation work, then some physical test would be sufficient.

Chairman: We have taken the attitude in this article that we are preparing by first of all making it quite clear that sapwood can be much more extensive than is commonly thought, that in some species, particularly some scrub timbers, the whole of the large log can be sapwood. We then drew attention to the fact that it is hard to differentiate between sapwood and truewood, and that for some purposes it is not necessary to make that differentiation.

Mr. Huddleston: If a batch of, say, 10 samples is taken from a treatment requiring analysis, and on analysis those 10 samples are regarded as an indication of the condition of the charge of possibly 5000 to 10,000 sup. ft. If you get one particular sample out of the 10 which has a low acid content, then the officer responsible for making a decision has to turn round and decide whether to regard that as truewood or sapwood. If it is sapwood it has to be tested for starch, but if there is no starch present and the timber is still sapwood the lot must be rejected. If it is truewood it is safe to let the charge go through. It may be sapwood showing no evidence of starch.

Mr. Irvine: If there was an unsatisfactory boric acid content in one specimen in 10 then the inference is that they haven't used approved schedule. I realize if it contains starch and hasn't any acid it is thrown out. If it doesn't contain starch then it should not cause rejection.

Chairman: We are still trying to determine our schedules. We keep on coming up against these samples low in boric acid content, and we do not know whether they are sapwood or truewood.

Mr. Tamblyn: To some extent Mr. Huddleston's difficulties might be met by an improved method of sampling. The present method of treatment, which is virtually an open tank method, in most cases means that sapwood will penetrate very much better than truewood. Thus every time you analyse a truewood specimen you have no results at all which will indicate whether the corresponding sapwood would have contained sufficient boric acid. The answer seems to be to eliminate truewood from your sample batch, otherwise you will always be in difficulty.

Mr. Huddleston: I agree with that, but do not think it solves the problem. You are working on the assumption that a sample taken at random is taken as representative, and on that assumption the theory of quality control can be applied, but the sample selected must have starch.

Chairman: That doesn't matter. Mr. Tamblyn's suggestion is that you make a random sampling of specimens showing starch. Well, that is what the liquid does.

Mr. Huddleston: That is what we asked the operators to do, but we still get an odd piece that comes through without showing any indication of starch and shows too low boric acid content. We have got round it by describing it as probably truewood or probably sapwood, depending on the evidence that we have available, and where that has cropped up we have left it in some cases to the operator to decide whether he is going to pass the charge or reject it.

Chairman: Another difficulty of your sampling is that it will not always be done on a charge. It may be a sample taken from a factory.

Mr. Huddleston: We have got another difficulty here. At the present time Mr. Ellis has got a number of plants operating in Queensland where they supply timber to the New South Wales market. Those timbers are supplied through agents in Sydney, who in turn apply for registration of a brand under the Timber Marketing Act. Now, as far as we are concerned, the agent acquiring that registered brand is the treating authority and if there is any defect detected in the treated timber it will be the agent who is prosecuted and not the firms in Queensland. The agents themselves are taking samples from consignments in Queensland which may not necessarily have come from the one charge. There may be a dozen charges mixed up in the consignment from which samples are taken at random. Those are analysed by ourselves at the present time, and the agents regard that as sufficient safeguard to themselves of making sure there are no abuses in Queensland. We deal with those samples coming in in that way, and we do get those species on borderline of sapwood and truewood - not showing starch or only in small proportions - and we do not know whether they are truewood or sapwood not containing starch.

Mr. Cokley: Tulip oak is our biggest difficulty. I will quote as an example a series of samples we took, working on 2 ft. 6 in. length. The starch sample taken from the end of that length gave us a moderate starch intensity with low boric acid content. When testing the section immediately adjacent to it we found no starch. Just where the starch finished we do not know.

Mr. Tamblyn: I believe you would save yourself a great deal of trouble if you arbitrarily tested all specimens for starch and discarded all that have no starch in them.

Mr. Cokley: We did that as a routine.

Mr. Tamblyn: It is a waste of time to test truewood for boric acid. Pre-test for starch and I think most of the problem will be solved.

Mr. Taylor: We had samples from one particular charge that were all truewood. When we asked for sapwood samples, we had to explain carefully what we wanted, and they stated they could not find any.

Mr. Cokley: That is the big difficulty with us, especially in tulip oak which we use for our testing purposes mainly because it is difficult to treat. We need to find samples that are going to give us good starch.

Chairman: I am not certain of Mr. Tamblyn's cure. On paper it sounds easy, but supposing you have got a charge with 500 pieces of timber in it and there are only 10 pieces in that containing starch. If you want 10 samples containing starch there is a strong possibility that you will have to go through the 500 pieces to get them.

Mr. Huddleston: Some of the regular operators have adopted the practice of building a stack and then looking round to find 10 pieces of true sapwood and putting those in as samples. The 10 pieces are taken as being representative of the stack, which may be 8 to 10 thousand super feet, not necessarily taken from the same timber or even from the same species. The samples may be obtained from the yard and they go in with the charge.

Mr. Cokley: That also applies where you have a country mill.

Mr. Tamblyn: Yes, I realize it is not always quite as simple as I would have it.

Mr. Shambler: May I ask Mr. Ellis a question in regard to grey satinash? There is a lot of it in Sydney. Is there any line of demarcation between the colour of sapwood and truewood?

Mr. Cokley: Generally no. On the other hand, speaking of demarcation, Mr. Irvine told me that white mountain ash, E. regnans showed a pinching at the point of junction of sapwood and truewood.

Mr. Irvine. In examining small hand specimens approximately 2 in. x 2 in. by the sapwood plus ½ in. of truewood cut from freshly felled logs by field officers and wrapped and posted to Melbourne, I have found frequently that the surface of the sapwood was much darker than that of the truewood. This, of course, was with light coloured eucalypts such as E. regnans and E. obliqua. A pinching or collapse of the sapwood for about 1/8 in. adjacent to the truewood was also quite frequent. Collapse in sapwood may be heresy but it seemed like it.

Mr. Tamblyn: It might have been an oxidation effect on the surface.

Mr. Irvine: Yes.

Mr. Huddleston: I feel that this Conference should confirm the decision reached last year about the necessity of deriving a method for determining the difference between sapwood and truewood. I move that differentiation of sapwood and truewood is an urgent matter and should be pushed ahead as quickly as possible.

Mr. Cokley: I second the motion.

Mr. Elliot: From this paper of Dr. Dadswell's it does appear that he is on the way to solving this problem. He has some very interesting lines he wants to follow up, and requests the co-operation of the Forest Services in collecting material in the way set out in the appendix, and forwarding it to him. Species he would like to receive to begin with are Acacia bakeri, Alstonia scholaris, Beilschmedia bancrofti, Tarrietia spp., Sloanea spp., Schizomeria ovata. He gives full details of the two alternative methods of taking samples, one by an increment borer the other by cut block, fixing them in Carnoy's solution or formalin - acetic - alcohol and they are then to be forwarded to Dr. Dadswell's section, where they will be immediately stained and sectioned. Data on the moisture content of the sapwood and truewood at the time of felling would also be very useful, and especially details of moisture content of discs from sapwood trees, giving moisture contents from pith to bark in large trees.

Mr. Huddleston: I have a research officer working in the Casino district who could obtain Schizomeria ovata and Sloanea species, but they would be restricted to the Casino district. The number of trees would not matter. We could get them from logs assembled in the mill yards or alternatively from logging operations, taking logs from freshly felled trees. We could arrange for regular supplies under fairly close supervision there, but if we have got to go to other districts it would involve using field officers who have got other duties, and this is not likely to be as satisfactory.

Mr. Elliot: There doesn't seem to be any indication of the distribution required. One very important thing is, the material has to be sectioned and stained immediately on arrival, even though it is to be fixed immediately. The paper states that it is not possible to cope with large numbers of samples at the same time.

Mr. Taylor: I take it, he would prefer these samples cut from the living tree rather than from a dead log.

Chairman: Dead logs are useless for our purpose.

Mr. Hartigan: In connection with dark heartwood with sapwood and truewood differentiation, will Mr. Elliot ask Dr. Dadswell if he would like some dark heart samples too.

Mr. Elliot: I will mention it to him.

Mr. Shambler: Acacia bakeri is not a very plentiful timber.

Mr. Elliot: The reason is that it is one of the few acacias that has colourless truewood.

I would like to draw attention to the fact that, in sending samples in phials of liquid by air mail, they must be very carefully packed. Quite a number of samples reach us in shattered glass.

Mr. Tamblyn: Reverting to our early discussion, it seems to me there is room for some clear thinking of the matter. Personally I cannot see why it is an urgent matter to differentiate between true sapwood and true truewood, at least from the aspect of boric acid treatment. We are interested only in treating susceptible timber and we have a simple test which demonstrates clearly the timber which is likely to be susceptible What benefit would it be to Mr. Huddleston to be able to differentiate non-susceptible sapwood from truewood? There is no justification for analysing timber not susceptible to Lyctus, and a probably more difficult test than the present one would have no added advantage unless we could correlate the boric acid content of sapwood containing no starch and sapwood containing starch. It seems to me that Dr. Dadswell's work is very desirable from a fundamental angle but has no relation whatsoever to Mr. Huddleston's problems of analysis.

Chairman: There are practical difficulties in sampling associated with the fact that we cannot tell the difference between sapwood and truewood. I do not think they have been satisfactorily answered. As Mr. Huddleston has pointed out it is difficult to lay down a law to test only materials with starch content. In practice whereby certain materials are selected and placed in stacks of samples, this is a most unsatisfactory procedure. The sample then is not a true sample of the charge of timber.

Mr. Tamblyn: We must have some criterion of susceptibility otherwise it is not a true sample of the material we are trying to treat.

Mr. Huddleston: I take it from Mr. Tamblyn's proposal that we should take a stack of timber as a whole and go through that stack with a bottle of iodine and brush and select 10 samples showing the presence of starch. I would like him to explain to me how we are to select 10 samples containing starch from a stack treated in the presence of iron, or stained with sodium trichlorphenate. I don't see any alternative to the derivation of a method for the determination of sapwood.

Mr. Tamblyn: Up to date I have had no trouble in locating starch in treated timber. I suggest Dr. Dadswell's method when it is perfected might not be any easier to use than the starch test.

Chairman: Surely our method of attack should be to find some means of differentiating between sapwood and truewood. When we can do that definitely we can start to worry about the limitations of the method.

Mr. Tamblyn: I haven't yet seen the starch test not work.

Mr. Huddleston: With timbers containing tannins, a dark stain is produced which masks the presence of starch.

Mr. Tamblyn: It only masks it visually - the starch granules are visible with the help of magnification.

Mr. Huddleston: If you are going to take 10 samples out of a stack of treated timber using a bottle of iodine and a brush, it would be a practical impossibility to view every sample with a magnifying glass.

Mr. Tamblyn: I think that is the problem rather than the development of a new method of determining sapwood.

Mr. Cokley: Also we must not forget that the problem is not only in relation to boric acid but in relation to other work as well.

Mr. Tamblyn: Yes, for other reasons Dadswell's work is going to be valuable.

Mr. Irvine: It would seem to me that this problem of samples not giving a starch reaction and not containing sufficient boric acid to pick up could possibly be solved by a physical test on the samples under standard conditions. If under some standard condition it should be difficult to obtain sufficient pick up within the specimen of boric acid, then I should think there is no reason to reject the charge.

Chairman: You would suggest, say, an open tank treatment for that particular sample.

Mr. Irvine: Not necessarily open tank treatment but some laboratory test of penetration.

Chairman: That is a good suggestion.

Mr. Cokley: In connection with Mr. Irvine's suggestion there are two points affecting such examinations. Firstly, in commercial testing, you have got to get results back in a hurry, and secondly, speaking for Queensland, we have not got the staff to do that.

Motion carried.

Chairman: I think this is an opportune time to take up the question of truewood. The term was suggested by New South Wales Timber Inspector Drew. He had in mind durable eucalypts. Now that quite a lot of sapwood is coming onto the market, we are rather worried that the term truewood indicates that the sapwood is not a satisfactory material.

Mr. Huddleston: I have felt that reaction in New South Wales on the trade. Immediately you get them to understand the difference between truewood and sapwood the reaction is that sapwood is no good, that it is only partly formed wood, immature, and should not be used.

Mr. Weston: I think the term truewood is very suitable - a very apt name.

Mr. Pinches: I think it is not applicable as a general term of use.

Mr. Ellis: The term truewood is quite commonly accepted and is very useful to distinguish between brittle heart. As far as Queensland generally is concerned the term "truewood" is being widely used and is meant to exclude sapwood but to include brittle heart. On the other hand "heart" is most frequently synonymous with brittle heart.

Mr. Payne: Could we overcome it by changing "sapwood" into "starchwood"?

Mr. Irvine: Is "sound wood" used in the definition of truewood?

Mr. Huddleston: The standard definition of truewood is "that portion of the tree which exists between the sapwood and the heart or pith".

Chairman: I think we all might give some thought to this problem. It will come up in our terms and definitions.

Mr. Ellis: I am not satisfied with our use of the terms "mature" and "immature". These terms are very frequently used in engineering and trade specifications, but they have never yet been satisfactorily defined, and I think the matter ought to be clarified. For instance, what is mature wood? Is it fast grown timber or must it be slow growing timber? A tree might be fast-grown up to the age of 30 years and thereafter it grows slowly. In such a tree does the wood up to 30 years old ever become mature? This comes up frequently in sleeper and pole specifications, but anyone who has tried to interpret such specification must surely conclude that they are untidy and unsatisfactory.

Mr. Huddleston: To my mind the words mature and immature as applied to timber are only used when we refer to mature trees or immature trees as those that have reached their most vigorous growth or are past that period, or those that are still in the vigorous growing period. But to apply the term to the timber produced in those trees is wrong. We have got the same problem with a number of N.Z. specifications and principally engineers in New Zealand who refer to timber as being mature and immature. I defy any man to tell me what mature and immature timber is. If the timber is open grained it is taken as evidence of its having been fast grown and may be rejected because it is immature timber, notwithstanding the fact that a tree in some categories might be 200 years old and still have open grained timber in the portion of the tree put down during the vigorous stages of growth.

Mr. Ellis: I have suggested in our department that we drop the terms completely and use terms for what they most generally mean - fast-grown and slow-grown timber.

Mr. Huddleston: A number of aircraft specifications have abandoned the use of "mature" and "immature" and specify that the number of rings shall be, say, between 3 and 15 rings per inch.

Chairman: Rings are indistinct in some timbers.

Mr. Huddleston: In timbers such as those we have got here I don't think rings per inch is a suitable classification, but we may have to get down eventually to pore-size as an indication of the rate of growth.

Mr. Taylor: What about density?

Mr. Turnbull: One interpretation could be that a tree reaches maturity when it is large enough for the purpose for which it is to be used. Some stage is reached when the rate of decay equals the rate of growth, and the tree becomes stagnant and this is regarded by some people as becoming mature. Over-mature is when decay has overtaken growth rate.

Mr. Huddleston: Another definition of maturity might be the stage when the annual increment starts to fall away.

I think we should strongly recommend to the people concerned with utilization that the words "mature" and "immature" should be deleted from specifications giving quality of timber and forest products. Railway specification for sleepers specify that sleepers shall not include sapwood and shall not be cut from dead timber. When the timber is sawn it is impossible to tell whether it came from living or dead trees and satisfactory sleepers have been sawn and accepted by railway timber inspectors from timber which has been lying on the forest floor for up to 30 years.

Mr. Elliot: I have a feeling that in the first instance this term was applied to timber which had not yet reached the size that that particular species would be utilized for commercial use. That was our first application of it.

Mr. Turnbull: I confirm Mr. Huddleston's proposal. In every specification I have had anything to do with, I have very definitely deleted it during revision simply because it could not be interpreted.

2. Boric Acid Treatment

(a) Price and supply position of boric acid and substitutes

At the request of the Conference, Mr. Fraser of Swift and Company was present for this item.

Mr. Ellis: I understand that Australia's allotted import quota of boric acid for all purposes is 560 tons annually and that £28,000 has been allowed for that purpose. We need an assurance from the Commonwealth authorities that if 560 tons is inadequate, more can be imported.

Mr. Gray: The Forestry and Timber Bureau has been asked to make representations for a dollar allocation for boric acid to be used for treatment of borer susceptible species. We are awaiting receipt of an estimate of the quantity of boric acid required because it is better to make representations to the Import Licensing Branch for total import requirements rather than piece-meal. There seems to be a very good case for importing boric acid as the quantity of timber available for use by treatment far exceeds the quantity which could be imported for an equivalent expenditure of dollars on timber imports.

Mr. Huddleston: Nearer one hundred times. It costs 120/- per 100 super foot to import timber but we can get it for 1/5 per 100 super feet by treating it. Total cost of treatment is 12/- per 100 super feet, but boric costs only 1/5 per 100 super foot.

Mr. Clarke: Do you know of any place where treatment of timber has been held up for lack of boric acid?

Mr. Fraser: I cannot understand people being held up for want of boric acid. We have had so much lately that it has been a rather difficult problem to know what to do with it. We were holding 75 tons of it and the price dropped and among many timber people using it, many were trying to sell.

Mr. Gray: There is a good deal of uncertainty as to the quantities of boric and borax which are required. I would like to know the overall picture. It seems to me that 75 tons is not very much in light of 560 tons being required each year for use in Australia.

Mr. Fraser: The supply of boric acid is unlimited.

Mr. Ellis: What about the dollar position.

Mr. Fraser: Where ligislation has been passed there is no trouble.

Mr. Cokley: How about if legislation has not been passed?

Mr. Fraser: In the past Sydney has been able to assist Brisbane if supplies have been late in arriving. Even if the demand goes to 1000 tons it will still be alright.

Mr. Gray: Do you have to give an assurance regarding its use?

Mr. Fraser: Yes.

Mr. Huddleston: What is the position with regard to price, is the fall likely to continue?

Mr. Fraser: I should say that the price will be shortly about £49 per ton.

Mr. Gray: I will take the matter up individually with certain members later.

(b) Substitutes for boric acid

Mr. Tamblyn: If greater dollar stringency occurs and there is much increase in the volume of timber treated we may be forced to consider the alternatives of sodium fluoride or sodium fluosilicate both of which are at present imported from Belgium as Australian manufacture has been discontinued. I obtained ruling prices for boric acid, borax, sodium fluoride and sodium fluosilicate last week from Swift and Co., and made some calculations which may be of interest. The prices quoted were

Boric acid (granular)	£56 per ton
Borax (")	£37 per ton
Sodium fluoride	£90 per ton
Sodium fluosilicate	£60 per ton

I have calculated unit chemical cost on these figures and on the basis that the toxic level for sodium fluosilicate would be set at 0.1 per cent. instead of the present 0.2 per cent. for boric acid.

On this basis cost per toxic unit would be

Boric acid	1.0
Borax	1.025
Sodium fluoride	1.09
Sodium fluosilicate	0.54

There is thus nothing to choose between the chemical cost for boric acid, borax or sodium fluoride. Sodium fluosilicate is however not much more than half the cost of the others. As Cummins did not test sodium fluosilicate down to its toxic threshold it is possible that lower concentrations than I have used may be still toxic.

Although I know there are objections to the use of fluorine-containing chemicals, it seems that on economic grounds we should give more attention to the development of a sodium fluosilicate treatment for solid timber. I have been rather against its use in the past because of the possible health hazard but in view of the discussion at the last Forest Products Conference am quite prepared to sink my objections. The other difficulty is that of analysis and I believe if we are to recommend its use we should give immediate attention to developing the simplest analytical technique possible.

Mr. Cokley: Although boric acid when used as a lycticide is satisfactory from most aspects, there are several disadvantages in its use,

1. Structural materials are limited.
2. High cost and its source viz. dollar areas.

These disadvantages have caused us to look for satisfactory substitutes, satisfactory in that while possessing all the advantages of boric acid, it must not suffer from the same disadvantages or if so to a lesser degree. Of these substitutes the most prominent can be listed as follows:-

1. Sodium fluoride and sodium fluosilicate.
2. Chlorinated phenols, principally pentachlorphenol.
3. Borax.

Sodium fluoride and sodium fluosilicate

In the past great prominence has been given to these chemicals and their consideration had reached the stage where we find in the minutes of the last conference that sodium fluoride would be recommended provided that a suitable method of plant control could be evolved, even though the fact that it was toxic was known. This chemical has three apparent great advantages over boric acid, these being as follows:-

1. Greater toxicity to Lyctus than boric acid and should require milder treatment schedules.
2. The source was in sterling areas.
3. Concrete could be used in the treatment.
4. Mould development would not occur.

Considering these in detail we find that these advantages are not as promising as we would at first believe.

1. Toxicity. Firstly although only 0.05 per cent. was found to be lethal, we do not know that treatment schedules can be altered although it would appear likely in view of the fact that no practical significance was found in its diffusion rate when compared to boric acid. Christensen's work showed that point clearly.

2. Sterling Source. Sodium fluoride does, it is agreed, come in sterling areas but its cost is far beyond that of boric acid in that whilst the latter costs approximately £53 per ton, the fluoride costs £84 per ton, i.e. to have equivalent practical costing we would require a solution concentration of this chemical below 1.25 per cent. It is further subject to similar transport difficulties as is the boric acid. Discussions I have had with importers on this matter do not give great promise of adequate supplies of this compound.

3. <u>The Use of Concrete</u>. It had been stated that unlined concrete can be used satisfactorily with sodium fluoride. This property has also been established for boric acid and hence the use of fluoride would be of no advantage in the plant. This factor would bear investigation as the reaction between calcium and magnesium salts with alkali fluorides is well known and in fact forms the basis of several quantitative methods of analysis of fluorides.

4. <u>Prevention of Mould Growth</u>. I agree that sodium fluoride may prevent mould growth upon treating solutions and this would be a definite advantage.

However I desire to point out several factors which I believe have missed the attention of members. These are as follows:-

(a) <u>Health Hazard</u>. Although the fact that sodium fluoride was toxic to humans was raised at the last conference, the conclusion reached was that recommendations could be made for its use and that the "health authorities could worry about the health hazards". I am afraid that this conclusion avoided the issue in that it is useless for us to recommend any chemical or treatment that clashes with any regulation of poison schedules of the Health Department. We referred this matter to the Queensland Health Department which said that sodium fluoride would not be satisfactory in Queensland. Under these conditions we could not and would not recommend its use.

The same arguments apply to sodium fluosilicate. The toxic nature of the chemical is similar to that of the fluoride and was discussed fully by Cummins in his original work on veneers.

(b) Stability. A further property of sodium fluoride which must be considered is its stability in solutions. Sodium fluoride and in fact all alkali fluorides could not be considered stable under the conditions of treatment solution. To show this point I will quote from a recognized chemical reference viz. J. W. Mellon, who states that "Alkali fluorides are decomposed by many organic acids, e.g. acetic and tartaric - carbon dioxide bubbling through the solution will do likewise".

These data would be directly applicable to our treatment solutions where we have not only quantities of acetic acid formed but also large quantities of acids such as tannic acid extracted from the timber.

This evidence shows that sodium fluoride is highly dangerous and I would suggest that sodium fluoride be not recommended. I would further suggest that, subject to conditions in each State, advice be based not only upon whether or not a chemical is a good preservative but also upon whether the respective health authorities would permit its use.

Mr. Clarke: Did you draw the attention of the Health Department to the fact that sodium fluoride has been used in Australia for a number of years.

Mr. Cokley: No, I merely asked if sodium fluoride could be used in Queensland and under what conditions.

Mr. Clarke: We know the effects of sodium fluoride.

Mr. Cokley: I haven't seen any reports on its use.

Mr. Clarke: The steel pipe line in Western Australia from Mundaring to Kalgoolie was partly replaced with wood stave pipe treated with sodium fluoride.

Mr. Huddleston: The fluarizing treatment is recognized and has appeared in text books. The health hazard has been properly investigated. Some years ago I proposed the use of sodium fluoride as a means of controlling decay. The Division of Forest Products objected on health grounds. We approached the Health Department which did not consider any danger was involved but they suggested a practical check. We also asked the University authorities for their opinion which was that no danger existed. There is no record throughout the world of deleterious effects in practice. So we have approved the use of Wolman salts in New South Wales but are not recommending the sodium fluoride treatment until a satisfactory method of analysis has been perfected.

Mr. Tamblyn: There is one point I want to make plain, that if we are going to interest ourselves in fluoride treatments we should concentrate on developing an analytical technique for sodium fluosilicate because of its cheapness. On the basis of fluorine content it is approximat ly half the cost of sodium fluoride. We should not waste time developing a technique for sodium fluoride unless it is going to be applicable directly to analysis of the fluosilicate. We should keep it in mind that sodium fluosilicate is what we want to use and not sodium fluoride in our present work. Sodium fluosilicate is much cheaper weight-for-weight than sodium fluoride. Its higher fluorine content further increases the cost difference in favour of the fluosilicate.

Mr. Huddleston: You will recall that the decision reached at last year's conference was that New South Wales should undertake to perfect the analysis for sodium fluosilicate. That work has been going on but we have struck the major difficulty of finding caustic in the fluoride.

Mr. Fogl: We have done some work on the development of methods of analysis for sodium fluoride both in treated timber and in treatment solutions. Methods of analysis for this preservative are known, but some simple, quick and accurate enough for plant control work have not as yet been evolved.

Mr. Cokley: Chlorinated Phenols. Coming to the next likely substitute we have the chlorinated phenols. Overseas literature, particularly South African, seems to favour the pentachlorphenol, but in Queensland we have no data upon its satisfactory use nor required concentrations etc. The difficulties that we have already encountered in this chemical have been:-

1. Its prohibitive cost - approximately 2/- per lb.
2. Its low availability.
3. Suitable solvents.

Discussions were held with an oil company who advised us that no oil answering to the A.W.P.A. specification we had, was available. I would also like information on the toxicity figures for pentachlorphenol.

Mr. Hadlington: We have found that solvent naptha is a suitable solvent for pentachlorphenol. Kerosene has been found unsuitable because of pentachlorphenol's low solubility in it. Solvent naphtha costs about 2/3 per gallon.

Mr. Tamblyn: After some tests we found that a dry cleaning fluid, the higher boiling point kerosene fraction, dissolved 5 per cent. pentachlorphenol at room temperature. This solvent seems entirely satisfactory and costs about 1/9 a gallon. I would be quite happy to use solvent naphtha but suggest that the dry cleaning fluid has the advantage by being colourless and relatively odourless.

Mr. Gay: For soil jar tests I have used kerosene with 5 per cent. absolute alcohol (in form of methylated spirits) to give 5 per cent. solution of pentachlorphenol.

Mr. Tamblyn: We also use kerosene with ordinary methylated spirits and find the addition of alcohol is sufficient to obtain 5 per cent. solution.

Mr. Clarke: hat is the toxicity threshold for pentachlorphenol?

Mr. Tamblyn: Unlikely to be sufficiently lower than boric acid to compensate for the higher cost. As it is volatile, it would be necessary to use a higher initial concentration.

Mr. Cokley: We have had a number of enquiries from manufacturers of finished articles who are either not keen on or are unable to use the boric treatment for small furniture articles. What is the attitude of the Conference towards the use of pentachlorphenol in this respect?

Mr. Huddleston: We have had a similar position in New South Wales, and we have adopted the attitude that, where the article is completely finished and ready for polishing, the surface treatment is satisfactory provided the treating material is not toxic, and further that the surface treatment is accompanied by a sterilization treatment. Generally speaking we frown on surface treatments, and we certainly would not approve of surface treatment unless accompanied by some sterilizing treatment.

Mr. Cokley: Borax. With regard to the third substitute viz. borax, it can be definitely stated that this chemical not only gives promise but has already been applied commercially in Queensland. In fact we are advising firms particularly in the north to use this.

In the original investigations borax was, although a satisfactory lycticide, rejected on the grounds that being alkaline, it would cause staining. Studies carried out by the Department, originally for other aspects of its use, gave evidence that borax did not stain. Discoloured solutions, taken from Brandon's vats after 21 months continuous use were converted to an alkaline pH and although samples representing 32 species were tested, no problem of staining arose. A surface discolouration did occur certainly but to an average depth of 17/1000 inches only - a distance that is of no practical significance. Tests were repeated using freshly prepared solutions and absolutely no discolouration occurred. Commercial experience with a furniture manufacturer who has now treated over 2000 sup. ft. with borax has proven this fact.

The second advantage of borax, and its great importance lies in the fact that standard fungicides such as trichlorphenate can be used satisfactorily in this medium - a condition that does not hold with boric acid. As this matter is discussed elsewhere I shall not elaborate further.

The third important property is its effect upon treatment structures. Extensive tests both in the laboratory and practice have shown conclusively that ferrous materials are suitable and that the iron-tannin reaction does not occur in this medium. This opens up simple and inexpensive plants for both large-scale and small-scale operators. In fact we have had two furniture manufacturers using 44 gallon drums and steel cylinders, both of which gave very satisfactory results.

One query has however been raised upon the concentration of the treatment solution. It would appear that theoretically one requires a 3.0 per cent. solution of borax to be equivalent to a 2.0 per cent. solution of boric acid.

Although our evidence is not yet complete, as we still have a number of species to test, our present indications are that similar concentrations of a figure not greatly in excess should be satisfactory. It may be pointed out that our criterion is not to get the identical concentration in the timber as with boric acid but get 0.20 per cent. of boron expressed as boric acid. The data upon which we base this contention concerning concentrations is as follows:-

1. Samples of white cheesewood required for fungicidal tests were treated with 1.5 per cent. boric acid solutions and with 1.5 borax solutions. A mean of 0.90 per cent. was obtained with the acid and 0.8 per cent. with the salt i.e. both treatments were satisfactory.

2. Samples of brown tulip oak were treated in an oil drum in one case with a 2 per cent. solution of borax and in the other with a 2 per cent. solution of the acid. In this test the borax gave a mean of 0.55 per cent. whilst the acid gave a mean of 0.28 per cent. although in the case of the latter several samples being starch free were probably truewood.

3. The furniture manufacturers are using 2 per cent. solutions of borax and in all samples we have tested satisfactory penetration has been found.

4. Samples of veneers (1/16 bolly gum and candlenut) were treated by Northern Plywoods in the following solutions:-

(a) 4 per cent. boric acid.
(b) 60 per cent. boric acid 40 per cent. borax made up to 4 per cent.
(c) 50 per cent. acid and 50 per cent. salt made to 4 per cent.
(d) 40 per cent. acid and 60 per cent. salt.
(e) 4 per cent. borax.

The results obtained were as follows:-
(a) 1.82, (b) 1.50, (c) 0.53, (d) 1.06, (e) 1.13.
Here again similar concentrations of the acid and the salt gave satisfactory impregnation.

Thus it would appear that either the same or very close concentrations of the salt would be just as satisfactory as the acid.

This matter has also a bearing upon costs for while both are dollar imports borax can be landed in Brisbane for £32 whilst the acid costs approximately £53, i.e. a 50 per cent. saving.

In summary all our results have shown that borax is not only a satisfactory substitute for boric acid, but is in fact possessed of all the advantages of the acid and none of its disadvantages except that it is a dollar import, which is offset by its greater availability due to its lower cost.

Mr. Huddleston: I want to deal with the question of the use of iron with borax for treating tanks. It has been our advice from leading metallurgists that an 8 per cent. of boric acid solution will have no effect on iron. We could use a mild steel tank and we will be quite content to use it if it were not for the extractives from the timber. The firm we contacted were quite content to recommend their steel for use in treatment tanks until we informed them that weak acetic acid would be present in the extractives. On receipt of this information they were hesitant about their recommendations but finally advised that one of their acid resisting steels would stand up to use. I do feel that with the extraction we are deriving from the timber, a stage will be reached when sufficient discolouration of the solution will have occurred to cause trouble. We have had that trouble using boric acid but I think borax will hasten it somewhat. There is another aspect concerning me - I must be critical of Queensland and I apologize for my criticisms to that State but I add that they are given in good faith. Following their recommendation about borax, some assistance and encouragement has been given by Queensland to a manufacturer using a makeshift plant.

Our feeling is that if it is worthwhile treating timber with boric or borax it is worthwhile doing it properly in a proper plant under proper control to render it free from borer attack. It is worth remembering that any failure in timber is going to react not only against the man doing the treatment but the whole of the State and other States as well. There are industries in all States which are going to depend on the boric acid treatment and we cannot view with anything but great concern the failure of these treatments. We will have difficulty in overcoming the prejudices which will be created, and for that reason I do not like to see these makeshift plants. If anyone wants to put up a plant for his own use only, that is alright; for anything that is going to be sold on the market we want a designed plant with designed equipment and operated by a responsible person.

Mr. Cokley: Firstly Mr. Chairman I regret that the particular plant has caused Mr. Huddleston any worry. All we are interested in is getting .2 per cent boric acid into the core of that timber and we have not found any starch containing samples giving less than that. I think the simplicity of any plant is important as it enables the small operator to treat at small capital outlay. The plant in question treats timber at a cost of 1/9 per 100 super ft. I have tried without success to get iron in these solutions.

Mr. Clarke: At the moment Queensland has no legislation. If the manufacturer concerned had been an unsuitable type what could you do if he put the timber into the vat only for an hour or two?

Mr. Cokley: Absolutely nothing at the moment.

Chairman: I must say that I was struck with the quality of the treating plant that we saw this morning and I don't think that anybody would deny that we want plant of that standard introduced throughout Australia. I am wondering how a person contemplating a plant of that type would feel regarding these small backyard plants.

Mr. Huddleston: The plant we showed you this morning is possibly the best plant in New South Wales, but I feel the standard of the other plants going in is on that level, but the fittings are not as elaborate. Generally speaking they are all well designed and properly controlled. There is no possibility at the present time of any man deciding that he is going to do treatment and go on with it without seeking assistance in the first instance. If you are going to allow plants using half oil drums as treating vats, there is a possibility that the method will be copied by others without sufficient knowledge of the treating procedure, treating timber in the plant, and having articles manufactured into furniture and sold, even with a description implying that the timber has been treated without any proper control being exercised.

In the event of any of these articles being attacked by borers, irreparable damage will have been done and will adversely affect firms like D. Hardy and Sons who are prepared to install a proper plant and employ qualified staff to operate it.

Mr. Irvine: What is the position in New South Wales if, for some good reason, the Forestry Commission does not approve of a particular treatment plant but the owner treats the timber successfully and sells it and the timber is satisfactory?

Mr. Huddleston: This bears closely on a case just dealt with. In that case some timber came under our notice showing borer attack and which had been treated with boric acid. Tracing back we found that the timber had been treated by a timber merchant who came into the Division and asked for details of the boric acid treatment. He was given a description, and was told of his obligations. He went away and we heard nothing more of him until a few weeks ago. We investigated the complaint and found that the timber showed a boric acid content of less than .2 per cent. The borer attack was there when the timber treatment had been carried out. The borer in the timber had been killed by the treatment. This was a plant, I understand, of the open tank type built by this timber merchant without any reference to this Division apart from his original enquiry. The prosecution was successful.

Mr. Worley: It might be helpful to mention at this stage, although some timbers showed a good percentage of boric acid content other timber showed percentage far below that required. Some showed a pass in the case and not in the core.

Chairman: The type of person who will erect an unauthorized plant is not the type of person who will treat timber satisfactoryily.

Mr. Ellis: It is conceded that plants of Hardy's type are going to go along very nicely without any trouble whatsover but surely no Government Department charged with administering such an Act could justify refusing to issue a licence, merely because it was thought that an applicant might not operate satisfactorily.

Mr. Huddleston: Even with a good system of inspection and control it is often difficult to obtain sufficient evidence to prosecute successfully a person who indulges in doubtful practices. In Sydney we watched a certain individual for 18 months before obtaining conclusive proof, although he had done a lot of damage in those months, and actually sent a firm broke by selling timber under a false description.

Mr. Cokley: Might I ask Mr. Huddleston if a man says "I want to treat 4 ft. 6 in. length timber. I have only facilities in my backyard. I propose putting in a timber vat for cold soak treatment". With the provision that he checked controls carried out under these conditions would he approve of this type of treatment.

Mr. Huddleston: It would depend entirely on whether the quantity of timber is sufficient to warrant a treatment plant, secondly, if he had the quantity, whether he has the required room to properly install his plant and properly carry out his treatment. We have refused similar applications. We usually suggest that he asks a large firm to immunize his material. The enquirer usually decides he would use one of the existing treatment plants, rather than go to the bother of putting in a plant himself. The total costs of boric acid treatment are likely to be in a small tank very much higher than in established plants with a treatment price of 13/6 as approved in Sydney. He returns home, gets a drum, cuts it down the centre, builds a trough to contain it, fills it with water and timber, adds 1 lb. of boric acid, 10 gallons of water, lights a fire under the tank and treats his timber. He would have no idea of the boric acid content of the timber and it may be months before he is detected by which time the damage is done.

Mr. Cokley: I will admit that there is that possibility of the backyard plants. I must also point out that we check up pretty thoroughly as to the man's bona fides and we actually keep pretty strict control of him.

Mr. Huddleston: We only approve well established plants.

Mr. Cokley: With sawmills at the moment we have sound arrangements which allow us to keep a check on well established plants. However apart from firms planning to use treated timber in making up a few chairs or tables, everyone of these firms have the right to install their own treatment plant if necessary.

Chairman: This has been made quite clear but up to the present you have not been faced in Queensland with implementing a Marketing Act. I think the matter has been discussed here sufficiently to make it clear that your decisions in Queensland are going to affect the whole of Australia.

Mr. Huddleston: One particular State recommending practices that are going to affect other States may ultimately affect the co-operation through this Conference. I can visualize circumstances where we would have to go into print stating that we do not agree with the Queensland Forest Service and would have to make it fairly widely known. It would be a matter of regret if circumstances arose where we would have to take action which would affect the very fine co-operation which has been built up through these conferences.

We have no objection to a small plant providing it is operated to specifications laid down by ourselves.

Mr. Ellis: If Mr. Huddleston could indicate, in general terms, what would be the minimum requirements he would impose for controls etc. on plants of the type we have been discussing, I think that we should be able to overcome this difficulty. I shall discuss this matter with Mr. Huddleston at the conclusion of the Conference.

Mr. Chairman: Do we want further discussion on iron tanks?

Mr. Tamblyn: I am very interested indeed in the tests Mr. Cokley has made on borax as an alternative to boric acid and I believe the case he has made out here and in his reports does justify our recommending borax and boric acid as both suitable for use. The insolubility of iron in alkaline solutions is a very important point indeed and it is particularly interesting to us as we have been considering recommending borax for the momentary dipping of veneer. It is possible, I think, that some trouble could occur in iron tanks in the steaming-quenching treatment where drippings due to condensation of steam on the cold timber would react to form iron tannates before the borax solution was admitted. There is also the possibility of corrosion during steaming. I don't know whether these effects would be serious, and we should not be biassed in favour of boric acid at this stage.

There are one or two other points which I think Mr. Cokley has not treated quite fairly. In the first place, there seems no doubt that in alkaline solutions there would be greater leaching than in acid solutions. The second point is one of cost. Mr. Cokley has indicated that substitution of boric acid by borax would reduce the chemical cost of the treatment. Actually on the basis of boron content borax is slightly dearer than boric acid and the only way to get cheaper chemical costs would be to reduce the boron content below that equivalent .2 per cent. boric acid. A point in favour of boric acid as against borax is that it is a well known fact that wood consumes alkali and I suggest that use of borax will require addition of soda ash to prevent it slowly being converted to boric acid. A further point that Mr. Cokley has made in reports is that borax has an advantage over boric acid because it is not steam volatile. Our tests indicate that steam volatility is a negligible factor. Another point Mr. Cokley has raised is that the use of organic mercurial fungicides in boric acid constitutes a considerable health hazard, including that of dermatitis. Trichlorphenol is a more active skin irritant when both chemicals are used at the concentrations required for prevention of mould growth. It seems we have little to gain from the use of borax in the present types of treatment plants but I would be most interested in the opinions of other delegates as to the desirability of recommending borax in future, not in preference to boric acid but as an alternative.

Mr. Huddleston: The position does not arise, as either boric acid or borax would be accepted, but because of the cheapness of the boric acid as compared with borax in relation to boron content we recommend boric acid. Treatment with borax would be accepted.

Mr. Cokley: Firstly as regards Mr. Tamblyn's comment on the use of borax and the possible use of acid, we don't find that happens in practice, for two reasons firstly the salts formed are sodium salts. Sodium acetate, for example, is alkaline and an alkaline pH is maintained. Secondly as we are adding borax after each treatment this also maintains the pH. As regards the cost item I think I mentioned in the report that all other factors being equal we use the same weight per charge for borax as for boric acid and so save about £20 per ton.

A recent experiment suggests that borax has a much greater diffusion rate than boric acid determined for timber, but this needs confirmation. I am not advocating wholesale changeover to borax, but I am recommending borax for milky pine because there are the other factors such as staining and mould growth involved. As regards fungicides, I will admit trichlorphenol is toxic and so can cause dermatitis, but I have discussed this with the Government Toxicologist and in his opinion it is not as dangerous as the mercurials when we consider the danger to the operator who is putting it in as well as the operator in maching it. These are the health hazards and as regards trichlorphenol I personally would say I don't like the smell of the chemical. Monsanto tests conclude that most dermatitis comes from people allergic to it.

Mr. Tamblyn: Everyone is allergic to it.

Mr. Cokley: As regards leaching of the extractives I have found that the extractives have absolutely no practical effect on timbers, even milky pine and veneers. All stains I have obtained have been capable of being sandpapered off.

Chairman: Would you suggest that a plant go over to borax for a while so results can be examined?

Mr. Cokley: I believe one plant is going to do so. With veneer it does not matter what they use, because in the most cases, judging by the plant they intend putting in, either could be used. They plan to use bondwood vats and wooden rollers from peeler logs.

Mr. Tamblyn: I personally am very pleased indeed that Mr. Cokely has succeeded with the use of borax. It is an easy way to treat our problems in connection with momentary dipping.

Chairman: Would you recommend the use of borax for a treatment plant?

Mr. Cokley: Yes Mr. Chairman. I have recommended one plant in the North to put in a steel plant.

Chairman: You would not be worried at all about steel corrosion?

Mr. Cokley: I would not, in general, recommend steam treatment at all. We have had variable success with it but I would say you would get some possible corrosion on your steaming lines. However this would not be great as suitable protective paints are on the market.

Mr. Huddleston: We have four plants in Sydney working on the steaming treatment. The treatment is entirely satisfactory. It has reached that stage in New South Wales that we would not recommend to anyone that other than the steaming treatment be put in. Hardy's are thinking of putting in quality control samples from treated timber being taken in the yard and not sampling each batch. Would Mr. Cokley recommend borax instead of boric acid for Sydney?

Mr. Cokley: I do not condemn it but I do say that only Hardy's conditions and types of firms like Hardys are suitable and I do not feel that the steaming treatment would be practicable in our small mills. I might mention that we have tried tests on timbers, mainly brown tulip oak, and we cannot get 2 per cent. boric acid with the steaming treatment. Whether it is intrinsic to the plant I do not know. I would not venture to advise the Division of Wood Technology on what would be suitable for New South Wales.

Mr. Fogl: There are two other methods of treatment known, the hot and cold baths and the cold soak methods, which could be used in plants not properly equipped for the steaming and cold soak treatment. All plants using the steaming and cold soak treatment in New South Wales have been equally successful to Hardy's, the reason being no doubt that the other plants have been built to very similar designs and are therefore equally efficient.

Mr. Cokley: Mr. Fogl is confining it to plants that have a sufficient background to do it on a large scale.

Mr. Fogl: Large scale plants will be more efficient than small ones, although small plants, if they are properly designed, equipped and controlled, can treat with satisfactory results.

(c) Re-examination of toxicity of boric acid and borax

Mr. Tamblyn: It has been agreed in discussion and by correspondence between the Division of Forest Products and the State Forest Services, that a re-examination of the toxicity of borax and boric acid to Lyctus should be made as soon as possible.

The original work on toxicity of boron compounds by Cummins was published in 1939 and indicated that the toxicity threshold for boron lay between 0.018 and 0.037 per cent. equivalent to 0.14 per cent. of boric acid or about 0.26 per cent. of borax. To some extent these figures are suspect for 2 reasons

(a) One timber (yellow carabeen) only was used.

(b) Boron content was apparently calculated from solution absorption and analytical results on treated wood are not quoted and possibly were not obtained. This may have resulted in some considerable error, especially with borax where the cation binding properties of wood are likely to have caused considerably greater absorption than indicated by uptake of solution.

We have had some recent correspondence with the Queensland Forests Department who have pointed out that some minor errors in calculation appear to have been made.

Against this rather critical picture is however the fact that the present accepted minimum level of 0.2 per cent. boric acid appears to be entirely safe as no case of Lyctus attack seems to have been recorded in timber treated to the 0.2 per cent. specification. Also it should be clearly understood that the concept of an <u>exact toxicity threshold value</u> has itself no practical significance because of the wide variation in sensitivity of individual organism. By this I mean that there is no exact does which will just kill all members of population where a very slightly smaller dose will kill none. Thus even if the work is repeated with the greatest accuracy we can only establish a definite figure at which there is (say) a 95 per cent. or a 99 per cent. probability of obtaining complete control. This figure would have to be then increased to give a safety margin for a practical treatment specification and would probably not be very different from the present accepted standard.

My purpose in presenting you with this picture is to explain one reason why we have not yet commenced the work to re-examine Cummins' figures. Despite any criticism of these figures, justified or not, the fact remains that the present accepted standard of 0.2 per cent. is proving satisfactory. As most criticisms suggest that Cummins' figures are slightly too low it may be inferred that repeating the work will merely show that the present 0.2 per cent. minimum is as low as possible with safety.

The second reason why the work has not been commenced is that we are having real difficulty in obtaining predictable results in our Lyctus breeding and testing. I shall go into this more fully under item 3(b).

However we expect to be able to commence testing within the next 12 months and will then be in a position to reconsider this project and list it according to its priority.

Mr. Huddleston: My feeling is very much that expressed by Mr. Tamblyn. Until we find evidence of attack in boards treated in accordance with the specification, the re-investigation of the toxicity level of boric acid or borax is not a matter of urgency, and I move that the matter be deferred until our next conference.

Mr. Cokley: Although we criticised Mr. Cummins' work, we find the figure fixed quite satisfactory. Even allowing for these weaknesses, Cummins did an excellent job, but I would, however, emphasize that it may be of some advantage to keep in mind the idea of re-examination. Would the position ever arise where the figure of 0.2 per cent. concentration of boric acid would be queried?

Mr. Huddleston: The position with regard to the Act is that timber must be treated with a preservative treatment approved by the Commission. We approve of the boric acid treatment, providing that 0.2 per cent. of boric acid is obtained in the core of the piece, and we define the core as a piece 1/5 thickness of the board, 1/5 the width, or ¼ of the thickness, whichever is less.

Chairman: Is everyone satisfied with the position that boric acid content be the basis of toxicity?

Mr. Tamblyn: Yes, on the basis of the boron content equivalent to 0.2 per cent. boric acid.

Mr. Ellis: The boric acid toxicity figure is on the basis of a percentage of oven dried weight. When dealing with say milky pine you require relatively little boric per cubic foot, whereas more dense timbers which may be more difficult to impregnate would require possibly twice as much boric acid per cubic foot. Are we quite satisfied that this basis is right?

Mr. Tamblyn: We discussed that at the previous Forest Products Research Conference, and we realized then that we did not have enough data to be sure, but felt that by using the percentage method we would have a better chance of reaching a uniform toxic level than specifying so many lb./cub.ft. That was one reason why the test was going to be repeated. Since then so many timbers of different densities have been treated that we have come to the conclusion that 0.2 per cent. boric acid is entirely safe.

Mr. Ellis: If the matter of toxicity concentration is to be thrown into the melting pot, other aspects should also be examined.

Mr. Huddleston: The 0.2 per cent. method has proved entirely practical and we have not yet had one complaint of borer attack in any treated timber.

Mr. Ellis: If it had 3 times as much boric in it, there would be no complaint, I am quite sure.

Mr. Huddleston: We have had complaints of evidence of borer attack where the boric acid was 0.1 per cent. There has been evidence of attack with treated timber where it has not had sufficient boric acid. So we have reached the conclusion that the toxic level is between 0.1 per cent. and 0.2 per cent.

The motion was seconded by Mr. Bryant and carried.

(d) Incorporation of fungicides in borax
(e) Dip treatments against surface moulds in borax acid tanks

Mr. Cokley: The failure of common fungicides, principally sodium trichlorphenate, in boric acid solutions presented real difficulty, and is one of the major problems associated with the treatment. This position is accentuated in Northern Queensland, where high temperatures, rainfall and humidity allied with a scarcity of kilns, renders timber particularly susceptible to stain attack.

The first experience was encountered by El Arish Sawmill, which found that sodium trichlorphenate was proving ineffective in preventing mould attack. Investigation showed that the trichlorphenate was being precipitated as the free trichlorphenol and forming a sludge at the bottom of the vat, i.e. it was useless. It was further found that this reaction did not proceed at a pH above 6.78 and it was advised that the solution be maintained at pH 8.02. The next logical step was a change from boric acid to borax, and apart from investigations into staining and vat materials resulting from such use, it was decided to study its effectiveness in regard to fungicides.

Accordingly, matched samples of white cheesewood were prepared and treated in the following solutions:-

1. Samples 1 - 12 were treated in a 1.5 per cent. solution of boric acid.
2. Samples 13 - 24 were treated in a 1.5 per cent. solution of boric acid converted by alkali to pH 8.0, to which trichlorphenate was added to a concentration of 0.017 per cent.
3. Samples 25 - 36 were repeated in a 1.5 per cent. borax solution to which trichlorphenate had been added as in 2.
4. Samples 37 - 48 were treated in a 1.5 per cent. borax solution to which sodium salicyl-anilide had been added to a concentration of 0.03 per cent.
5. Samples 49 - 52 - untreated control.

After treatment, samples of each series were exposed for three months in a glass house at the Queensland University for a period over a range of three weeks. They were kept wet by daily spraying. The temperatures varied between 63°F. and 78°F. After this, they were removed and examined visually for attack. They were finally given a heavy watering and block stacked under wet conditions for several more weeks before being sectioned and examined microscopically for fungal penetration.

In this latter examination our criterion of satisfactory treatment was penetration to a depth less than 1/16th inch. The following results were obtained:-

RESULTS OF EXPOSURE UPON WHITE CHEESEWOOD

Series	Visual	Microscopic
1	Heavy to medium	Penetrated
2	Nil	Nil
3	Nil	Nil
4	3 samples showed very slight	3 samples showed surface attack only
Controls	Heavy	Penetrated

These results show that the fungicides are quite satisfactory when used in alkaline media and in particular in borax.

The remainder of the samples were analysed for boron content and in all cases satisfactory penetration was found. It is of interest that no significant variation occurred in results from the borax when compared with those from the acid.

During a visit to El Arish sawmill last March, it was found that the stacks were one complete mass of fungal growths. Examination of the solution showed the presence of trichlorphenol. This was redissolved by the addition of sodium hydroxide and several charges were treated satisfactorily. Due to the strike, supplies of alkali were unobtainable, and as further acid was added, the pH dropped and mould growth developed. Since that time supplies of soda ash were obtained and the firm has been satisfactorily treating. The Hull Timber Syndicate has now been advised to change completely to borax to obviate the double cost.

Borax of itself, although a recognized fungicide when in high concentration, has been shown by other experiments to be somewhat ineffective in the concentrations used in Lyctus treatment. However, it may be pointed out that although samples so treated were block stacked in rain for several weeks in all cases the mould had not penetrated.

In conclusion, I would like to point out that other fungicides, such as the organic mercurials, were not considered as they are toxic and subject to strict health control. In addition, they are known to cause dermatitis and would be a possible source of labour difficulties.

Mr. Hartigan: After consultation with Messrs. Timbrol Ltd. it was decided to incorporate sodium trichlorphenate in the boric acid tanks at an approximate concentration of 0.02 per cent. This was done by Mr. Welch in our own experimental tanks at Balmain in 1945 or earlier and the problem seemed to be solved.

The concentration of chemical was not considered to be critical and no attempt was made to measure it very exactly. About every three months sufficient chemical was added to give a concentration of 0.01 to 0.02 per cent., zero concentration being assumed at the time of addition.

In the Summer of 1946-47 there were isolated reports that sodium trichlorphenate was not completely effective against mould, and last season trouble was experienced by D. Hardy and Sons.

Further up the coast the trouble was more intense and the Kyogle Veneer Co. asked if we could suggest an alternative fungicide to sodium trichlorphenate.

We suggested phenyl mercuric acetate at a concentration of 3 parts in 100.000 or higher, and this apparently was satisfactory.

To Hardy's we suggested increasing the concentration of sodium trichlorphenate tenfold so that they built up their concentration in the tank to 0.10 per cent., and for the latter part of last season had no further moulding problem.

Over the last two years we have discussed this subject with Timbrol's chemists and in private correspondence with Dr. Lindgren of the U.S. Forest Service.

The chemical explanation for the failure of sodium trichlorphenate is simply that the sodium salt dissociates at a pH around neutral point to form the corresponding phenol.

Since Timbrol's product is mainly the 2-4-6 substituted compound, the solubility of which in water is around 0.18 per cent. at 77°F., this is the highest concentration which can be used.

Further addition of the sodium salt only results in a precipitate of trichlorphenol. Although it has been suggested that precipitated trichlorphenol might still be effective against mould by reason of it becoming adsorbed onto the surface of the wood being treated, it would seem that this would be an uneconomic way of using it since there is no way of controlling the adsorption rate. Apparently timber also exerts an affinity for both this type of chemical and phenyl mercuric acetate.

If concentrations of sodium trichlorphenate can be maintained around the 0.10 per cent. mark in the boric acid baths, there is no reason to believe at present that it will not be an effective deterrent to mould growth. The problem seems to be to keep the concentrations of chemical at effective levels. At this Division we are trying to find what is the minimum effective concentration for prevention of mould. The hot liquid extracts quite a lot of material from timber which it is reasonable to suspect can become a suitable pabulum for mould.

Trichlorphenol is steam-volatile and some is lost when a cold solution is poured onto hot wood. Only loss by absorption is made up for successive charges so progressive dilution of the total sodium trichlorphenate content occurs.

Until further evidence is obtained, we see no good reason for abandoning the use of sodium trichlorphenate in boric acid baths as a mould preventative. Consequently, we do not ~~at any rate~~, consider at this stage that the mould problem is one which should make us incline to using borax in place of boric acid.

Mr. Huddleston: Hardy's agitate the whole tank and in this way get a good mixture of the solution. If any insolubles are precipitated they are easily dissipated in suspension when running in. Failures have only occurred with cold soak treatments where the solution was left to stand a number of days with the material in it.

Mr. Cokley: In reply, there are three points I wish to raise. Firstly, with regard to Hardy's, although the samples mentioned showed no further mould there was mould on other stacks. There is a big possibility that mould would not have occurred in any case on that stack. Secondly, with regard to mixing of the solution, Brandon's solution mixed by a pump, gives an excellent mix but we found sodium trichlorphenate was alright for one charge only. We have complete evidence of the unsuitability of sodium trichlorphenate in boric acid solutions in North Queensland. The solutions tried were well mixed and covered a wide range of concentrations, but none prevented mould. Thirdly, I cannot see any advantage in adding sodium trichlorphenate to boric acid solution with an acid pH. I think you are simply wasting chemical at 15/- a gallon by adding it to the solution and allowing it to sludge. It is not only the surface layers of the charge you are interested in but in all the subsidiary layers underneath, and in our experience they do not get this precipitated sludge. As regards phenol mercuric acetate, we did not consider it firstly on account of the dilution and secondly, quoting Dr. Lindgrin, the mercuric salts will not act as killers of all fungi I agree with Mr. Hartigan that Hardys are working on false premises, but it may be saving them money.

Mr. Hartigan: We will not know until this summer whether last season's increase in concentration of sodium trichlorphenate should be taken as a definite cure. The solubility of trichlorphenol is 0.18 per cent. and that concentration should be effective. There should be no precipitation of sludge containing appreciable quantities of sodium trichlorphenate.

Mr. Huddleston: The attitude adopted by the practical man works in New South Wales. We do add sodium trichlorphenate, we do not get extensive mould growth. We do know it is on the whole satisfactory. We know from past experience that we have had on timbers like milky pine and tulip oak very extensive mould growth where the sodium trichlorphenate has not been added.

Mr. Cokley: That may be the position in New South Wales, but in Queensland it is far more serious, probably because conditions in Queensland, especially in Northern Queensland, are different to those in New South Wales. Where we have kiln facilities it does not become a problem because we can satisfactorily handle our fungus in later kiln treatment. Brandons are not doing anything because in Brisbane we are getting surface mould only which doesn't worry us since the timber undergoes kiln treatment which sterilizes the charge.

Mr. Fogl: I should like to clarify a couple of points raised by Mr. Cokley. First of all he said that there is no guarantee that mould was prevented at Hardy's by sodium trichlorphenate as none of the stacks treated or untreated showed any evidence of mould. He has, however, only the evidence of a single inspection and I can assure him that quite a good deal of mould has been found on untreated stacks during other inspections whereas there has been no evidence of mould on stock treated in boric acid containing sodium trichlorphenate. Another point he mentioned is that the sodium trichlorphenate gives only a surface treatment. I cannot see the significance of this as surface protection is all that is required.

Mr. Cokley: Mr. Fogl has misunderstood me; the surface referred to is the surface layers of a stack, i.e. the top layers. From our experience sodium trichlorphenate in boric acid sometimes renders immune only the top one or two layers.

Mr. Taylor: I take it then that there is mould growth on the inside of the boards in such cases?

Mr. Cokley: In one case yes, in the other case no, but in the latter case our controls themselves did not show anything.

Mr. Tamblyn: I do not find anything incompatible in the different results obtained in New South Wales and Queensland. Conditions are very suitable for mould growth in North Queensland and a treatment which might fail there could easily prove effective under the lower hazard conditions in New South Wales. It has been shown that borax and sodium trichlorphenate together are more effective, than would be expected from using them separately. If boric acid has proved satisfactory with an addition of sodium trichlorphenate in New South Wales it would seem that there would be no advantage in changing to borax. The possibility of using borax was considered by Cummins but from the evidence available it appeared that less extraction of the timber would occur with an acid solution resulting in loger longer life of the solution. It would therefore appear to be dependent on the local requirements whether borax should be used to obtain higher fungicidal efficiency.

(f) The use of unlined concrete in the construction of preservation vats

Mr. Cokley: The desirability of being able to obviate the necessity for copper lining of boric acid vats has been discussed previously at the 1947 Conference. On that occasion it was pointed out that our Department had initiated tests to ascertain the actual magnitude of the effect of treatment solutions. These tests have now been completed and lathough the report is still under compilation, members may be interested in the results.

Sixteen standard test cylinders, some treated with a silicate glazing and subjected to varying times of seasoning were exposed for fifteen months in Brandon's vats. In addition six reinforced concrete slabs had been cast using $\frac{3}{8}$ in. reinforcement and subjected to the same conditions of exposure. After this period they were removed and tested mechanically, and in several cases chemically. The mechanical tests on both slabs and cylinders showed that neither the immersion nor the pre-treatment had any significant effect upon the material. This can be seen from the following tables:-

TABLE 1

Compression Tests upon 12 in. x 6 in. Cylinders Exposed to Boric Acid Solutions

Mixture:

River gravel	-	60 lb.
Moist sand	-	43 lb.
Cement	-	20 lb.
Average slump	-	$3\frac{3}{4}$ in.

Series	Strength p.s.i.			
	7	4S	40	Control
A	Damaged	2860	3530	4160
B	3530	4160	3770	3210
C	Damaged	4320	4400	2820
D	2860	2390	2860	3450

Legend:
7 - 7 days' seasoning
4S - 4 weeks' seasoning and silicate
40 - 4 weeks' seasoning

TABLE 2

Flexural Strength Tests upon 3 Ft. x 6 In. x 3 In. Reinforced Concrete Slabs

Mixture: Gravel $4\frac{1}{2}$ parts (kerosene tins)
Cement 1 part " "
Water 4 gal.

Slump Test $2\frac{1}{2}$ in.

Specimen	Age in days	Pre-treatment	Max. load (lb.)	Mod. of rupture
1	617	7 days' seasoning	8040	2680
2	617	7 days' seasoning	10810	3605
3	617	4 weeks' seasoning. 2 washes with silicate	8340	2780
4	617	do.	9380	3125
5(Control)	617	4 weeks' seasoning	7090	2365
6	617	4 weeks' seasoning	9550	3185

The exposure samples were found to have a surface pitting and discolouration averaging a depth of 1/16 in. ~~and can be seen in the accompanying plates.~~

In addition chemical tests were made upon an untreated control and an exposed cylinder of the same series, not treated with silicate. Strips were taken in both cases to a depth of $\frac{1}{4}$ in. with a further strip in the case of the treated sample at a depth of 1 in. The results are shown in Table 3.

TABLE 3

Chemical Analysis of Concrete Exposure Cylinders

Sample	Volatiles	Silica SiO_2	Lime CaO	Iron Fe_2O_3	Aluminum Al_2O_3	Magnesium MgO	SO_4*	Cl*	Boron+ H_3BO_3
Untreated	12.8	57.5	17.0	2.75	6.6	Trace	Present	Present	Nil
Treated at ¼ in.	15.1	65.1	12.1	3.32	4.2	"	"	"	2.02
Treated at 1 in.	10.8	63.0	11.8	3.7	4.57	"	"	"	Nil

* Qualitative test only.
\+ Determined on separate sample.

It is a moot point as to whether the chemical analyses show any significance between the treated and untreated samples. To examine significance, it would have to be assumed that:-

1. The mixture was perfectly mixed.
2. All sample cylinders were homogeneous and identical.

As the mixing was done by hand and the cylinders cast by filling of a mould and hand pounding I do not consider that these assumptions are valid. Examination of the plate showing the internal nature of the aggregate will, I believe, substantiate this conclusion (Plate shown).

In addition to these, small 2 in. cubes made with a mixture of 3:2:1; were exposed in pure solutions of boric acid. Over a period of six months there was no significant variation in the concentration of the solution. This data indicated that the reaction between boric acid and the concrete was of very small magnitude. When this was correlated with a previous experience of the department where acetic acid formed by moist heat in a kiln caused the formation of calcium acetate, we have arrived at the following conclusions:-

1. Pure boric acid solutions do not have any practical effect upon first class concrete.
2. Superficial reaction occurs between the organic acids extracted from the timber and the lime but over a period of fifteen months penetration had not exceeded 1/16 in. of an inch.
3. Provided that there is an internal coverage of the reinforcement to a depth of two inches, a reasonable life can be expected from unlined concrete treatment plants.

It must be emphasized however that these results do not give a complete picture of what happens to the concrete in service. Stresses such as the effect of rigidity and heat did not enter into the exposure and would need to be considered in the design of such structures. However these latter are a matter for designing engineer and would presumably be already satisfactory covered.

Practical Applications

These results have already been put into practical application principally at Mirani Sawmills. Here the vat has been constructed of brick with a two inch concrete coverage. It is a direct firing unit 1 run/day reaching 160°F. in 5 hours. Although this plant has only been in operation since August of this year, arrangements have been made to ascertain the effect, if any, upon the concrete at 12 monthly intervals.

Protective Coatings

In Queensland, work has been carried out only on one plant using the "cold-soak" process wherein the concrete has been lined with bitumastic paints. To date this has given fairly satisfactory service (3 months) but one item noted has been the effect of abrasion when the charge is lowered into the vat. With regard to other coatings we have been content to advise enquirers with the information based upon the results of the Division of Wood Technology who have covered this matter in detail.

In this regard, however, we have recently been approached by the Brisbane agent for Swift Vule, a liquid rubber preparation, with a request that we test the material. The firm Swift Tennis Ball Coy. (Melbourne) claims that it resists acids and corrosives and withstands heat to 200°F. Before any tests are initiated, we would like the views of the other members of the Conference. I would suggest that as the Division of Wood Technology have already examined this field in detail, that enquiries such as this should be referred to either them or to the Division of Forest Products who also have had wide experience in these matters.

One further item on which I would like to comment is the resistance of brazing metals to the solutions. We have recently found that in several seams at Brandons, the Fobin Bronze Welding has failed. This material, composed principally of 60 per cent. copper and 33 per cent. zinc was found to be dezincified in the areas that have failed. It is interesting to note that the failure occurred along the seams joining the vertical lining with that on the bottom the latter being rigidly held by bearers and sleepers. It is of no real economic magnitude as it necessitates re-brazing only at 6-12 monthly intervals and would not warrant the firm stripping all brazes and using the phospho-bronzes or any other low zinc content alloy.

That above is a brief resume of our developments in this field and in conclusion I suggest that future recommendations should not cover the necessity for copper lining of treatment plants.

Mr. Huddleston: We cannot say definitely yet that unlined concrete vats will be satisfactory. It will depend upon our experience.

(g) The effect of initial moisture content upon the steaming cold quench process

Mr. Cokley tabled the following report:-

The effect of moisture content upon treatment results was raised at the 1947 Conference. To ascertain the magnitude of this effect, tests were carried out upon brown tulip oak. Moisture content in the test samples covered a range from 10 per cent to 60 per cent. The specimens were steamed in a small sealed vat for 3 hours and then quenched overnight in a cold 1 per cent. solution of boric acid.

After treatment all boards were allowed to season for one month, and were sampled after this period. Analysis showed that in approximately 20 per cent. of cases core concentrations were in excess of the required minimum. Mr. Leslie of the Division of Forest Products examined the results and the final report has been based upon his helpful comments. Our results in summary are in the following table:-

The Effect of Moisture Content in the Steaming Cold-Quench Process

Series	Initial M.C.	Final M.C.	Increase in M.C.	Per cent. Boric Core	
				Mean	Range
A	26.4	74.7	48.3	0.20	.10-.38
B	11.3	63.5	52.2	0.10	.08-.20
C	60.1	74.9	14.8	0.13	.09-.23
D	30.5	78.0	47.5	0.15	.04-.23
E	31.3	46.7	15.4	0.17	.04-.36

The moisture content effect may be due to two causes viz.

1. The method of estimation of moisture content.
2. The presence of only low starch contents.

1. Moisture Content

In our trials all moisture contents were determined by the oven dry method upon sections of the board. For this test we have possibly made the assumption that there is a relationship between actual core moisture and total moisture. This may not be the case and I would like the opinion of other members.

2. Starch Content

On the average the starch content was light, but was of such a nature and distribution as to necessitate treatment under commercial conditions. It has been generally assumed that absence of a low starch concentration indicates a change from "sapwood" to "truewood" and this condition may have held in the test samples.

In an attempt to explain the results, we have attempted a correlation of the initial steaming process with the reconditioning process. In the latter it had been found by the Division of Forest Products that an increase of moisture content did occur in the outside skin. We have postulated that this outside moisture forms a "moisture skin" which is ruptured in the quenching stage. This skin would not be of importance in open textured species such as white cheesewood but would be important in timbers such as tulip oak. The "sucking-in" of this moisture would, it is believed, nullify any variation in the original moisture content. It is emphasized that this postulate can be regarded only as an attempt at explaining our results, and I would appreciate the Conference views upon it and any suggestions that members might make.

(h) The cold soak treatment of spotted gum and other susceptible timbers

Mr. Cokley tabled the following report:-

During the past year our Department received a query concerning the treatment of spotted gum. The conditions were such that the only practical type of treatment was the "cold soak" process. In the past we had not favoured this process as we believed that the effect of the moisture content was critical and necessitated treatment immediately after cutting i.e. in as green a state as possible.

As we had no information upon suitable schedules for spotted gum, flitches were obtained and cut into 4 in. x 1 in. planks from which matched sample boards were obtained. These were then divided into three major series whilst an extra sample was tested as a fourth series. On all cases moisture content and starch gradings were determined. The series were then immersed in a 3 per cent. solution of boric acid and removed at periods of 6, 8 and 10 days respectively. The extra sample was allowed to remain in the solution for 15 days. After this treatment, the samples were allowed to air season for four weeks before sampling.

The results obtained from these tests are summarized as follows:-

Series	Initial M.C.	Final M.C.	Mean Core Concentration
A	23.6	40.7	.31
B	24.95	43.2	.27
C	25.3	45.15	.32
D	22.6	41.5	.44 (one sample)

It will be noted that in all cases, the initial moisture content was very much lower than that originally thought safe, but the results indicate that air dry timber can be satisfactorily treated by the "cold soak" process. When the results of this experiment were being collated, we were fortunate to have Mr. Leslie of the Division of Forest Products with us and were able to have the benefit of his advice in planning the further work necessary to confirm these results. In this connection we desire to express our thanks to the Division for Mr. Leslie's visit which was of great assistance to us in examination of this and other experimental work as our own Statistician had just recently commenced duties.

It is of interest to note that, in general, in series A, there existed a fairly regular linear relationship between increase in moisture and core concentration; in series B there was no relation, and in series C an inverse relationship occurred. Whether such relationships were fortiutious or significant can only be determined by the further experiments mentioned above. It also suggests that there may be an optimum period of steeping followed by a flattening out of the curve.

Since these experiments a local joinery firm has installed a "cold soak" plant and at present are treating 2 in. kurrajong in a 3 per cent. solution in 7 days. In fact the results are excessive and average 1 per cent. in the core and we have arranged for samples to be taken at 3, 5 and 7 days so as to ascertain the optimum treatment period. Other species proposed for immunization by this firm are blush alder (2 in.) and brown tulip oak (1 in. and 1½ in.) and as the timber will be partly air dry, their treatment will serve as a valuable adjunct to our own experiments.

With regard to the process in general, however, we still believe it to be suitable only for small plants such as furniture manufacturers where time of treatment is not a governing factor.

(i) Australian standard specification for boric acid treatment

Mr. Tamblyn: This matter has been raised from time to time in the past and deferred for future discussion on the grounds that treatment methods are still being standardized or that a specification would serve no very useful purpose. Personally, I have felt some doubt whether a specification is necessary and consider that the manual on boric acid treatments, already discussed and agreed to, is required first. The manual will serve a more useful purpose than a specification which could only fix the minimum boron content for safe treatment and define the methods of analysis. The specification would be restrictive if it attempted to standardize treatment methods or schedules. If we issue a specification I believe it should follow and not precede the manual.

Mr. Cokley: The specification was not required to fix treatment schedules. We were hoping that this Conference would decide upon, firstly, a standard method of sampling, secondly, standard position and size of samples, and thirdly, permissible variation in the sample. I have discussed this with Mr. Tamblyn and we reached a conclusion in accord with the 1945 Conference. We also agreed on a tentative basis to accept a sample not less than 3 ft. from the end of the board.

Mr. Huddleston: At the Timber Industries Committee meeting it was tentatively decided that specifications for preservative treatment should be considered. Some delegates, no doubt, have sent their comments in to the Standards Association. I feel we have reached the stage where we need a specification for boric acid treatment. The specification should confine itself to specifying the minimum amount of boron content, method of analysis, such things as core, etc., but should not endeavour to specify schedules or method of penetration.

Mr. Irvine: Such a specification would have great advantages from the Victorian point of view.

Mr. Huddleston: The Act specifies that the treatment must be approved by the Commission. The Commission will only give approval on the condition that 0.2 per cent. boric acid concentration is obtained at the core of the board.

Chairman: It is generally agreed that a standard is necessary. That standard should not go too far and cover methods of treatment. It might be desirable to specify boron content rather than boric acid content.

Mr. Huddleston: That is done automatically with the method of analysis which is an analysis for boron. The method of analysis is as important as any other aspect and should be included in the specification.

Chairman: Do you want specific action on that? I think the position lies with the Standard Association.

Mr. Cokley: I think it has been sufficiently covered.

Mr. Tamblyn: I suggest that Mr. Huddleston assume responsibility.

Mr. Huddleston: I have intimated to the Standards Association that it is urgent.

(j) Dip treatment of veneers

Mr. Cokley: I would like to know, firstly, the attitude of the Division of Forest Products to this method of treating veneers.

Chairman: We have requested the Minister to issue a statement that the momentary dip is satisfactory.

Mr. Cokley: Secondly, I would like to inform members of one condition experienced in momentary dip treatment. The dressing knives rapidly blunted, but we could discover no reason for this. In the last 2 months that position has disappeared and there is now no problem.

3. LYCTUS

(a) Susceptibility lists and publication

Mr. Tamblyn: It is proposed by the Division of Forest Products to include the Lyctus susceptibility list as an appendix to the Lyctus Trade Circular or Bulletin to be issued by the Entomological Sub-Committee. The formation of this Committee was discussed at the last Conference and in accordance with the decision then reached we have prepared and circulated, for comment, a draft of the proposed Lyctus publication to the State and New Guinea Forests Departments and to the Division of Economic Entomology, Canberra. So far comments received have not objected to incorporation of the Lyctus susceptibility list in this bulletin. This being so, the question of publication of the list depends on publication of the bulletin. In inviting discussion on this bulletin I would suggest that delegates confine comments to:-

(a) Agreement (or disagreement) with the subject matter in general and the method of presentation rather than detailed criticism of statements made. This detailed criticism can best be handled by correspondence.

(b) Discussion on illustrations required.

(c) Discussion (if any) on the susceptibility list.

(d) Discussion on publication.

As we have prepared the initial draft and are conscious of its shortcomings we invite now the very frank comments of delegates.

Mr. Taylor: I think that the general set-up is quite sound and the main headings are appropriate but I have not yet considered it in detail. We should have more headings and sub-headings. One error should be pointed out. It is stated that Lyctus dust is lightly packed and the larvae push it out from the flight holes.

I would say that the dust is fairly tightly packed and the beetles push it out. In the case of Anobium it is loosely packed and this is a recognized point of distinction between Anobium and Lyctus. The trade circular as it is presented here would have a definite value for persons interested in the prevention of Lyctus attack or in the boric acid treatment. For general enquiries I do not think it is at all suitable and I propose that a much shorter leaflet dealing with the main points only should be prepared in addition to the present trade circular.

Chairman: Would an article that we might publish in a newsletter do?

Mr. Taylor: I think that would be a good idea.

Mr. Ellis: I agree with Mr. Taylor. I feel that there is room for a pamphlet to be handed to people who want to know how to get rid of borers and reprints from newsletters would meet the case.

Mr. Hartigan: It has been my object to get into Technical Notes articles by members of the staff on subjects for which we get many enquiries. We could get such articles circulated through New South Wales and perhaps Queensland.

Mr. Huddleston: The problem is essentially different in the different States, and even within the State. It is different even between Sydney and Newcastle.

Mr. Irvine: Many queries regarding susceptible timber from New South Wales, Queensland and New Guinea and the Islands have arisen. There is a great need for accurate information dealing with or to provide the person interested with a detailed understanding of Lyctus attack and methods of controlling the attack in sawn timber but there is also a great need for something which you can hand out to a domestic enquirer. So far as the draft publication under discussion is concerned it is a matter for New South Wales, Queensland and New Guinea to decide what details of commercial treatments are required.

Mr. Taylor: I have been considering these practical problems at the end and I wonder whether they are entirely suitable in a comprehensive publication.

Mr. Tamblyn: Our terms of reference were to prepare a comprehensive document and we have done this. In addition it seems desirable to have a smaller publication which will answer the average simple enquiry. However for many other purposes the comprehensive publication is desirable. Our previous Lyctus Trade Circular was almost the same length as this and we have found it one of the most popular of our trade circulars. We got over the difficulty of a lengthy document by marking the subject matter which referred to a specific problem. However, I do think in future we need two types of publication - firstly a comprehensive one which I believe will serve a wider purpose than some delegates think, and secondly a small hand-out which covers common problems in each State. It will be essential that the latter be prepared separately for Victoria, New South Wales and Queensland, preferably by Forest Services.

Chairman: The general opinion seems to be that we need two documents. As to how we can supply the second document may be left to a later discussion.

Mr. Gay: The proposed title mentions Lyctus - the Powder Post Borer. We have formed a small sub-committee to standardize the common names of insects, and we have, in the course of this committee's activities, compiled a list of accepted names in other countries such as America, Great Britain and Germany. In America, Great Britain and the first edition of the present trade circular, Lyctus is referred to as the Powder Post beetle. We would like to change back to Lyctus, Powder Post beetle as is done overseas.

Mr. Irvine: The term "borer" is generally used by the public but it might be a good idea to do as Mr. Gay wants.

Mr. Gay: Could have the main title "Wood Borers in Australia" with sub-title "The Lyctus Beetle"?

Mr. McAdam: It seems to me there should be some more detailed reference to the apparatus and equipment used in commercial boric acid treatment.

Mr. Taylor: I have been thinking the same thing. I wonder whether boric acid treatment could be dealt with in the C.S.I.R. Journal? In a comprehensive publication on Lyctus it should suffice to give a brief, general account similar to that given other methods of treatment. We might find that there are radical changes to be made in a few years because methods are changing.

Mr. Tamblyn: I was going to suggest a manual to cover treatment methods under another agenda item.

Mr. Irvine: The manual would have to be of the loose-leaf type. There would be a limited number of potential users, and it would be necessary for you to revise the manual within a short number of years.

Chairman: I think that is still within the bounds of possibility. Our Head Office has a multilith and could run off about 500 copies.

Mr. Huddleston: We would need up to 1000 copies.

Chairman: It is not difficult to reprint from time to time.

Mr. McAdam: I think it would be better to have two separate publications rather than one comprehensive one, which could not include engineering details.

Mr. Tamblyn: I agree.

Chairman: If we include treatment in a trade circular, any new treatment would make it out of date. This would be serious as we get 10,000 copies of the circulars.

Mr. Huddleston: I do not think these details should be included in a trade circular.

Mr. Taylor: If we have a separate manual we will not need the appendix.

Mr. Tamblyn: I move that this Conference agrees that a comprehensive document somewhat similar to the draft prepared is needed, that each State should prepare a small leaflet for its own requirements, and that a manual for issue to treatment plants should be prepared.

Motion seconded by Mr. Huddleston. Carried.

Chairman: Further details of this publication can be handled by correspondence. Will one of the States handle the manual?

Mr. Taylor: We are already preparing a similar publication. This could be circularized for comment. In New South Wales we want to include a reference to the Timber Marketing Act; this could be covered as an appendix.

Mr. Fogl: A suitable draft could be prepared in two months.

Mr. Tamblyn: The manual should cover veneer and saw mill treatments and contain a chapter on the theory of the treatment.

Mr. Taylor: That has been done.

Chairman: New South Wales will be the initiating authority?

Mr. Taylor: Yes. We will circulate the draft with suggestions that others complete certain parts.

Susceptibility Lists

Mr. Cokley: I suggest we have only two grades, susceptible and non-susceptible. Other distinctions are too fine and dependent on personal factor.

Mr. Tamblyn: I disagree. Where we can grade the susceptibility of timber it is of use to do so. Species which are very susceptible should be indicated.

Chairman: We can asterisk species about which information is incomplete.

Mr. Cokley: The trade is only interested in whether the timber has to be treated or not.

Chairman: I would not agree. *Eucalyptus gigantea* is shown as susceptible but is not in the same class as some Queensland species.

Mr. Taylor: I agree with Mr. Tamblyn. Some susceptible timbers are rarely attacked and so would not need treatment.

Mr. Huddleston: We must maintain grading. Research workers and others find a detailed list useful. It would be a backward step to eliminate grading. However, in legislation we only include species which must be treated - no grading about it.

Mr. Gay: Rating "I" has been omitted from the draft list.

Mr. Tamblyn: The matter of illustrations could be covered by correspondence.

Mr. Taylor: We will send copies of our illustrations to the Division of Forest Products.

Mr. Ellis: What nomenclature shall we use?

Chairman: Use standard trade name followed by botanical name. If we have the same trade name for two botanical species we can still show these separately if the species have different susceptibilities.

Mr. McAdam: A separate list for exotic timbers is desirable.

Chairman: That would be difficult at the moment. We can follow up further details by correspondence.

(b) Laboratory breeding and testing techniques

Mr. Tamblyn: We have met with serious difficulties during the last 12 months and have been forced to suspend some of the projects which we agreed to undertake at the last Conference.

We cannot guarantee to breed Lyctus uniformly well from material selected as apparently susceptible on the basis of its starch content and pore size. This means that in any test set-up there is likelihood of control material remaining unattacked with resultant difficulty in interpreting the effectiveness of treatments under test.

I am satisfied that the fault does not lie with our technique of beetle collection, sexing and inoculation, or with conditions of incubation of test material. It lies with the material itself. Admittedly we have improved our technique considerably during the past 12 months and possibly some earlier failures were due to faults we have now eliminated. Briefly, our present technique is to breed or test in large glass jars with metal screw lids. The jars are sealed against enterance of parasites or mites by waxing the cardboard wad and screwing the lid down tightly. We have tested this method of sealing and find the jars are completely water-tight. To provide aeration we then cut a $1\frac{1}{4}$ inch diameter hole in the lid and cover this with rice (cigarette) paper glued down at the edges with Canada Balsam. This type of container is mite proof as judged from the fact that malt agar placed in the bottom remains sterile in mite infested rooms. Incidentally, sealing with cigarette paper is a recognized method of preventing contamination of fungous cultures by mites.

The timber specimens used are sterilized against introduction of parasites by heating and are brought to about 14 per cent. moisture content just before inoculation. Inoculation with sexed or paired beetles is made by handling techniques which are claimed to be successful by other workers. The jars contain about $\frac{1}{4}$ in. depth of sand in the bottom - a technique copied from Mr. Gay. Unfortunately our incubation room is running at a humidity corresponding to approximately 12 per cent. E.M.C. which is slightly below the moisture content believed to be optimum. Our temperatures are, however, between 77 and 80°F. which are approximately optimum.

Under these conditions we have had very anomalous results. Some specimens have hatched Lyctus rapidly (in 4 months) while other apparently similar material has proved non-susceptible or has hatched very few beetles. With messmate stringybark sapwood we have about 90 jars which after 8 months incubation still contain active larvae which have not pupated. In many jars set up with several different timbers with medium starch content and inoculated with 15 Lyctus pairs we have had no emergence and no sign of attack. In other cases attack has been unexpectedly severe and rapid.

It is therefore evident that some factors essential to Lyctus breeding are not being controlled and this fact has led us to suspend new projects which depend for their result on susceptibility of material used to Lyctus as judged by the number of beetles hatched.

Two projects which we have underway are the veneer momentary dipping experiment and the experiment designed to test the effect of incorporation of toxic chemicals in the glue line. Fortunately we have secured sufficient attack in the controls to be reasonably sure of the results but both experiments have suffered from the fact that quite a number of the controls have not been attacked despite several inoculations. However, it is difficult to proceed under such "touch and go" conditions.

We do know from our contact with Mr. Gay of the Division of Economic Entomology, Canberra, that he has achieved considerable success to date in breeding Lyctus. In fact he has supplied us with several thousand beetles. Our technique does not differ materially from his except that we have introduced some refinements to eliminate the possibility of parasites. There is no doubt that Mr. Gay's success appears to reflect on our results but I am reasonably sure that his failures have still to come and that ultimately much the same picture will be reproduced. We have had successes mixed with our failures. If Mr. Gay desires suggestions for his future work I would strongly urge that he concentrates on the nutrition of Lyctus and the factors other than starch which are necessary for completion of the life cycle.

<u>Mr. Gay</u>: If you were not collecting daily you would find yourself running into difficulties. Although they live for periods of up to several weeks, the majority of the eggs are laid within the first few days.

<u>Mr. Tamblyn</u>: We collected daily.

Mr. Gay: Your difficulties rather puzzle me. 7,000 beetles which we sent to you are a fair indication of the success we are having. We were collecting 100 to 150 adult beetles per day. Production has fallen down to about 40 per day, but we will build up again very shortly.

Mr. Tamblyn: When we get the right material we might be able to solve our breeding problem but up to the moment we cannot get good susceptible sapwood.

Mr. Taylor: Beetles go back into their holes and even if you do collect daily there are a number of beetles that you cannot get. Mr. Brimblecombe has told me that if he knows there is a beetle hiding he pushes a pin behind it to persuade it to come out. He uses a soft timber such as kurrajong for this reason.

Mr. Gay: That would be alright for small blocks, but would not be practicable with stock culture jars.

Mr. Hartigan: Has Mr. Tamblyn done any experiments in nutritional aspects?

Mr. Tamblyn: We have just started to impregnate wood blocks with starch and peptone but it remains to be seen whether we can induce Lyctus susceptibility.

Mr. Hadlington: When I first started at this Division I was sent down to Mr. Gay for experience in Lyctus and termite work. At that time Mr. Taylor had been using white birch with which he had been having considerable success. Some of this material was sent to Mr. Gay and the remainder used at this Division. Some fresh material was obtained and no beetles were obtained from this material. Since Mr. Gay was having success with his material some of this second lot of material was forwarded to him. My experiences have been similar to those of Mr. Tamblyn. I have been using identical temperatures and similar humidities.

Mr. Gay: With reference to the first lot of white birch we found the length of time of development was 136-140 days averaging 120 days. In the second lot beetles emerged in 150 days.

Mr. Hadlington: We pared the ends from the timber and found the larvae had developed to the age of 3 to 4 weeks judging by the size of the workings, that is assuming they take approximately 3 to 4 months to emerge at optimum conditions. It would seem that these larvae died due to starvation.

Mr. Taylor: I do not think we have made it clear that the second lot of white birch did not contain nearly as much starch as the first lot, and I think that as far as the length of life cycle is concerned the amount of starch in the timber has a very direct bearing. I am not so sure the amount of workings has much bearing on the time the insect takes to develop; in other words, if there is plenty of starch it does not have to work so far.

Mr. Tamblyn: We recently collected 20 or 30 attacked specimens of various timbers for starch tests. Some of these with high starch showed less Lyctus attack than lightly starched wood which serves to confirm our belief that elements other than starch may be a limiting factor in Lyctus nutrition. One would expect that nitrogen, which is normally low in wood, might be one of the limiting factors.

Mr. McAdam: How many Lyctus has Mr. Tamblyn bred himself.

Mr. Tamblyn: Perhaps 20,000 beetles have been collected from our breeding material.

Mr. McAdam: He is taking a mass of material and breeding a mass of beetles. Are you breeding on the same scale that Mr. Gay is breeding on?

Mr. Tamblyn: We have only recently started breeding in jars.

Mr. McAdam: Would you have time to see the production of these beetles yet?

Mr. Tamblyn: As collected from naturally infested timber, beetles have probably come from most States and perhaps New Guinea as well. Recently however we set up a breeding experiment in 100 separate jars with one Lyctus pair in each jar. These beetles were collected from various sources to get wide variation. We used messmate stringybark sapwood with the result that the larval stage is developing very slowly and few beetles have hatched. We do not knoown whether there will be much variation.

Mr. Huddleston: I think there is a lot of point in Mr. Tamblyn's suggestion that materials other than starch are vital.

Mr. Hartigan: I would like to know how long beetles could stay alive on individual items of foodstuffs, e.g. sugars and nothing else, starch and nothing else, proteins and nothing else, and so on, and I consider investigations along these lines, in conjunctions with the analysis of the frass obtained might give some lead on the metabolism of the Lyctus beetle.

Mr. Gay: The question of using larvae for experiment is difficult because of their structural disabilities. The larvae are straight for two or three days but then start to get a hump-back. They require very special conditions under which they can feed.

Mr. Hartigan: Can you use a piece of bread instead of wood.

Mr. Gay: No, I do not think that would be very successful. A piece of wood would have to be used.

Mr. Huddleston: The easier way would be to take a piece of sapwood. Mr. Bryant has been analysing some of the frass from Anobium and found that this frass contained vanillin which would indicate that the lignin was being attacked.

Mr. Irvine: I seem to remember large beetles emerging from a sterculia, but they did no good when they were put into anything else. They were used in the early work on Lyctus control by the impregnation of sapwood with insecticides but failed to establish themselves in any other species tried.

Mr. Gay: It is not an easy matter to undertake any more projects as at the moment we have a great lack of staff. I have tried white birch, Sterculia and various other timbers.

Mr. Huddleston: The Division of Forest Products and ourselves are carrying out investigations which require large numbers of virile beetles. The position concerns this Division for until we can be sure of producing beetles which will continue to work on other material the work cannot proceed. Someone has to investigate why we cannot get results. The body who ought to do it is the Division of Economic Entomology.

Chairman: The Division of Economic Entomology should take up the problem as they are the best equipped to do it.

Mr. Cokley: Would Mr. Gay inform us whether he considers the iodine test sufficiently satisfactory to determine whether a timber is susceptible or not?

Mr. Gay: I have found the starch test can be misleading. I have obtained some samples of sapwood from the Division of Forest Products from which I have cut 1 in. cubes and had extensive development of larvae but on visual examination would not rate them very highly.

Mr. Taylor: I agree with Mr. Gay. It is a very difficult matter to estimate the starch accurately. Mr. Tamblyn mentioned placing up to 140 beetles in one container with no results. What is the size of the specimen in the container and was there any larval development. Too many larvae might eat all the starch before any of them reach maturity.

Mr. Tamblyn: The 140 beetles mentioned was the approximate number used for inoculation of cages containing about 30 small sheets of plywood used in our toxic glue line tests.

Mr. Hartigan: If the starch granules were beginning to disintegrate the colour reaction will be pink to reddish instead of the characteristic purple colour of the starch iodine reaction. This might account for some confusion in the normal starch test.

Chairman: I think we should form some kind of corresponding committee consisting of Mr. Tamblyn as convenor, Mr. Taylor, Mr. Gay and Mr. Brimblecombe as members. It will be necessary to ask the Department of Agriculture to allow Mr. Brimblecombe to be a member.

Mr. Cokley put the motion in this form. The motion was seconded by Mr. Taylor and was carried.

(c) Lyctus legislation

Mr. Ellis: The Forestry Department in Queensland has drafted legislation and it is now being considered by the Minister. It is similar to the New South Wales legislation, with some minor amendments. We have suggested that instead of the term "sapwood" the term "starch free timber" be used. We have also suggested in the section dealing with moisture content, that minimum moisture content be specified and that the specification should refer to the timber at the time and place of sale or after the sale. New South Wales has been operating their Act for some time now and I should be glad to have the comment of the New South Wales delegates on the adequacy of their present Act.

Mr. Huddleston: One point, the word sapwood appears in the New South Wales Act in two places. It is defined in the definitions of the Act in very much the same terms as in the standard terms and definitions and it appears in the body of the Act which specifies "No person shall sell or offer for sale timber described as being free from sapwood or in such manner as to convey or be likely to convey to any person the impression that such timber is free from sapwood unless the Lyctus susceptible sapwood has been previously removed therefrom". I feel that "free of sapwood" is a well established trade term, and that it would be a bad principal to depart from that term. I would like to say that we are gratified to see that Queensland is considering legislation. It will certainly make our job much easier, will eliminate certain objection from plywood interests in that they claim that supplies of plywood from Queensland are affected by the New South Wales legislation.

Mr. Ellis: The point raised by Mr. Huddleston is one that we still have to review. Could Mr. Huddleston inform me if any difficulty has been met by merchants or millers in the branding of each piece of timber as required under their Act. I thought from the point of view of practicability it might be better to drop this section of the Act.

Mr. Scott: Branding is done very quickly and an extra man for turning the timber over is not always necessary. I would not say that the man stripping could do the job. The more common practice is to turn the timber and to apply the brand after sorting the boards.

Mr. Ellis: We are concerned more with 2 x 1, 3 x 1 and 4 x 1. Is it necessary to brand every piece of timber?

Mr. Huddleston: Every board inspected must be branded with the inspectors brand.

Mr. Morley: You may realize later that the time factor is beside the point when dealing with that section of legislation concerned with approved preservative treatments. All timber treated must be branded as by no other way can a faulty treatment be traced to an operator.

Mr. Huddleston: The P.M.G. Department's decision to use treated timber in some of their jobs was only because it was branded.

Mr. Cokley: Take 4 x 1 flooring for instance, where would you brand it, on the end?

Mr. Morley: We haven't seen any flooring treated yet.

Mr. Huddleston: The position is that the actual supplier of the timber has the option to say where he will apply the brand. The brand has to be registered and approved, and there would be nothing to stop a brand being registered to be applied by a marking device attached to a machine and applied before the timber was sold or removed from the yard. Other people may prefer to use the hammer brand on the ends of boards.

Mr. Irving: There is a problem in dressed timber which is often stamped with the miller's brand.

Chairman: Branding will be more difficult as narrower pieces go through the machine.

Mr. Huddleston: In New South Wales and Queensland there has been little tendency to produce narrow boards. The practice seems to be to cut the widest possible boards and if such boards contain sapwood to treat the whole board.

Mr. Cokley: Take the case of flooring where you brand on the end and the particular section carrying the brand was cut off. Later on it was found that attack occurred in that piece. What would be the procedure?

Mr. Huddleston: Retention of the brand is here not necessary on the timber he is putting into flooring, because flooring becomes a manufactured article, and it is an offence to use borer susceptible timber in manufactured articles. In that case, if flooring was attacked by borers we would prosecute the manufacturer for using borer susceptible timber in the manufacture of articles for sale.

Mr. Irvine: As far as the problem in Victoria is concerned, it is a fair statement to say that we have no problem with our native timbers. The amount of damage is small and in domestic buildings is confined generally to bracing and tiling battens and similar sized members. However, increasing quantities of susceptible timber, some of it treated perhaps but most of it untreated, are being imported into Victoria, and I would be very happy to have this Conference's advice on how Victoria, and I don't necessarily mean the Forests Commission, can best deal with this problem, whether it should be by legislation, by extension work, or by a combination of both.

Mr. Gray: Do I understand that New South Wales legislation covers the marketing or the production of these susceptible species.

Mr. Huddleston: Marketing and use, mainly.

Mr. Irvine: Susceptible timber can be exported from New South Wales, untreated timber may be sold in Victoria.

Mr. Tamblyn: Mr. Gray may be interested in the fact that in the last 12 months, one shipment of approximately ½ million super feet of untreated timber in the log from Cairns arrived in Melbourne and to our knowledge only about 50,000 feet has been since treated. In all, about 20 species were represented and probably 80 per cent. of them were Lyctus susceptible. Much of this timber has thus been sold without any treatment at all. If that is going to continue then legislation seems necessary.

Chairman: It might be desirable to hold a meeting of Victorian Agents.

Mr. Huddleston: I have knowledge of two N.S.W. Agents operating in Melbourne with their office in Sydney, selling from their Sydney office with no Victorian representatives. I know one particular case where timber was being sold in Melbourne which could not be sold on the New South Wales market. We do not require that all timbers should be cut free of sapwood but the timber shall be sold with a true description so that the buyer is able to form his own opinion as to its suitability. Knowing the susceptible timber, and being required to use only timber which is not susceptible, the user can buy according to species, and if the species is susceptible can have the timber either cut free of sapwood or treated at an additional cost.

Recently a Conference consisting of representatives of Master Builders Association, Architects, co-operative building societies and lending institutions conferred concerning the Timber Marketing Act. It was recommended to us that the Act be amended. The building organizations are recommending that the clauses in the Act be widened by the elimination of the words "for sale" so as to make the provisions of the Act apply to all buildings.

Mr. Cokley: If Victoria did introduce an Act how would they police it?

Mr. Taylor: They would have no control over the vendors in other States, but they could control the re-sale of timber by Victorian agents and merchants.

Mr. Irvine: I did not know that Queensland was about to legislate regarding the situation. Once Queensland legislates, the position will be much easier.

Mr. Tamblyn: I think the position is quite serious. Recently a firm brought in some specimens of supposedly treated milky pine and we tested them. There was no sign of boric acid in the timber. In addition we often find it extremely difficult to identify timbers from vernacular names and so are helpless to reply to queries regarding the need for the timber to be immunized until specimens can be obtained.

4. ANOBIUM

Susceptibility of radiata pine

Mr. Tamblyn: I have asked for the inclusion of this item on the agenda partly because I was impressed when recently in New Zealand by the very general feeling there that untreated P. radiata will be severely damaged by Anobium before a building reaches natural obsolescence.

Mr. Harrow of the Plant Diseases Division of D.S.I.R., Auckland, is using P. radiata sapwood as one of the timbers highly suitable for breeding Anobium in the laboratory. His work has shown that P. radiata is susceptible as soon as it is dry and that the degree of attack is similarly heavy to that being obtained in Kahikatea (New Zealand white pine).

P. radiata is coming into increasingly wide use in Australia and the plantation-grown timber is very largely sapwood. I have little doubt that under certain conditions it could be seriously attacked by Anobium.

I believe we should give careful thought to testing the susceptibility of *P. radiata* under a range of Australian conditions so as to be in a position to recommend treatment if the tests indicate that it will be necessary.

The treatment would probably be with boric acid as Harrow has demonstrated that boron is toxic yo Anobium in much the same degree as to Lyctus. Boric acid treatment would also have the additional advantage of increasing very materially the decay resistance of *P. radiata* where it is not subject to leaching.

The tests which I have in mind very tentatively are the inoculation of test panels of *P. radiata* and their distribution to a number of selected points (possibly Forestry Offices) where they can be hung so as to simulate a service test under known conditions. Possibly similar panels should be sent to Harrow in New Zealand so that we can get a comparison between the severity of attack in known sites of high Anobium hazard.

At this stage I do not want to work out the detail of such a test but rather to suggest that something of this type is necessary if we are to answer questions which will undoubtedly arise.

Our observations in Victoria lead to the conclusion that Anobium attack can be severe in susceptible timbers mainly where reasonably high humidities exist. Most attack we have seen is in Baltic flooring and skirtings where presumably the moisture content is higher than in timbers well above the floor. However with New Zealand white pine attack seems to occur more readily in furniture, picture frames, doors, mantels and even in one case in material stored in a loft. With Baltic pine, attack in Victoria is usually not really severe although I have seen a few cases where floors have been renewed. If P. radiata is no more susceptible than baltic pine its treatment would probably be unnecessary if we are prepared to accept the nuisance of limited attack. If it is as susceptible as N.Z. white pine I honestly believe there would be many cases of its complete destruction from roof to floor over a fairly long period. Harrow's work suggests its susceptibility is high though laboratory tests may not be a fair indication. However with so much radiata coming into the Australian market we can't afford to neglect the question. At all costs we should avoid starting a borer scare with radiata, and I would suggest that we be particularly careful in this respect until tests have clarified the picture one way or the other.

Mr. Cokley: Mr. Harrow mentioned one item which interested me, namely the occurrence of Anobium in fresh, and even in green, timber

Chairman: I think that the general feeling that the Anobium occurs in old timber and not much in new timber arises from the long life cycle.

Mr. Tamblyn: Mr. Harrow uses P. radiata straight from the log for his breeding, only leaving it to dry for a few weeks before inoculation.

Mr. Taylor: This subject is linked with the importation of Swedish prefabricated houses. The five I have seen are entirely constructed of white Baltic timber. A number of building inspectors and other people who have had experience in building in Sydney have expressed the opinion that Anobium attack is certain with a period of 20 years. The Housing Commission proposes to import the houses and naturally it is concerned with the life of them. I have to discuss the question of treatment with an officer of the Building Research Station and then make some report. No progress has been made at all at the moment and I would like to hear some expression of opinion, firstly on the risk of Anobium attack and secondly whether anything can be done to prevent it. The timber is probably quite new and the possibility of Anobium being already active in these houses is fairly low, so if we can apply an overall spray we would probably minimize the damage and perhaps prevent it completely.

The obvious insecticide is pentachlorphenol which is now becoming available in Sydney and I think if we can spray the houses with it we have a fair chance of preventing attack.

Mr. Huddleston: The estimated cost of the houses is about £1000 each. Round about 1928-29 there were large quantities of Baltic lining imported into Sydney which has shown extensive Anobium damage. If the main structural members of the houses now being imported show the same extent of attack as that shown in the flooring and lining, the strength of the building will be seriously impaired with probably an expected life of 20 years. The problem is concerning us in N.S.W., because whilst we want to see the houses come to relieve the State position, we feel that with depreciation of £60 or £70 per annum plus the normal outgoings, the annual cost will be too high.

There is a very serious problem of commercial interests creating a borer scare. Boricure is about to set up in New South Wales and their publicity will have an effect on all States. We should reach a common policy on the action we are going to take in individual States on borer and pest exterminator firms.

Mr. Elliot: Is Mr. Huddleston concerned with this or the Housing Commission. There is a similar scheme in Victoria under which the houses will cost £2,000 each. The object is to bring these houses out with a view to replacing them in less than twenty years with something better - irrespective of borer attack.

Mr. Huddleston: That is a difficult question to answer. We considered it our responsibility to draw the attention of the Housing Authorities to the possibility of borer attack. They expressed very considerable concern that this could happen and will advise the Minister accordingly.

Chairman: We had a request for information from one of the Victorian State Departments regarding the use of New Zealand grown Pinus radiata for floorings and weatherboards. We did not consider that Anobium attack was likely in Victoria if adequate ventilation was provided.

Mr. Tamblyn: I submit that we were forced to make that statement in the absence of better information.

Mr. Pinches: At the present time we have not heard of any such attack, nor have we made any investigation into it. In view of Mr. Tamblyn's opening question we should be glad to get all the information we can and to co-operate in any investigation that may be made.

Mr. Irvine: There will be some quantity of radiata milled shortly in Victoria for flooring and weatherboards and we hope to have much more information on the possibility of Anobium attack in that timber.

Mr. Taylor: I agree with Mr. Tamblyn that the sooner we start some investigation the better. There may be some difference in the radiata pine grown in South Australia to that grown in New Zealand.

Mr. Tamblyn: I did have in mind the possibility of getting Mr. Harrow of D.S.I.R. to keep half the specimens for exposure in N.Z. and to send half for exposure in Australia. This would provide a comparison between severity of attack in New Zealand and Australia.

Mr. Gay: We would be very happy to have Mr. Harrow carry out this work as New Zealand has the experience with Anobium and we have not. I have no knowledge of incidence of Anobium in Australia.

Mr. Taylor: Could we include Baltic pine in the test? We have to make a decision on Swedish houses before we get results of test, but further information would be useful.

Mr. Tamblyn: I suggest that we play down in this particular instance the possibility of Anobium attack. I fear we would start something we could not stop if we recommended spray treatment for these houses. The only reasonable treatment would be spraying with pentachlorphenol which is only effective for several years and would not control attack in the later life of houses. I doubt if we would gain much by spray treatment now and we would loose much by starting a borer scare in softwood.

Mr. Huddleston: We are getting enquiries from building inspectors who want to know the possibility of borer attack in softwood and what treatment can be applied.

Chairman: I think N.Z. experience is that spray treatment is unsatisfactory as Anobium can bore through the thin surface treated layer.

Mr. Tamblyn: As pentachlorphenol is very toxic and is a contact poison providing the concentration is reasonably high, Anobium is unable to do much damage for a few years.

Mr. Wright: As I presume that Anobium occurs in Europe, surely we could get information from these countries, possibly through Britain, as to how Anobium attacks Baltic species in climates similar to Australia.

Mr. Taylor: I intend to make these enquiries.

Chairman: We do not know what to ask for. We know little about controlling factors in Anobium.

Mr. Huddleston: We do know that we get a vigorous attack in Baltic pine in the Sydney area.

Mr. McAdam: Could the Conference inform me what is the life cycle of the borer?

Mr. Tamblyn: About 3 years.

Mr. McAdam: Then why does it take 20 years for a house to fall apart?

Chairman: Sir Reginald Stradling says there does not appear to be one case of a house ever having fallen down due to Anobium attack. I know of a number of cases where portion of the floor, shelving, etc. has had to be replaced. I do not know of any case where the house has fallen down. Houses used to be put up with entire frames in Baltic pine in Victoria.

Mr. Tamblyn: The evidence in Melbourne indicates that no treatment is necessary for Baltic pine. There is the possibility of much more extensive attack in *Pinus radiata* with its wider sapwood.

Chairman: When we say Baltic pine we are using the term rather loosely for two timbers - White Baltic pine is spruce (*Picea abies*), red Baltic pine is (*Pinus sylvestris*).

Mr. Huddleston: It is a particularly difficult problem. I know of a case in Sydney where there are two places side by side both with Baltic floors. In one place the floors have been attacked and in the other there is not a sign of Anobium.

Chairman: Very large quantities of rimu are used in Sydney. This is highly susceptible to attack in New Zealand.

Mr. Taylor: It is quite commonly attacked in Sydney also.

Mr. Shambler: Our experience of Baltic has been that where it is very seriously attacked it is usually possible to trace the attack back to New Zealand white pine, which is very susceptible.

Chairman: Would it be possible to have a survey in Sydney where it is a very important problem?

Mr. Huddleston: We have made arrangements for such a survey. The Department of Works and Housing is arranging for inspectors to report the incidence of such damage.

Chairman: The same thing should be done in Victoria.

Mr. Huddleston: I agree with Mr. Tamblyn that spraying would be only temporary, but what advice can we give to housing authorities, various building inspectors, rural banks and co-operative building societies, etc.

Chairman: Just give them the information we have and leave it to them.

Mr. Tamblyn: Would you advocate treatment of *Pinus radiata* with boric acid?

Mr. Huddleston: No.

Mr. Tamblyn: Then why advocate it for Baltic?

Mr. Huddleston: Because there is evidence in Sydney of Baltic pine being attacked so seriously that you may have a break-down.

Mr. McAdam: Is it only sapwood that is susceptible to Anobium?

Mr. Tamblyn: Virtually.

Mr. McAdam: Then, as there is not much sapwood in scantling, it is not so important?

Chairman: If the houses are from Southern Sweden they may have a large percentage of sapwood.

Mr. Huddleston: As regards the type of publicity from borer exterminator firms, the Boracure people put out a bulletin once a month and they send me a copy of it. About two months ago I found a reference to creosote to which I took exception, and I wrote to Crowe and told him so, giving my reasons. He wrote back to say he was very sorry the error had occurred and it would be corrected in the next issue. The next issue had an article entitled "This Bulletin of Ours" which, after stating the wide distribution of the bulletin, went on with works to the effect "We are particularly pleased to see the interest being taken in it by Government Departments and others by comment received. We received a letter from Mr. Huddleston which rightly contained some adverse comment concerning the bulletin. We thank Mr. Huddleston for his letter". They are prepared to make wrong statements, but are not prepared to correct them. Anybody who has seen the Boracure Bulletin type of publicity will appreciate what effect that will have.

Chairman: Our only hope seems to be an educational campaign conducted by ourselves.

APPENDIX II

DECISIONS AND RECOMMENDATIONS OF THE CONFERENCE

Item 1. General business arising from the 1947 Conference

(a) Australian standards

(i) Nomenclature of Australian timber producing species

The lists prepared by Queensland and New South Wales are to be forwarded to the Division of Forest Products for collation and subsequent re-circulation to all States for comment.

The New Guinea representative agreed to prepare a list of New Guinea species, and the Commonwealth Forestry and Timber Bureau representative agreed to prepare a list of overseas species imported into Australia.

The Conference decided that the standard trade reference name should be no longer used. In cases where the botanical name is less familiar than the trade reference name, the latter, preceded by the word "formerly", may be used as well as the former.

(d) Building boards

The Division of Forest Products was urged to press forward with its research on building boards, particularly with respect to developing a process suitable for small-scale operations.

(e) Marine borer investigations

The Conference considered that investigation of the possible relation between silica content and resistance to marine borer attack was an important project, and that there was need for carrying out a survey of the silica content of various species and its distribution in the tree.

(f) High-pressure preservation treatment

Rapidly-grown timber which will be available in the future from species at present considered durable is to be included in future tests.

(h) Forestry abstracts

The Forest Products and Utilization Section of "Forestry Abstracts" was considered satisfactory.

Item 2. Equilibrium moisture content

A corresponding committee comprising representatives from each State department and the Division of Forest Products was appointed to operate a project for determining the equilibrium moisture content at as many places throughout Australia as possible. The Division of Forest Products is to continue with laboratory studies on fundamental aspects.

Item 6. Grading instruction

The following motion was carried:

"That the attention of the Eastern States Timber Industry Stabilization Conference be drawn to the need for grading timber to secure its most efficient utilization."

Item 7. Uniform building regulations: building research

The Division of Wood Technology is to send the reports on its statistical surveys of pest damage in houses to the Division of Forest Products for forwarding to the Building Research Committee.

Item 10. Durability tests

The Conference decided that laboratory and field testing should proceed simultaneously but the position is to be reviewed in a few years when sufficient information has been obtained on both methods. The Division of Forest Products is to circulate its working plans to all State departments before work commences.

Item 11. Pole tests

The following motions were carried:

"That the results of the pole tests be published as soon as possible, and that a symposium be arranged as soon as convenient thereafter."

"That a working plan for a new series of pole tests be put in hand."

Item 12. Australian standards: railway sleepers

The following motion was carried:

"That this Conference requests the Standards Association of Australia to prepare as a matter of urgency adequate specifications for sleepers for both wide and narrow gauge railway lines."

Item 18. Paints and lacquers

The following motions were carried:

"That there be set up a co-ordinating committee comprising representatives of the Defence Research Laboratories and the Divisions of Forest Products and Wood Technology for the purpose of planning and co-ordinating investigations into painting problems connected with wood utilization, having regard to requests received from individual States with respect to their particular problems."

"That this Conference expresses appreciation of the investigations into paint work being undertaken by the Defence Research Laboratories, and considers that, insofar as such investigations have a direct relation to wood utilization, the investigation should be extended to cover a wider range of problems and specific problems which arise from time to time."

Item 20. Preservation

(c) Taxonomy of fungi

An herbarium collection was considered to be desirable in Australia and delegates agreed to co-operate in establishing one.

Item 21. Veneers and plywood

It was decided that an item "The gluing of veneer and plywood" be placed on the agenda for the next Conference.

Item 22. Fibre content of bark of radiata pine

The Division of Forest Products agreed to carry out scout tests on barks with a view to their commercial utilization.

Item 25. General

(a) Provision of a library of educational films for forest products

The following motion was carried:

"That each organization represented at this Conference inform the others of any films available or in course of production."

Item 26. Co-operation

(a) Publications

The draft Lyctus publication was approved subject to minor alterations in the wording of the title page and foreword.

(e) Collection of material

The State Forest Services agreed to co-operate with the Division of Forest Products in the implementation of a plan similar to the draft Instructions to Collectors which, however, would need amendment owing to certain differences in procedure between States. When appointed, the Collector for the Division of Forest Products is to visit each State to discuss details of the collection and modify the Instructions to suit the conditions in each State.

Conclusion

The next Conference to be held in Melbourne in October in 1949.

LYCTUS CONFERENCE

1. Differentiation between sapwood and truewood

The following motion was carried:

"That differentiation of sapwood and truewood is an urgent matter and should be pushed ahead as quickly as possible."

2. Boric acid treatment

(c) Re-examination of toxicity of boric acid and borax

The following motion was carried:

"That a decision regarding the re-examination of the toxicity level of boric acid or borax be deferred until the next Conference."

3. Lyctus

(a) Susceptibility lists and publications

The following motion was carried:

"This Conference agrees that a comprehensive document somewhat similar to the draft prepared is needed, that each State should prepare a small leaflet for its own requirements, and that a manual for issue to treatment plants should be prepared."

Further details of the comprehensive publication are to be handled by correspondence. The Division of Wood Technology is to prepare a draft of the manual and circulate for comment.

A suggestion that "susceptible" and "non-susceptible" be the only two susceptibility grades was not approved.

(b) Laboratory breeding and testing techniques

The following motion was carried:

"That a committee be formed consisting of Messrs. Tamblyn, Taylor and Gay to do work as a matter of urgency on the problem of the variable results obtained in breeding Lyctus beetles, and that the Department of Agriculture be requested to allow Mr. Brimblecombe to be a member."

Item 4. Anobium: susceptibility of radiata pine

It was agreed that an investigation of the susceptibility of radiata pine to Anobium attack should be started as soon as possible, and that more information was needed on the susceptibility of Baltic pine to Anobium attack.