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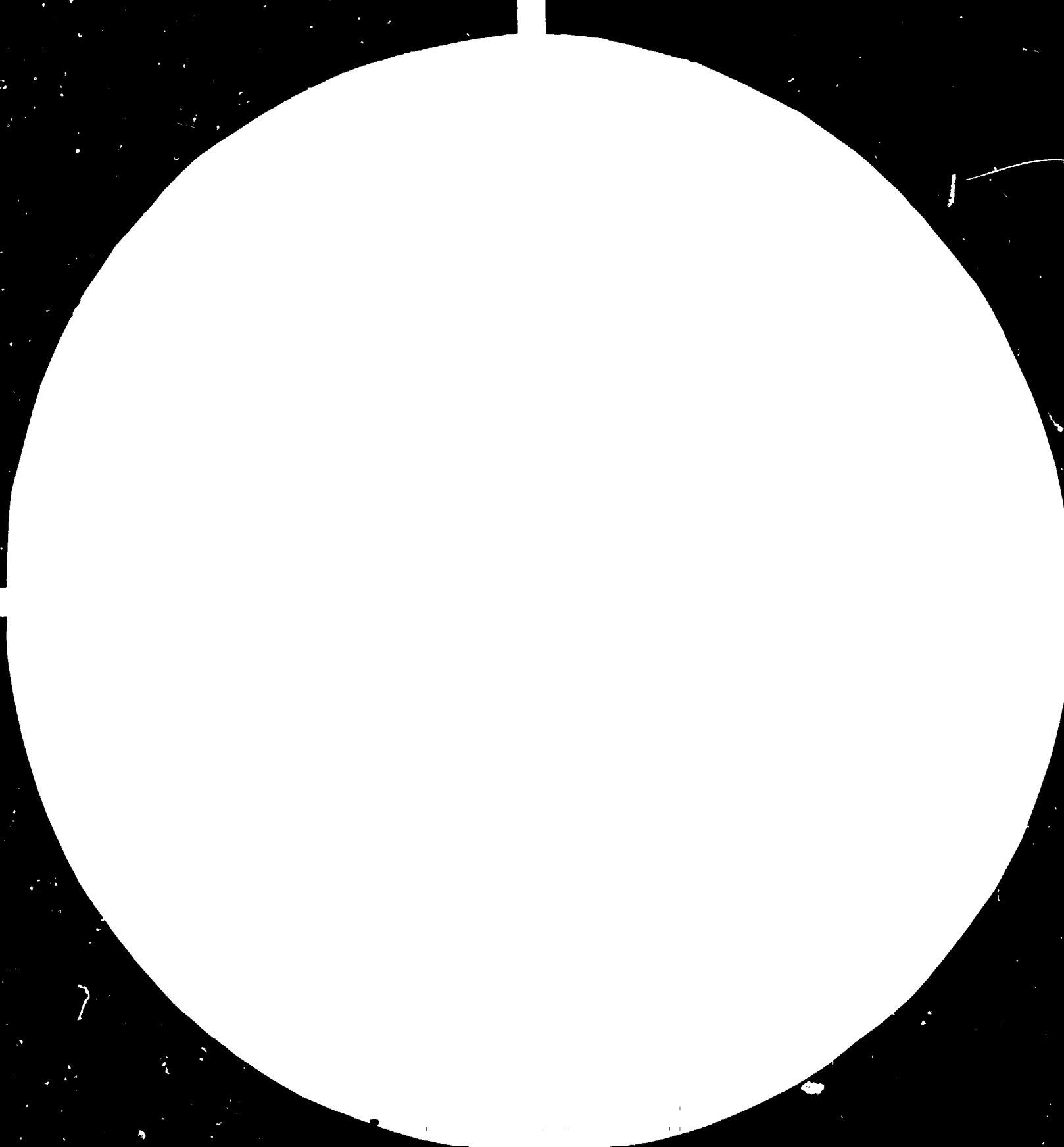
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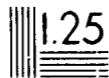
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Resolution test patterns are available from the National Bureau of Standards, Gaithersburg, MD 20899. The patterns are available in a variety of sizes and formats. For more information, contact the National Bureau of Standards, Gaithersburg, MD 20899.

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UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

Training Course on Timber Engineering
Auckland, New Zealand, 14-24 May 1984
UC/RAS/84/005

Mission report*

(Training course on
timber engineering).

prepared by

Agro-industries Branch
Division of Industrial Operations

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- 14 -

C O N T E N T S

	<u>Page</u>
1. Purpose of the Mission	1
2. Attendance	1
3. Participants	1
4. Programme	2
(a) Introductory Course	2
(b) Pacific Timber Engineering Conference - PTEC	7
5. Administration	10
6. Other matters	10
(a) Technical contacts	10
(b) New Zealand bilateral support	12
7. Acknowledgements	13
 <u>ANNEXES</u>	
1. List of countries invited and participants	15
2. Programmes	19
A. Introductory course	21
B. PTEC	
3. Executive Director's statement	28
4. A. Summary of participants, replies to evaluation form	33
B. Summary of opinions on conference papers	34
5. Opening remarks made on behalf of the Executive Director	43
6. UNIDO Secretariat paper No. 464 - PTEC Timber Engineering in Developing Countries	46
7. Recommendations for Timber Construction Development	54

1. PURPOSE OF THE MISSION

A staff member of the Agro-industries Branch of the Division of Industrial Operations, Robert M. Hallett, went to New Zealand to conduct the Training Course on Timber Engineering which was held in Auckland from 14 to 25 May 1984.

2. ATTENDANCE

UNIDO had planned for between 20 and 25 participants from the New Zealand aid countries plus 4 others (see Annex 1). Due to the wish to maintain as high a level of participants' qualifications as possible (in view of the high level of the Pacific Timber Engineer Conference - PTEC, which participants were to attend), the distribution of countries moved away from the Pacific Islands towards the Asian mainland countries. The effect was to increase the travel expenses and decrease the number of attendees.

The project was only approved at the last moment but in view of the preparations made in New Zealand and the fixed dates of the Conference, it was decided to go ahead with the course rather than cancel it. Unfortunately, several participants were not notified until a few days before the event and travel authorizations were received by some only a day or two in advance. One standby candidate from Malaysia was notified on 12 May and arrived on 15 May having missed only 2 days. Two accepted candidates (Indonesian) could not arrange travel formalities in time and their acceptance was rescinded.

All attended the full course except one (Fiji) who was ill on two occasions (1 day and a 1/2 day).

3. PARTICIPANTS

A total of 33 nominations were received before the course with sufficient information to be evaluated and action taken if accepted. A further 9 were nominated either by cable only or fully but too late for acceptance action. Several others had learned of the course and requested assistance in attending and 3 were actually sponsored by others to participate (one from each of Australia, New Zealand and Papua New Guinea).

Of those 33 able to be evaluated in time, 20 were recommended, 9 recommended with reservations, and 4 not recommended. There was an interesting mix of experience amongst the 21 participants since a few were recent engineering graduates with only 2 or 3 years with Public Works Departments whilst others had 20 or more years in building design and construction work in both the private and public sectors. Seven had institutional university backgrounds - 5 in forest products or materials research and 2 as professors of civil engineering and so benefitted from the Conference proceedings especially.

4. PROGRAMME

The programme was proposed by Wood-Inge (New Zealand) Advisory Services Ltd. and accepted with only a few changes by UNIDO. Wood-Inge then made all the local arrangements for lectures, lecturers and meeting facilities as well as for participation in the Pacific Timber Engineering Conference. The final programme is attached as Annex 2 - both for the introductory course and the PTEC plus additional events organized for the second week for the participants.

(a) Introductory course

The main aim of the introductory course was to show what the New Zealand industry and professional engineers had been able to accomplish by a co-ordinated, multi-faceted approach to getting timber construction accepted for domestic, individual and special purposes. It certainly succeeded in demonstrating this and showed that a solid base of standards and technology plus continual development and liaison between industry, specifiers/users and research institutes is necessary. The visits were particularly useful since they showed a great variety of buildings and structures either under construction or completed that used timber as the main material. The statement made at the opening on behalf of the Executive Director, Dr. Abd El-Rahman Khane, is included as Annex 3.

Although the New Zealand industry is justifiably proud of its success in manufacturing and using glulam beams, it was felt that this was over-emphasized since the technology is not readily suited to most tropical countries due to excessive humidity and heat and the difficulties of quality control.

Most participants seemed impressed by the developments seen and appreciated the efforts needed truly to integrate timber as a material into the mainstream of construction activities. The lack of experience in New Zealand with hardwoods in construction was, however, noted as an important failing.

The entire course was evaluated using the standard UNIDO form and the replies are summarized in Annex 4. In general, the course was too short and too tightly scheduled. An extra 2 or 3 days following the PTEC would have been most worthwhile to give participants a chance to digest what they had learned, to follow up specific aspects arising from discussions, visits and lectures, to make individual or small-group visits to particular sites or to do special research. Also, there were too many evening sessions and there was no time to reflect on points raised between lectures or to have informal discussions during the first week.

In other words, while appreciating the enthusiasm of the organizers in collating and presenting the great amount of material, the human side was neglected in the effort to get so much done.

The lecturers were all very qualified and experienced in their fields but some had clearly had little experience in presenting their material to people without a timber background. In particular, too much time was spent on introducing the New Zealand forest and forest-based industry situation, especially as this was repeated during the Conference as well. The historical summary was interesting but not very relevant.

The lecture on New Zealand organizations was well received and relevant since the need for this sort of institutional backup is usually neglected. On the other hand, the lecture on units was too elementary although done in a most interesting way.

The demonstration of materials testing at the Engineering Laboratory was useful and well illustrated the different failure modes of steel, concrete and timber. The lecture on mechanical properties which introduced various strength tests, stress grading and strength grouping principles and correction factors, and gave the background to assignment of allowable working stresses, was relevant, well presented and interesting.

Then followed a very good visit to manufacturers of scaffold boards, glulam beams and prefabricated building components (trussed rafters and wall panels) which illustrated as well a variety of simple and cheap buildings using poles and either glulam or trussed rafter roofing systems.

In the evening, the participants presented their country papers and generally were able to exchange experiences although more time could well have been allocated to this.

The presentation of basic design philosophy in New Zealand for timber structures was well presented and received, with a useful set of references and some cost estimates. This could have been expanded with more economic comparisons although the following introduction to design codes and standards provided a practical approach to problem solving. It became known that only 3 countries among those represented had standard design aids, span tables and charts ready prepared - Malaysia, Philippines and Thailand - and it was recognized that these are fundamental to applying the technology on anything but a limited scale.

The presentation on fire performance properties of timber was useful and the audio-visuals good. Many misconceptions are held with regard to this aspect and some were no doubt dispelled.

The field visits to show retaining walls and short driven pile foundations for domestic housing were most informative. Unfortunately time did not permit visits to see timber culverts but this was made up for by very good video films on culverts and water tanks and a visit arranged later for those especially interested in this subject. Also, lectures were given the next day. A good presentation of timber bridge construction was given but with too much on glulam beam use. The UNIDO prefabricated modular system was introduced then and described in greater detail by the author at a later evening session.

Agricultural shelters or windbreaks are a specialized New Zealand use of timber pole structures (to protect kiwi fruit from bruising by wind action) but although the lecture was excellent it was not very relevant.

Among the less commonly appreciated uses of wood may be counted water storage tanks and the two lecturers dealing with this subject gave a good presentation of the design procedures used for over 1,000 such tanks of 100 to 500 m³ capacity in New Zealand and showed excellent slides of a recent project.

Following this, a professionally done video film was shown on the driving of short pole piles for foundations using a variety of equipment and a lecture described the design and widespread use of retaining walls of timber (referring to "Retaining Wall Design Notes", Ministry of Works and Development, Civil Division, Government of New Zealand bookshop, CDP 702/C, July 1973).

Timber bridges were then dealt with and the UNIDO system costed out.

Further lectures covered simple shelters which take advantage of timber's cheapness and flexibility and showed design calculation examples with a lot of discussion on practical aspects that was obviously well received by participants. There followed 2 other lectures (a) on the use of plywood and ply-box beams in structures, emphasizing the need for quality control through all stages of manufacture and (b) giving a very detailed account of design economics using glulam beams based on an impressive amount of personal experience.

On the Saturday morning of the first week, a session was held on specifications and the need for explicit instructions to the supplier and to the building site which aroused considerable interest, ending with the advice to use simplified standard lists requiring "yes" or "no" answers to ensure clarity.

An interim evaluation was held which brought out comments from participants that the schedule was too crowded; that there was not enough on wind forces (since Auckland was not windy); that more should have been given on preservation; and, that the entire course should have been more directed at developing countries and hardwoods rather than "merely" showing what progress New Zealand had made. This presumably should have been clarified earlier!

This was followed by a review of the opinions of each "special interest group" (formed on Tuesday afternoon) which elicited that:

- (a) promotion aimed at politicians and administrators was necessary based on harmonized costing methods which showed whether (or not) timber could bring cost advantages. Mr. Angel Lazaro (Philippines) further noted that durability and serviceability were also key aspects to emphasize;
- (b) research should focus on the preservability and service aspect, especially for lesser-known species, and that stress grades, fire performance and glues deserved attention as well;
- (c) appropriate standards must be worked out and adopted, together with simplified codes;
- (d) standard designs and design aids should be produced and disseminated with the message that failure can be avoided; and
- (e) housing needed a "light framing code" similar to NZS 3604 (virtually a manual on carpentry) to help in mass production of components and reliable construction and on-site practices.

Also, more applications should be developed in countries now only making minimal use of timber in construction and costing should be on an international scale to help in the promotion effort.

The Conference programme was then introduced and participants urged to plan their attendance selectively and seek advice of the organizers in making best use of their time.

(b) Pacific Timber Engineering Conference (PTEC)

The conference was possibly the largest such held on this subject with over 300 delegates attending and was opened by the Minister of Forests with introductory remarks made by the four theme leaders, the organizers from the New Zealand Timber Design Society and also by Mr. Hallett on behalf of the Executive Director of UNIDO*.

The programme was extremely full and the proceedings were issued in 3 volumes which will be edited and reproduced. The UNIDO Secretariat presented a paper "Timber Engineering in Developing Countries" (No. 464) on Tuesday, 22 May afternoon, which is reproduced as Annex 6 of this report, but without the score or so of slides presented at the time.

To summarize this very complex conference with its three concurrent themes (I. Timber Construction; I. Timber Design Theory, and III. Wood Science) in this report would be outside its scope. However, from the point of view of the participants of UNIDO's course the following points should be noted.

(a) Those with specialized training in timber engineering and wood technology found the conference very useful for professional current awareness: and those without such formal timber experience certainly had their eyes opened to the degree of sophistication and level of development achieved in this field and to the potential of timber as a structural material. All could be said to have made good personal contacts with others in their fields

(b) There was an overemphasis, from their point of view, on the use of pine and glulam products which are not relevant to their own conditions. This point was made during the final session by Mr. Hallett who used the occasion to draw attention to the lack of

*This was unexpected and the statement was prepared in New Zealand and so was not cleared in advance. The text is shown as Annex 5.

developing countries on the key ISO Technical Committee 165 on the Strength of Timber; this despite the leading positions of such countries as Malaysia, Philippines, Indonesia, Thailand, and Brazil in international timber trade. This was intended also to counter the strongly held opinions and stated official positions of some key delegates to the effect that coniferous species and design procedures suitable for them should receive most attention and that the search for speedy, simplified procedures that would enable houses and other structures to be built more readily in developing countries was not appropriate.

(c) The key role of the Timber Design Society within the Institute of Professional Engineers of New Zealand (IPENZ) was evident to participants in working over the years on technical committees and in professional meetings to ensure that standards and codes relevant to timber construction were "properly" drafted to suit the timber industry and users alike, consistent with established engineering principles and accepted norms of public safety.

In this context, a statement was prepared by the group of participants, under the leadership of Mr. Angel Lazaro (Philippines) which was presented to the Conference at the final session following Mr. Hallett's statement described in (b) above. (See Annex 7.)

This statement also recommended a programme that could be followed by professional engineers working within their professional societies or institutes with the objective of co-operating between countries to introduce rational use of timber in construction. (Note: This approach was also recommended at the preceding year's "Timber Engineering Workshop" in Australia and an informal network was created between African and Latin American professionals interested in timber construction.)

Finally, during the PTEC, extra events were arranged for the participants of the UNIDO course. These were:

1. 23 May 1984 1800 - 1900 h: Group discussion on special interest topics, conclusions to be made and recommendations for the PTEC. This led to the statement referred to earlier and constituting Annex 7.
2. 24 May 1984 1000 - 1100 h: Special lecture and discussion on timber frame housing led by three industry representatives.
3. 24 May 1984 1600 - 1715 h: Lecture on practical aspects of timber preservation in developing countries by C. R. Francis (UNIDO expert). This reviewed the main treatment methods and presented in a clear and simple way the basic concepts of this complex and highly important subject. It was very well received in no small measure due to Mr. Francis' own wide experience in coping with very difficult conditions and "making do" with salvaged equipment to produce treatment facilities.

It also brought out the points that penetration of chemicals into the wood was of paramount importance; that a lot of research had been done on suitably durable species which should either be used or the product/timber should be kept off the ground; and that the CCA/Tanalith process was more flexible than creosoting. Furthermore, Mr. Hallett noted that a change in concept as to what constituted a structural species was needed, and that easily treated timbers, even though not very dense nor in the higher strength classes, were preferred to those heavier species that were difficult to treat or were unpredictable in their penetrability.

There was a special discussion session (24 May 1730 h) devoted to if, where and when a second PTEC should be held which was attended by the organizing committee and a selected group of conferees including Mr. Hallett who agreed to work informally with the planning group. Possible UNIDO involvement was mentioned, especially if the next PTEC were held in a developing country.

5. ADMINISTRATION

Administrative procedures followed those of previous such training courses but for this one arrangements were made very hurriedly to meet the deadline imposed by the fixed dates of the PTEC.

Mr. Hallett had arranged for the DSA money to be transferred to an account at the University of Auckland branch of the Bank of New Zealand and was able to make cash payments to the participants on the first day. Each was met at the airport by the local organizers "Wood-Inge" who handed over an explanatory package with welcoming letter and \$US 75 to start with.

Accommodation was somewhat spartan in the International House comprising student rooms with central cafeteria, lounge, etc., and there were some early complaints but there were no serious objections. It also allowed a saving of several thousand dollars since UNIDO paid the room and board directly and gave participants 30 per cent DSA for lunches and out-of-pocket expenses plus normal DSA for stopover and other travel days.

Since the local organizers "Wood-Inge" looked after local (bus) transport, registration at the PTEC and all lecturers - funded by the New Zealand Ministry for Foreign Affairs, this made UNIDO administration much simpler. In fact it could be said that there were 2 separate projects brought together to implement this event. For their part, "Wood-Inge" deserves full praise for the conscientious efforts put into making the course a success.

6. OTHER MATTERS

(a) Technical contacts

An important aspect of such training courses is that they afford the opportunity of making useful contacts with participants to learn of the situations and problems in their countries and to explain about UNIDO.

A brief note on each country follows:

Burma. Interested in diversifying species' use and in using timber within Government construction plans - especially the efficient management of projects.

China. The participant was able to spend a few weeks' extra time in New Zealand to learn at first hand the technology of fingerjointing, which was a new concept for him, at the Carter Holt factory visited during the course. It may be that China will set up a factory and request technical assistance from UNIDO and possible financial support from New Zealand as a joint venture. This was discussed in Wellington with Ms. F. M. C. Lee, Director, Department of Trade and Industry.

Fiji. Mr. Hallett travelled to Fiji on his return and a separate Note for the File was made dated 25 January 1985. (See also Back to Office Mission Report dated 7 June 1984.)

Malaysia. The main result was that Professor of Civil Engineering, V. Navaratnarajah, became interested in creating a timber engineering course at the University of Malaysia. Low-cost housing is also a priority and he was also interested in hosting a "National Timber Appreciation Seminar".

Papua New Guinea. Both participants were young civil engineers working for large international companies and the course appeared most worthwhile to broaden their experience.

Philippines. The 3 participants represented private engineering consultants, the National Housing Corporation and the Forest Products Research and Development Institute, and complemented their country's participation in the Australia 1983 course. Good groundwork has thus been laid to develop a longer-term technical assistance programme in timber construction in the Philippines which could include revision of the building code and supporting standards.

Sri Lanka. The participant occupies a key post in the State Engineering Corporation and is interested in making use of his experience in New Zealand especially in view of the project DP/SRL/79/053 on structural uses of rubberwood and coconut wood. The CTA, Mr. Francis, attended the PTEC and was able to make professional contact which had been virtually denied in Sri Lanka. Interested also in building codes and stress grading standards.

Thailand. Strongly represented by 4 engineers and, as with Burma, there is interest in diversifying species use and in hosting further conference or training events in Thailand.

Tonga. The Tonga participant was especially interested in timber framed housing and in general building and civil engineering design - emphasizing high wind problems.

(b) New Zealand bilateral support

The co-operation between the New Zealand Ministry of Foreign Affairs and UNIDO for this course was the first such in the wood industries sector. It is felt that others might follow owing to the particular experiences of New Zealand in light framing construction and timber engineering and its interest in technical assistance to the Asia and Pacific Region, especially the small island countries of the Pacific.

The conversion and use of coconut wood for building has been the subject of past assistance from New Zealand in support of the Zamboanga Research Centre in the Philippines which was recently the focus of a regional project involving UNIDO. Architectural drawings were produced for low to medium-cost houses using coconut wood almost entirely and these were used to build a prototype house in Davao. Further work on combining coconut wood with other timber species and introducing prefabrication is proceeding in Quezon Province. A regional training course was held in the Philippines in February 1985 to disseminate this technology.

UNIDO has further ideas on how to increase the proper use of timber in construction into countries of this region especially, notably, assistance to the professional engineering institutes to create "Timber Design Societies" or similar (as has been done in New Zealand within the IPENZ) and to hold a series of national "Timber Construction Appreciation Seminars" in countries of the region. Serious interest was shown by some participants in having their institutes host such events. This matter will be pursued with the appropriate people in the potential host countries and if sufficient real support develops, a project proposal will be presented.

The meetings held in Wellington between Mr. Hallett and officials of the Ministry for Foreign Affairs (External Aid Division), the Department of Trade and Industry, and the New Zealand Forest Service suggested that well-considered proposals in this field might be favourably received. Furthermore, Mr. Hallett visited the Timber Industry Training Centre, Rotorua, which has excellent facilities for training in sawmilling, wood machining and sawdoctoring and which has made special provisions for overseas trainees. The Colombo Plan has sponsored many such trainees and in late 1983 two trainees from Sri Lanka visited the TITC as part of their study tour from project funds. UNIDO should definitely bear these facilities in mind when drafting project documents in this sector, especially for this region.

7. Acknowledgements

The author wishes to thank the organizers of the New Zealand-funded part of the project - Messrs. David Willmott and Spencer Nichols and "ex-honoris" Mr. Alex Anderson (former UNIDO staff member now living in Auckland) for their dedicated efforts at making the course a success. Special thanks are also due to Mrs. Karen Willmott and Mrs. Julie Nichols for secretarial and logistic support before and throughout the event, including generous hospitality for the overseas visitors in their own homes.

UNIDO is also grateful to the lecturers who spent much time and effort in preparing and presenting their material for only nominal recompense and especially those who helped out by acting as guides for plant and site visits and as discussion leaders. Thanks are also directed to the timber and construction industry representatives who permitted the group to view their operations, without whose support the course would have had much less impact.

Finally, UNIDO very much appreciates the efforts of the members of the Timber Design Society of the IPENZ who constituted the organizing committee of the PTEC and who went out of their way to help the participants from the UNIDO course to benefit from the Conference.

The generosity of the New Zealand Ministry for Foreign Affairs in sponsoring the local costs is naturally much appreciated.

ANNEX 1

LIST OF COUNTRIES INVITED AND PARTICIPANTS

A. New Zealand bilateral aid recipients

Cook Islands
.iji
Kiribati
Niue
Papua New Guinea
Solomon Islands
Tonga
Tuvalu
Vanuatu
Western Samoa

B. ASEAN countries

Indonesia
Malaysia
Philippines
Thailand

C. Other countries

Burma
China P.R.
India
Sri Lanka

PARTICIPANTS

TIMBER ENGINEERING TRAINING COURSE AUCKLAND MAY 14th - 19th 1984

<u>COUNTRY/NAME.</u>	<u>TITLE, COMPANY OR DEPT.</u>	<u>ADDRESS, TELEX AND TELEPHONE</u>
<u>* AUSTRALIA</u>		
Ian <u>Conley</u>	Executive Officer (Technical)	126 William Street, Port MacQuarie, NSW 2444, Telex: AA63232. Ph: 065 857137.
<u>BURMA</u>		
U. <u>Thaung</u>	Executive Engineer Construction Unit (II)	Construction Corporation, Rangoon. Ph: 32395.
<u>CHINA P.R.</u>		
Zhai <u>Deming</u>	Engineer, Dept Science & Technology Ministry of Forestry.	Hepingli, Beijing. Ph: 463061 Ex: 397.
<u>FIJI</u>		
Sauriaki <u>Mitchell</u>	Architectural Co-ordinator.	Commercial Building Division, N.L.D.C., P O Box 2110, Suva. Telex: FJ 2319. Ph: 313477.
Ame U <u>Racule</u>	Engineer - Design.	Property Division, N.L.D.C. P O Box 2110, Suva. Telex: FJ 2319. Ph: 313477.
Suresh <u>Chandra</u>	Engineer (Structures).	Public Works Department, Ganilau House, Private Bag, Suva. Ph: 23260/315133. Ex: 207.
<u>MALAYSIA</u>		
V. <u>Navaratnarajah</u>	Prof. Civil Engineering, Head of Department, University of Malaya.	Dept. of Civil Engineering, University of Malaya, Kuala Lumpur 22-11. Telex: MAL. Ph: 553466.
Mohd <u>Shukari Midon</u>	Research Officer	Forest Research Institute, Kepong, Selangor.
<u>* NEW ZEALAND</u>		
Mark <u>Beaton</u>	Engineer's Assistant	Engineering Design Office, Dunedin City Council, P O Box 5045, Dunedin.

<u>COUNTRY/NAME</u>	<u>TITLE, COMPANY OR DEPT.</u>	<u>ADDRESS, TELEX AND TELEPHONE NOS.</u>
<u>PAPUA NEW GUINEA</u>		
Ian <u>Gapi</u>	Structural Engineer	Ove Arup & Partners Pacific, P O Box 1594, Port Moresby. Telex: OVAPART NE 23009. Ph: 214918/214933.
* Chris <u>Kobal</u>	Assistant Lecturer PNG University of Technology.	Private Mail Bag, UNITECH, Lae.
Gedisa <u>Zauya</u>	Engineer.	BECA GURE (PNG) Pty, Ltd., P O Box 1720, Boroko. Ph: 256059/256544.
<u>PHILIPPINES</u>		
Angel <u>Lazaro III</u>	President, Angel Lazaro & Associates, Cons. Architects & Engrs.	160 Panay Avenue, Quezon City.
Andres R. <u>Obias</u>	Developmental Management Officer.	Ministry of Human Settlements, National Housing Corporation, Taia, Caloocan City. Ph: 901636 to 39, 901008.
Joaquin <u>Siopongco</u>	Chief Science Research Specialist	Forest Products Research & Development Institute, FPRDI College, Laguna.
<u>SRI LANKA</u>		
Don Ravindra N. <u>Ferdinando</u>	Chief Engineer (Designs) Designs Section.	State Engineering Corporation of Sri Lank P O Box 194, Colombo 2. Telex: SECOL CE 22060. Ph: 34944.
<u>THAILAND</u>		
Chalat <u>Choeypunt</u>	Senior Laboratory Supervisor.	Asian Institute of Technology, P O Box 2754, Bangkok 10501.
Ekasit <u>Limsuwan</u>	Associate Professor, Civil Engineering Dept.	Civil Eng. Dept., Chulalongkorn University Bangkok 10500.
Phichai <u>Sethapanich</u>	Director of Construction Services.	National Housing Authority, Klongchan, Bangkok.
Suddhisakdi <u>Samrejprasong</u>	Head of Building Materials Laboratory, Thailand Inst. of Scientific & Technological Research	Thailand Institute of Scientific and Technological Research, 196 Phaholyothin Road, Bangkok Bangkok 10900.

COUNTRY/NAME TITLE, COMPANY OR DEPT. ADDRESS, TELEX AND TELEPHONE NOS.

TONGA

Sione Taumoepeau Deputy Director of Works Ministry of Works,
P O Box 52, Nukualofa.
Ph: 21-102

* Denotes self-supporting

COURSE ADMINISTRATION

Robert <u>Hallett</u>	Industrial Dev't Officer, Agro-Industries Branch Div. of Ind. Operations.	United Nations Industrial Dev't Organization Vienna International Centre. P O Box 300, A-1400 Vienna. Austria. Telex: 135612. Ph: 26 310
David <u>Willmott</u>	Director, Wood-Inge.	Wood-Inge, 51 Ridings Road, Auckland 5. New Zealand.
Spencer <u>Nicholls</u>	Director, Wood-Inge.	Telex: 60570 Kenhayn/Trans for Wood-Inge. Telephone: N.Z.(09)542724
Alec <u>Anderson</u>	Associate, Wood-Inge.	
Karleena <u>Mitchell</u>	Assistant Manager	

ANNEX 2
PROGRAMMES

A. Introductory Course

COURSE DESCRIPTION

1. Lecture content

Introduction:

- History of New Zealand's Timber Engineering Industry (Ships spars to the present)
- The modern material; properties, stresses, durability and traditional use, preservation.

Design Basics:

- Units, terminology
- local design philosophies - earthquakes
- local timber availability
- Economics - timber and alternative design materials
- Specialist properties, eg fire resistance.

Regulatory Infrastructure:

- NZ Loading Codes - wind, earthquake and fire
- NZ Timber Design and Light Framing Codes
- NZ Specialist Codes, eg plywood, laminating treatments etc.
- The roles of SANZ, BRANZ, THADA, NZFS, NZFI (ROTOKUA) and major industrial groups/

Local Timber Usage Generally:

- Commercial & industrial structures:
 - Beam & column construction
 - Warehouses, factories
 - Schools, halls, stadia
 - Aircraft hangers, barns
 - Plywood applications
- Civil Structures:
 - Culverts
 - Reservoirs
 - Bridges, retaining walls
 - Marine piling, breakwaters, docks
 - Sundry - power poles, guardrails etc.
- Domestic housing:
 - Roof trusses
 - Pole foundations & framing
 - Reconstituted boards.
- Agriculture & horticulture:
 - Vine support, fencing
 - Windbreaks

Special features

- (jointing framing systems)
- (lamination, portal knees)
- (bracing)
- (glues, nailing)
- (shaping)
- (waterproofing)
- (preservation)
- (nail plates)
- (bolting)

2. Technical visits (afternoons; Friday optional)

Factories and Plants

- Finger Jointing and Laminating
- Timber preservation
- Precutting & Pre-nailing kitset buildings
- Gangnelled truss manufacturing

Civil Structures:

- Culverts, crippwalls, polewalls
- Water reservoirs.
- Marine structures.
- Highway furniture.

Buildings:

- B.J. Bell complex - Penrose - plywood use.
- Exotic Timber Warehouse, Tameki - unique framing
- Assorted churches & assembly halls - portals, plated joint systems.
- Domestic housing - new estate under construction.

Education Institutions:

- Auckland University Engineering School. (Laboratory testing of timber samples and connections to destruction)

3. Workshops and Seminars (evenings)

- Full design (local) costing and specification procedure for:
 - Culverts.
 - Walls
 - Standard bridges
 - Reservoirs
 - Simple shelters
 - Barge building
- Discussion groups report on regional practice
- Technical films.

4. Social and optional time

- Wednesday evening free
- Friday afternoon optional technical visit or free
- Saturday afternoon and evening, and all Sunday optional hosting by Members of Auckland Branch IPENZ or free.

INTRODUCTION TO TIMBER ENGINEERING IN N.Z.

TRAINING COURSE PROGRAMME

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
8.45 - 10.30	Welcome and introduction to course & lecturers, to each other, to accommodate.	Wood properties, stresses, durability, local timber availability, visual & m/c grading Comparisons of NZ and Asian woods	A.Z. Design philosophy, local economics, Timber treatments, Design Codes.	Design Exercise (1) - culverts - crib walls - reservoirs	Design Exercise (3) Simple shelter structures - poles, trusses, laminated beams	Specifications Introduction to PTIC Conference, Questions
	Willmott, Willmott & Nicholls History of A.Z. wood industry. Ships spare to present McClashin	Dr. Walford	Nicholls	Willmott & Jordan	Nicholls	Nicholls, Willmott & Simperingham
10.45 - 11.10	NZ Timber industry. SANZ, infrastructure. SANZ, BRANZ, TRADA, SETHA etc. Percentage GNP spending on building & research. NZ forestry groups.	Timber Engineering terminology & symbols. The ISO System of Units	Design Codes Control. Timber fire resistance	Design Exercise (2) - pole walls - driven piles - standard bridges	Design Exercise (4) A timber building - frames, nailed or glued joints	Concluding speakers. UNIDO - Mr & Mallett MFA - N.Z. Industry -
	Willmott	Willmott	Simperingham	Lapsley & Billings	Gibson	END OF FORNIAL PROCEEDINGS
2.00 - 3.00	Lunch	Lunch	Lunch	Lunch	Lunch	
	University timber lab - materials & sample testing. Programme review - Form groups to plan presentation of reports	Field visit - laminating plant, housing product plant, industrial kiln building plant	Field visit - retaining walls, culverts & reservoirs. finger jointing plant, treatment plant	Field visit - major timber buildings, office block (laminated), paper factory (ply-wood), church (laminated arches)	Field visit - general fastenings plant. Truss making plant.	FREE - or visits to local houses or Auckland region timber or furniture plant or Sporting fixtures
	Dr Bryant, Nicholls & Willmott	Simperingham et al				
	Dinner	Dinner	Dinner	Dinner	Dinner	END OF COURSE FUNCTION
7.00 - 9.00	Slices & film of Local timber usage UNIDO Policy-eye Timber Bridge Supper Speakers present	Registrants own local practise reports Supper Speakers present	Free, city visits or harbour outing available. -----	Design Exercise 1 & 2 - tutorials Supper Willmott, Lapsley, Gibson & Nicholls	Design Exercise 3 & 4 - tutorials Supper Willmott, Lapsley, Gibson & Nicholls	Disperses

B. Pacific Timber Engineering Conference May 1984 PROGRAMME SUMMARY

Notes:

- (i) This summary is intended to show the programme outline only and is liable to change.
- (ii) The detailed programme with topics by principal guest speakers will be sent to Conference Registrants.
- (iii) Topics are of 1½ hour duration each and will be concurrent in separate lecture theatres.

The Three Themes of the Conference are:

- TI : Building in Timber
- TII : Timber Design
- TIII: Wood Science

DAY 1: Monday 21 May

- 9.00am Registrations
- 10.00am Morning recess
- 10.30am Opening by Minister of Forests Hon. J Elworthy. Introduction to four principal guest speakers, Prof. Hans Larsen, Denmark; Prof. Borg Madsen, Canada; Dr R.H. Leicester, Australia; Prof. Hideo Sugiyama, Japan.
- 12.30pm Luncheon recess
- 2.00pm TI : Review of Timber in World Countries
TI : Use of Timber in Houses
- 3.30pm Afternoon recess
- 4.00pm TI : Application of Timber in Industry
TI : Timber Economics
- 5.30pm End of Session
... Cocktails & Buffet Dinner

DAY 2: Tuesday 22 May

- 9.00am TIII : Wood Diaphragms
TIII : Multistorey Timber Use
TI : Timber in Light Framing
- 10.30am Morning recess
- 11.00am TII : Timber Retaining Walls
TIII: Sheet Diaphragms
- 12.30pm Luncheon recess
- 2.00pm TI : Timber In Agricultural & Horticultural Use
TII : Timber Fasteners
TI : Timber Use In S.E. Asia
- 3.30pm Afternoon recess
- 4.00pm TI/II: Domes, Shells & Prefabricated Panel Use
TI : Surface Coatings For Timber
- 5.30pm End of Session
... ICI/SETMA Design Award Cocktails & Presentation

DAY 3: Wednesday 23 May

- 9.00am TII : Glue-Laminated Timber
TII : Plywood Gussets
TI : Timber Quality
- 10.30am Morning recess
- 11.00am TI : Pole Usage
TII : Timber Fasteners
TII : Timber & Fire
- 12.30pm Luncheon recess
- 2.00pm TII : Floor & Ceiling Diaphragms
TII : Timber & Earthquakes
TII : Wood Stave Structures
- 3.30pm Afternoon recess
- 4.00pm TII/III: Wind Effects
TII : Timber & Seismic Effects
TI : Timber Usage In Industrial Buildings
- 5.30pm End of session
... Social hour with cocktails

DAY 4: Thursday 24 May

- 9.00am TIII : Timber Design Codes
TI : Wood Supply
TII : Plywood Design
- 10.30am Morning recess
- 11.00am TIII: Load/Time Effects
TII : Timber Design Workshop
TI : Timber & Fire
- 12.30pm Luncheon recess
- 2.00pm TIII: Grading Systems
TII : Timber Design Workshop
- 3.30pm Afternoon recess
- 4.00pm TIII: Derive Stresses from Grading Systems
TI : Adhesives for Timber
- 5.30pm End of session
... Formal dinner at Hyatt Kingsgate Hotel.

DAY 5: Friday 25 May

- 9.00am TIII: Moisture & Load Duration Effects
TI : Timber Quality
- 10.30am Morning recess
- 11.00am TIII: Moisture & Load Duration Effects
TIII: Shear in Timber
- 12.30pm Luncheon recess
- 2.00pm TIII: Cyclic Loading on Timber
TII : Plywood Shear Strength
- 3.30pm Afternoon recess
- 4.00pm TII : Plywood Shear Walls
TI : Preservation of Timber
- 5.30pm End of session

This Conference is Sponsored by:

- Carter Holt Ltd, Box 8532, Auckland 1.
- Fletcher Challenge Ltd, Private Bag, Auckland 1.
- NZ Forest Products, Ltd, Private Bag, Auckland 1.

- Odins Ltd, Box 3748, Wellington.
- NZ Forest Service, Private Bag, Rotorua.
- The NZ Timber Industry Federation Inc., Box 12017, Wellington.

TECHNICAL PROGRAMME *

MONDAY, 21ST MAY - MORNING SESSION

MONDAY, 21ST MAY - AFTERNOON SESSION

9.00 - 10.00

10.30 - 12.30

2.00 - 3.30

4.00 - 5.10

Registrations	<p>AT THE MAIDMENT THEATRE</p> <p>Welcome address by President of N.Z. Timber Design Society Dr G.B. Walford</p> <p><u>OPENING</u> by Minister of Forests, The Hon. J. Elworthy Ref: Paper 182</p> <p>Introduction to four principal guest speakers: Prof. Hideo Sugiyama, Japan Dr R.H. Leicester, Australia Prof. H.J. Larsen, Denmark Prof. Borg Madsen, Canada</p> <p>Greeting from Executive Director of U.N.T.D.O. per Mr R.M. Hallett</p> <p>Mr P. Simperingham Ref: Paper 172C "NEW ZEALAND TIMBER REVIEW"</p> <p>Prof. H. Sugiyama Ref: Paper 052A "HEAVY TIMBER CONSTRUCTION IN JAPAN"</p>		<p>GROUP I Timber Construction</p>	<p>Mr R.F. Gale Ref: Paper 085B "GANG-MAIL APPLICATIONS"</p> <p>Mr G.J. Cooper Ref: Paper 021 "MAY THE FORCE BE WITH YOU"</p> <p>Mr P.A. Campbell Ref: Paper 107 "SPECIFICATION OF TIMBER FOR LARGE TRUSSES AND SIMILAR STRUCTURES"</p>	<p>Ir Van der Put, T.A.C.M. Ref: Paper 111A "DISCUSSION ON THE DESIGN OF MAIL PLATE CONNECTIONS"</p> <p>Prof. V. Kulbach/K. Oiger Ref: Paper 198 "WOODEN SHELLS IN ESTONIAN SSH"</p> <p>Mr J. Rich Ref: Paper 150B "J. RICH DOME SYSTEMS"</p> <p>Mr E.O. Willson Ref: Paper 158B "THE YMCA GYMNASIUM, TOKOROA"</p>
	<p>Introduction to four principal guest speakers: Prof. Hideo Sugiyama, Japan Dr R.H. Leicester, Australia Prof. H.J. Larsen, Denmark Prof. Borg Madsen, Canada</p> <p>Greeting from Executive Director of U.N.T.D.O. per Mr R.M. Hallett</p> <p>Mr P. Simperingham Ref: Paper 172C "NEW ZEALAND TIMBER REVIEW"</p> <p>Prof. H. Sugiyama Ref: Paper 052A "HEAVY TIMBER CONSTRUCTION IN JAPAN"</p>		<p>GROUP II Timber Design Theory</p>	<p>Prof. H.J. Larsen Ref: Paper 159C "AN OVERVIEW OF TIMBER CONSTRUCTION IN EUROPE"</p> <p>Mr Idris/Mr Sukirah Ref: Paper 137 "THE PROSPECT OF TIMBER CONSTRUCTION IN INDONESIA"</p> <p>Mr D.B. Willmott Ref: Paper 147 "THE POTENTIAL FOR TIMBER ENGINEERING IN THE EAST ASIA AND PACIFIC AREA"</p>	<p>Mr Fang Fu Ref: Paper 060 "HISTORICAL TIMBER STRUCTURES IN CHINA, AND THEIR CONSERVATION"</p> <p>Mr R.S. Beckett Ref: Paper 117 "TIMBER ENGINEERING IN ZIMBABWE AND S.A.D.C.C. REGIONS"</p> <p>Mr J.S.F. Nicholls Ref: Paper 080 "A SUGGESTED METHOD TO ASSESS POTENTIAL SAMM TIMBER USE IN N.Z. OR ASIAN COUNTRIES"</p>

* Some changes were made in the order of presentation and a few pages were substituted but the final actual programme had not been received before reproducing this report.

TUESDAY, 22ND MAY - MORNING SESSION

TUESDAY, 22ND MAY - AFTERNOON SESSION

9.00 - 10.30		11.00 - 12.30		2.00 - 3.30		4.00 - 5.30	
GROUP I Timber Construction	<p>Dr S. Samuelsson Ref: Paper 207 "THE STRUCTURAL USE OF WOOD-BASED PANELS IN BUILDING COMPONENTS"</p> <p>Mr G.J. Cavenagh Ref: Paper 180A "STRUCTURAL PANELS - DEVELOPMENT AND TRANSITION IN NORTH AMERICA"</p> <p>Mr M.M. Hughes Ref: Paper 140 "PARTICLEBOARD FOR COMMERCIAL AND INDUSTRIAL FLOORING SYSTEMS"</p>	<p>Mr D.P. Hanley/R.H. Thomas Ref: Paper 096 "PLATE BEHAVIOUR OF PLYWOOD AND PARTICLEBOARD"</p> <p>Mr A.M. Pidgeon Ref: Paper 163 "FIBROUS PLASTER ON TIMBER STUDS AS DIAPHRAGMS"</p> <p>Mr P. Hill Ref: Paper 152B "LAMINATED TIMBER FLOOR AND CEILING PANELS - DESIGN, MANUFACTURING AND INSTALLATION"</p>	<p>GROUP I</p>	<p>Mr R.M. Halliell Ref: Paper 464 "TIMBER STRUCTURES IN DEVELOPING COUNTRIES"</p> <p>Mr C.R. Francis Ref: Paper 330 "THE U.M.I.D.O. TIMBER BRIDGE"</p> <p>Dr G.W.J. Van Rensburg/ Mr C. Cillie/Mr M. Ebersohn Ref: Paper 208 "STEEL REINFORCED TIMBER STRUCTURAL ELEMENTS"</p>	<p>Mr F. Naulta Ref: Paper 183 "M.Z. FOREY SERVICE TIMBER BRIDGES"</p> <p>Mr P. Geay Ref: Paper 203 "DESIGN ASPECTS OF THE MOUNT WELINGTON BOROUGH COUNCIL FOOTBRIDGE"</p> <p>Mr G.A.J. Szakats/Mr G.W. Butcher Ref: Paper 099 "40M GLULAM HIGHWAY BRIDGE"</p>		
GROUP II Timber Design Theory	<p>Prof. H. Sugiyama Ref: Paper 052B "JAPANESE EXPERIENCE AND RESEARCH ON TIMBER BUILDINGS IN EARTHQUAKES"</p> <p>Mr R.L. Williams Ref: Paper 170 "DESIGN OF TIMBER STRUCTURES TO RESIST HIGH WINDS AND EARTHQUAKES - STATE OF THE ART SUMMARY"</p>	<p>Prof. S.S. Rinal Ref: Paper 222 "BEHAVIOUR OF TIMBER BUILDING STRUCTURES DURING COLLINGA EARTHQUAKE 1983"</p> <p>Prof. I. Sakamoto/Y. Onishi/ M. Shibata Ref: Paper 204 "THEORETICAL ANALYSIS OF SEISMIC RESPONSES OF WOODEN DWELLINGS IN JAPAN"</p> <p>Mr A. Buchanan Ref: Paper 115A "WOOD PROPERTIES AND SEISMIC DESIGN OF TIMBER STRUCTURES"</p>	<p>GROUP II</p>	<p>Mr C.K. Cheung/Prof. R.Y. Tsant Ref: Paper 112 "DAMPING CHARACTERISTICS OF SHEATHED WOOD DIAPHRAGMS"</p> <p>Mr G. James/A.H. Bryant Ref: Paper 092 "PLYWOOD DIAPHRAGMS AND SHEAR WALLS"</p> <p>Mr M. Stewart/Dr J.A. Dean/ Dr A.J. Carr Ref: Paper 194 "THE SEISMIC PERFORMANCE OF PLYWOOD SHEATHED SHEARWALLS"</p>	<p>Mr S.J. Thurston/D.L. Hutchinson Ref: Paper 041 "CYCLIC-LOAD TESTING TIMBER-SHEATHED WALL PANELS"</p> <p>Mr D.R. Griffiths Ref: Paper 093 "DETERMINING THE RACKING RESISTANCE OF TIMBER FRAMED WALLS"</p> <p>Dr J.A. Dean/M. Stewart Ref: Paper 148 "A DESIGN PROCEDURE FOR RECTANGULAR OPENINGS IN SHEAR WALLS AND DIAPHRAGMS"</p>		

WEDNESDAY, 23RD MAY - MORNING SESSION

WEDNESDAY, 23RD MAY - AFTERNOON SESSION

9.00 - 10.30

11.00 - 12.30

2.00 - 3.30

4.00 - 5.30

	9.00 - 10.30	11.00 - 12.30		2.00 - 3.30	4.00 - 5.30
GROUP I Timber Construction	<p>Mr J.A. Gibson Ref: Paper 224 "TIMBER MOMENT FRAMES AND THEIR USE"</p> <p>Mr A. Loughnan Ref: Paper 173 "TIMBER: BUILDING SYSTEM - ITS DESIGN AND APPLICATION"</p> <p>Mr G. Dainty Ref: Paper 164 "TIMBER BUILDINGS USING SOLID TIMBER, GLULAM, AND PLY-WEB BEAMS"</p>	<p>Mr E. Willson/E. Phythian Ref: Paper 158A "DESIGN AND CONSTRUCTION OF THE KINLEITH DRY DRUM BUILDING"</p> <p>Mr C.N. Grove Ref: Paper 109 "THE USE OF STRUCTURAL TIMBER IN THE FERTILIZER AND RELATED INDUSTRIES"</p> <p>Mr A.B. King/Dr J. Webster Ref: Paper 004 "A SAMOAN FALE USING GLULAM ARCHES"</p> <p>Mr J.C. Reelick Ref: Paper 154 "HOLD-DOWN SYSTEMS FOR TIMBER BUILDINGS"</p>	GROUP I	<p>Mr P.C. Smith Ref: Paper 169 "DESIGN OF LOW-RISE BUILDINGS IN HEAVY TIMBER CONSTRUCTION"</p> <p>Dr D. Plackett Ref: Paper 337 "EXTERIOR SURFACE COATINGS ON TIMBER"</p>	<p>Mr B.C. Carter Ref: Paper 177 "DESIGN AND ITS EFFECTS ON THE MANUFACTURE AND ERECTION OF ENGINEERED TIMBER COMMENTS"</p> <p>Mr P. Simperingham Ref: Paper 172A "DESIGN ECONOMICS USING TIMBER"</p> <p>Mr E.D. Willson Ref: Paper 158U "DESIGN DECISIONS BASED ON ECONOMICS"</p>
GROUP II Timber Design Theory	<p>Mr C.G. McDowell Ref: Paper 110 "QUALITATIVE ASSESSMENT OF WHOLE HOUSE STRUCTURAL RESPONSE TO LATERAL WIND LOADS"</p> <p>Mr G.W. Broughton/G.F. Reardon Ref: Paper 143 "SIMULATED CYCLONE WIND TESTS ON A TIMBER-FRAMED HOUSE"</p>	<p>Mr T.S. Tarpy Jnr Ref: Paper 103 "CONTINUOUS TIMBER DIAPHRAGMS"</p> <p>Dr G.R. Walker/Mr D. Gonano Ref: Paper 114 "INVESTIGATION OF DIAPHRAGM ACTION OF CEILINGS UNDER LATERAL LOAD"</p>	GROUP II		<p>Mr Marley Ref: Paper 234 "DEVELOPMENT OF MEDIUM-RISE MULTI-PURPOSE TIMBER FRAMES FOR SIMULATED STRUCTURAL PERFORMANCE"</p> <p>Mr P. Moss Ref: Paper 230B "SEISMIC RESPONSE OF MULTI-STORIED FRAME HAVING MOMENT-RESISTING JOINTS"</p> <p>Mr Peter Moss Ref: Paper 230C "TORSIONAL RESPONSE OF LOW-RISE TIMBER STRUCTURES TO SEISMIC LOADING"</p>
GROUP III Wood Science	<p>Mr I.D. Whiteside Ref: Paper 336 "REVIEW OF FUTURE N.Z. WOOD SUPPLY AND QUALITY"</p> <p>Mr B. Allison Ref: Paper 178 "REVIEW OF FUTURE WOOD SUPPLY AND QUALITY - A PRIVATE COMPANY PERSPECTIVE"</p> <p>Mr A.G. Coppens Ref: Paper 073 "WOOD SCIENCE AND FORESTRY IN THE WORLD'S SOUTHERNMOST PLANTATION"</p>	<p>Prof. H. Sugiyama Ref: Paper 052C "AN OVERSEAS ASSESSMENT OF P. RADIATA FOR STRUCTURAL APPLICATIONS"</p> <p>Dr R.H. Leicester Ref: Paper 145A "STRUCTURAL GRADING SYSTEMS"</p> <p>Dr P.J. Pellicane Ref: Paper 221 "SIMULATION OF THE PROBABILITY DISTRIBUTION OF WOOD PROPERTIES"</p>	GROUP III	<p>Mr H. Bier Ref: Paper 333 "DERIVATION OF TIMBER DESIGN STRESSES IN N.Z."</p> <p>Dr R.H. Leicester Ref: Paper 145B "PROOF GRADING"</p> <p>Dr G.B. Walford Ref: Paper 031A "IN-GRADE STRENGTH OF RADIATA PINE"</p>	<p>Mr J.D. Hutchison Ref: Paper 179U "GRADING TIMBER FOR SPECIFIC APPLICATIONS"</p> <p>Prof. B. Madsen Ref: Paper 144B "MOISTURE CONTENT" EFFECTS IN TIMBER"</p> <p>Mr J.D. Barrett Ref: Paper 106 "MODELLING MOISTURE CONTENT EFFECTS FOR DIMENSION TIMBER"</p>

THURSDAY, 24TH MAY - MORNING SESSION

9.00 - 10.30

11.00 - 12.30

THURSDAY, 24TH MAY - AFTERNOON SESSION

2.00 - 3.30

4.00 - 5.30

THURSDAY, 24TH MAY - MORNING SESSION		THURSDAY, 24TH MAY - AFTERNOON SESSION				
9.00 - 10.30		11.00 - 12.30				
GROUP I Timber Construction	Dr M.E. Hedley Ref: Paper 374 "LONG TERM FIELD AND SERVICE PERFORMANCE OF TREATED EXOTIC SPECIES"	Mr E. Lapsch Ref: Paper 149 "RETAINING WALLS IN TIMBER-HEIGHT RANGE 1-2M TO 3-6M"	GROUP I	Mr Clark/Mulligan Ref: Paper 232 "USE OF P. RADIATA IN FOUNDATION RECONSTRUCTION OF GOVERNMENT BUILDING"	Mr R.C. Hansen Ref: Paper 155 "SENTON SAHM HOUSE POLES"	
	Mr T.C. Chiddle/Ms J.M. Taylor Ref: Paper 223 "L.O.S.P. PRESERVATION OF BUILDING TIMBERS"	Dr D.V. Town Ref: Paper 161 "LOADING UPON AND DESIGN OF TIMBER RETAINING WALLS"		Prof. E.L. Ellis/Dr J.C.F. Walker Ref: Paper 088 "RESIDENTIAL POLE HOUSING"	Mr C. La Grouw Ref: Paper 146 "LOCKWOOD HOMES"	Dr Hans Fox T. Ref: Paper 059 "WOOD HOUSING IN CHILE"
	Mr M. McLean Ref: Paper 329 "TIMBER PRESERVATION QUALITY CONTROL AS AN AID TO MARKETING"	Mr M.W.B. Jordan/R.J.W. Granwal Ref: Paper 174 "TIMBER STAVE TANKS FOR ABOVE GROUND WATER STORAGE"		Mr L.N. Megget Ref: Paper 196 "DESIGN AND CONSTRUCTION OF POLE HOUSES IN THE WELLINGTON AREA"	Dr A.K. Sherma/A. Joseph Ref: Paper 167 "PHYSICAL EXAMINATION AND EVALUATION OF RESIDENTIAL AND LIGHT TIMBER BUILDINGS"	
	Mr R. Anderson Ref: Paper 160 "DESIGN OF WOOD-STAVE CULVERTS"	Mr P. Stimperingham Ref: Paper 1728 "WOOD-STAVE RESERVOIRS"		Dr G. Tonks Ref: Paper 328 "ECONOMIC MULTI-STOREY TIMBER BUILDING USING POLES AND DIAPHRAGMS"		
GROUP II Timber Design Theory	Prof. H.J. Larsen Ref: Paper 159B "INSTABILITY OF COLUMNS AND BEAMS"	Dr A. Buchanan Ref: Paper 115B "DESIGN OF SAWN TIMBER MEMBERS FOR COMBINED BENDING AND AXIAL LOADING"	GROUP II	Mr R.D. Hunt/A.M. Bryant Ref: Paper 091 "NAIL JOINTS FOR TIMBER STRUCTURES"	Mr Kohel Komatsu Ref: Paper 265 "DESIGN OF CROSS-LAPPED GLUED JOINTS FOR GLULAM PORTAL FRAMES"	
	Mr S.K. Malhotra Ref: Paper 219B "ANALYSIS AND DESIGN OF SOLID AND BUILT-UP TIMBER COMPRESSION MEMBERS"	Mr C.R. Hellawell Ref: Paper 192 "THE SHEAR PROPERTIES OF SOME RADIATA PINE PLYWOODS"		Dr P.G. Lowe/M.R. Edwards Ref: Paper 227 "ASPECTS OF DUCTILITY IN NAILED TIMBER CONNECTIONS"	Mr M. Batchelar Ref: Paper 185B "IMPROVED PLYWOOD GUSSET JOINTS FOR TIMBER PORTAL FRAMES"	Mr J. Rich Ref: Paper 150A "STRUCTURAL PLYWOOD DESIGN"
	Dr R.H. Leicester Ref: Paper 145C "ULTIMATE STRENGTH OF PLYWOOD WEBS"			Mr M. Batchelar/G. Cavanagh Ref: Paper 185A "NAILED PLYWOOD GUSSET JOINTS FOR TIMBER PORTAL FRAMES"		
GROUP III Wood Science		Mr I. Feder Ref: Paper 335 "BOND DURABILITY AND ITS IMPLICATIONS FOR NEW ADHESIVES FOR WOOD"	GROUP III	Prof. B. Madsen Ref: Paper 144C "DURATION OF LOAD"	Mrs A. Ellison/Prof. R. Saunders/ Dr A. Tang Kai Ref: Paper 216 "STUDIES ON HYSTERESIS PROPERTIES IN TRINIDADIAN TIMBER"	
		Prof. V. Navaratnarajah Ref: Paper 189 "PERFORMANCE OF MECHANICAL AND GLUED CONNECTIONS WITH MALAYSIAN KERVING"		Mr B.J. McDowall Ref: Paper 171 "DURATION OF LOAD - A FRACTURE MECHANICS APPROACH TESTED EXPERIMENTALLY"	Prof. dr eng D. Maruscaac Ref: Paper 200C "COMMENTS ON BEHAVIOUR OF GLULAM BEAMS SUBJECT TO REPEATED STATIC LOADS"	
		Mr R. Kling Ref: Paper 225 "RADIO FREQUENCY CURING OF FINGER-JOINTS AND GLULAM BEAMS"			Dr A. Buchanan Ref: Paper 115C "EFFECT OF MEMBER SIZE ON THE STRENGTH OF TIMBER"	
	Mr P. Hill Ref: Paper 152A "QUALITY CONTROL OF GLULAM TIMBER MANUFACTURE"					

THURSDAY, 24TH MAY - MORNING SESSION

THURSDAY, 24TH MAY - AFTERNOON SESSION

	9.00 - 10.30	11.00 - 12.30		2.00 - 3.30	4.00 - 5.30
GROUP I Timber Construction	<p>Dr M.E. Hedley Ref: Paper 374 "LONG TERM FIELD AND SERVICE PERFORMANCE OF TREATED EXOTIC SPECIES"</p> <p>Mr T.C. Chiddle/Ms J.M. Taylor Ref: Paper 223 "L.O.S.P. PRESERVATION OF BUILDING TIMBERS"</p> <p>Mr M. McLean Ref: Paper 329 "TIMBER PRESERVATION QUALITY CONTROL AS AN AID TO MARKETING"</p> <p>Mr R. Anderson Ref: Paper 160 "DESIGN OF WOOD-STAVE CULVERTS"</p>	<p>Mr E. Lapiush Ref: Paper 149 "RETAINING WALLS IN TIMBER-HEIGHT RANGE 1-2M TO 3-6M"</p> <p>Dr D.V. Toan Ref: Paper 161 "LOADING UPON AND DESIGN OF TIMBER RETAINING WALLS"</p> <p>Mr M.W.B. Jordan/R.J.M. Granwal Ref: Paper 174 "TIMBER STAVE TANKS FOR ABOVE GROUND WATER STORAGE"</p> <p>Mr P. Simperingham Ref: Paper 172B "WOOD-STAVE RESERVOIRS"</p>	GROUP I	<p>Mr Clark/Mulligan Ref: Paper 232 "USE OF P. RADIATA IN FOUNDATION RECONSTRUCTION OF GOVERNMENT BUILDING"</p> <p>Prof. E.L. Ellis/Dr J.C.F. Walker Ref: Paper 088 "RESIDENTIAL POLE HOUSING"</p> <p>Mr L.M. Meggat Ref: Paper 196 "DESIGN AND CONSTRUCTION OF POLE HOUSES IN THE WELLINGTON AREA"</p> <p>Dr G. Tonks Ref: Paper 328 "ECONOMIC MULTI-STORY TIMBER BUILDING USING POLES AND DIAPHRAGMS"</p>	<p>Mr B.C. Hansen Ref: Paper 155 "SENTON SAWN HOUSE POLES"</p> <p>Mr C. La Groux Ref: Paper 146 "LOCKWOOD HOMES"</p> <p>Dr Hans Fox T. Ref: Paper 059 "WOOD HOUSING IN CHILE"</p> <p>Dr A.K. Sherma/A. Joseph Ref: Paper 167 "PHYSICAL EXAMINATION AND EVALUATION OF RESIDENTIAL AND LIGHT TIMBER BUILDINGS"</p>
GROUP II Timber Design Theory	<p>Prof. H.J. Larsen Ref: Paper 159B "INSTABILITY OF COLUMNS AND BEAMS"</p> <p>Mr S.K. Malhotra Ref: Paper 219B "ANALYSIS AND DESIGN OF SOLID AND BUILT-UP TIMBER COMPRESSION MEMBERS"</p>	<p>Dr A. Buchanan Ref: Paper 115B "DESIGN OF SAWN TIMBER MEMBERS FOR COMBINED BENDING AND AXIAL LOADING"</p> <p>Mr C.R. Hellowell Ref: Paper 192 "THE SHEAR PROPERTIES OF SOME RADIATA PINE PLYWOODS"</p> <p>Dr R.H. Leicester Ref: Paper 145C "ULTIMATE STRENGTH OF PLYWOOD WEBS"</p>	GROUP II	<p>Mr R.D. Hunt/A.M. Bryant Ref: Paper 091 "NAILED JOINTS FOR TIMBER STRUCTURES"</p> <p>Dr P.G. Lowe/M.R. Edwards Ref: Paper 227 "ASPECTS OF DUCTILITY IN NAILED TIMBER CONNECTIONS"</p> <p>Mr M. Batchelor/G. Cavanagh Ref: Paper 185A "NAILED PLYWOOD GUSSET JOINTS FOR TIMBER PORTAL FRAMES"</p>	<p>Mr Kohel Komatsu Ref: Paper 265 "DESIGN OF CROSS-LAPPED GLUED JOINTS FOR GLULAM PORTAL FRAMES"</p> <p>Mr M. Batchelor Ref: Paper 185B "IMPROVED PLYWOOD GUSSET JOINTS FOR TIMBER PORTAL FRAMES"</p> <p>Mr J. Rich Ref: Paper 150A "STRUCTURAL PLYWOOD DESIGN"</p>
GROUP III Wood Science		<p>Mr I. Feder Ref: Paper 335 "BOND DURABILITY AND ITS IMPLICATIONS FOR NEW ADHESIVES FOR WOOD"</p> <p>Prof. V. Navaratnarajah Ref: Paper 189 "PERFORMANCE OF MECHANICAL AND GLUED CONNECTIONS WITH MALAYSIAN KEVING"</p> <p>Mr R. Kling Ref: Paper 225 "RADIO FREQUENCY CURING OF FINGER-JOINTS AND GLULAM BEAMS"</p> <p>Mr P. Hill Ref: Paper 152A "QUALITY CONTROL OF GLULAM TIMBER MANUFACTURE"</p>	GROUP III	<p>Prof. B. Madsen Ref: Paper 144C "DURATION OF LOAD"</p> <p>Mr B.S. McDowall Ref: Paper 171 "DURATION OF LOAD - A FRACTURE MECHANICS APPROACH TESTED EXPERIMENTALLY"</p>	<p>Mrs A. Ellison/Prof. R. Saunders/Dr A. Tang Kai Ref: Paper 216 "STUDIES ON HYSTERESIS PROPERTIES IN TRINIDADIAN TIMBER"</p> <p>Prof. dr eng D. Marusceac Ref: Paper 200C "COMMENTS ON BEHAVIOUR OF GLULAM BEAMS SUBJECT TO REPEATED STATIC LOADS"</p> <p>Dr A. Buchanan Ref: Paper 115C "EFFECT OF MEMBER SIZE ON THE STRENGTH OF TIMBER"</p>

FRIDAY, 25TH MAY - MORNING SESSION

FRIDAY, 25TH MAY - AFTERNOON SESSION

9.00 - 10.30		11.00 - 12.30		2.00 - 3.30		4.00 - 5.30	
GROUP I Timber Construction	<p>Mr M.D. Robinson Ref: Paper 078 "RURAL STRUCTURES - THE CHALLENGE"</p> <p>Mr R.F. Gale/J. Kroonenberg Ref: Paper 085A "CURVED GANGLAM ARCHES"</p> <p>Mr G.D. Lawn Ref: Paper 151A "USE OF LARGE TIMBER MEMBERS IN HORTICULTURE FOR ARTIFICIAL SHELTER"</p>	<p>Dr A.B. Walford Ref: Paper 0318 "SELECTION OF POLES TO ANSI 05.1 SPECIFICATION"</p> <p>Mr G. Pinnell Ref: Paper 072 "POLE STRENGTH ASSESSMENT FOR ARTIFICIAL SHELTER"</p> <p>Mr G.D. Lawn Ref: Paper 151B "USE OF SMALL TIMBER MEMBERS IN HORTICULTURAL CROP SUPPORT"</p> <p>Mr E. Willson/G. Cavanagh Ref: Paper 180B "LIGHT TIMBER FRAME IND/AGR BUILDINGS"</p>	GROUP I				
GROUP II Timber Design Theory	<p>Mr K. Whybrow/Dr J.C.F. Walker/ H. Gunzerodt/G.R. Johnson Ref: Paper 089 "COMPRESSION ROLLING OF NOTHOFAGUS FUSCA"</p> <p>Mr M.G. Spencer/P.C. Smith Ref: Paper 181 "FIRE DESIGN OF TIMBER STRUCTURES"</p>	<p>Mr Barnett Ref: Paper 166 "TIMBER IN FIRES - REVIEW OF CHEMICAL AND PHYSICAL CHARACTERISTICS"</p> <p>Mr K. Golding Ref: Paper 156 "FIRE-RATED CONSTRUCTION"</p> <p>Dr H.L. Baber/A.H.R. Fowkes Ref: Paper 105 "FIRE-RESISTANCE OF LOAD-BEARING TIMBER STUD WALLS"</p>	GROUP II	<p>Prof. H.J. Larsen Ref: Paper 159A "HARMONIZATION OF EUROPEAN TIMBER CODES"</p> <p>Dr J. Webster Ref: Paper 075 "PRACTICAL ISSUES IN DEVELOPMENT OF A LIMIT STATES DESIGN CODE FOR TIMBER STRUCTURES"</p> <p>Mr H. Wagstaff Ref: Paper 332 "QUALITY CONTROL OF STRUCTURAL TIMBER IN NEW ZEALAND"</p>	<p><u>PLENARY SESSION</u></p> <p>Prof. B. Madsen Ref: Paper 144A "A DESIGN CODE FOR CONTEMPORARY TIMBER ENGINEERING AND ITS IMPLICATIONS FOR INTERNATIONAL TIMBER TRADE" B.28</p>		
GROUP III Wood Science	<p>Dr P.J. Moss Ref: Paper 230A "PLAIN STRESS ANALYSIS OF A BOLTED JOINT IN WOOD"</p> <p>Mr N. Harding/A.M.R. Fowkes Ref: Paper 095 "BOLTED TIMBER JOINTS"</p> <p>Mr D.O. Spurr/Mr M. Phillips Ref: Paper 101 "TESTING OF BOLTED TIMBER JOINTS" BOLTED JOINTS"</p>	<p>Prof. S.K. Malhotra/B. Thomas Ref: Paper 219A "EFFECTS OF INTERFACE CHARACTERISTICS ON MULTI-MAILED JOINTS"</p> <p>Mr M. Collins Ref: Paper 191 "INFLUENCE OF DENSITY ON MAILED JOINTS IN RADIATA PINE"</p> <p>Mr G.F. Reardon/G.M. Boughton Ref: Paper 068 "WITHDRAWAL RESISTANCE OF GROOVED NAILS IN SEASONED PINE"</p>	GROUP III				

ANNEX 3

STATEMENT MADE ON BEHALF OF DR. ABD EL-RAHMAN KHANE
AT THE OPENING OF THE TRAINING COURSE ON TIMBER ENGINEERING
ON 14 MAY 1984, AUCKLAND, NEW ZEALAND

On behalf of the Executive Director of UNIDO, Dr. Abdel Rahman Khane, I take pleasure in welcoming you to this "Training Course on Timber Engineering" which has been jointly organized by UNIDO and WOOD-INGE through the generosity of the Government of New Zealand.

I feel it is opportune to review briefly the global view behind UNIDO's technical assistance programme in the secondary wood products and processing field, and to indicate how our activities in the use of wood in construction fit into this overall programme.

In the field of wood industries, technical assistance is generally provided by UNIDO to individual countries, usually directly to the factories involved to enable them to operate more efficiently - often helping them to move from the craftsman to the industrial level. Certain supporting activities, such as expert group meetings and training seminars/workshops complement this mainstream work in specialized fields, and we have held many such seminars in furniture and joinery production and in the selection of appropriate woodworking machinery.

Consistent with our aim of helping developing countries upgrade the living conditions of their populations, through inter alia providing them with better housing at lower cost, while at the same time using a locally available and renewable resource - wood - UNIDO held a meeting in 1969 on production techniques for the use of wood in housing under conditions prevailing in developing countries. This led to the meeting in 1971 in Vancouver, co-sponsored by FAO, the UN Centre for Building and Housing and UNIDO. In 1978, UNIDO organized a course in France and a study tour in the UK to show French-speaking specifiers how their own timber species were being used in construction in the UK. More recently, in late 1981 in

Vienna^{1/}, we had a meeting on timber stress grading and strength grouping.

I shall not dwell upon the assistance we provide in the field of the use of wood in non-load-bearing situations, although this has represented the majority of our work. However, some examples of assistance given in the field of the use of wood as a structural material might be of interest and will serve to illustrate our work:

- In Laos, we designed roof trusses and a low-cost prefabrication system for use in schools using grouped local species and built a prototype school house as well as a 40-meter bridge.
- In Kenya, we developed a system for low-cost modular prefabricated wooden bridges using ten-foot (3m) modules that can be assembled into bridges of spans up to 100 feet (30m) for live loads of up to 40 tons. This system has been successfully introduced since in Kenya, Honduras and Peru, while prototype bridges have been built in Madagascar and the Central African Republic. We are currently working on bridge projects in Bolivia, Ecuador, Dominica and Nicaragua and have requests from Equatorial Guinea and Guinea.
- In Paraguay, the Institute for Industrial Standards and Technology was assisted in developing a wide wood research programme including timber strength testing.
- In Indonesia, UNIDO has provided assistance for many years to the building materials research

^{1/} Documents ID/WG.359/2 to 7 are available upon request.

institute in Bogor, which included design of trusses and the use of particle boards in pre-fabricated housing.

- In Sri Lanka we are just completing a project to develop the use of coconut stem wood and rubberwood in trussed rafters and glulam beams (including the technology of finger jointing).
- In the Philippines, we collaborated with FAO in a project to train people from the region in the production and utilization of coconut wood in construction. This was followed up by a small but interesting project to help the SPDA (Southern Philippines Development Authority) build and study the economics of two coconut wood houses before starting a programme to build a further 200.
- A Technical Course on Timber Structures was just conducted in Costa Rica and Honduras (in Spanish) with the aim of pointing out to civil engineers and architects, without much background in timber construction, the advantages (and restrictions, too) of using wood in construction.

Unfortunately, there exists in most developing countries an aversion to the use of wood in construction, associating wood with slums and shanty towns and considering it an unreliable short-term use material.

It is with this background that this current workshop is being organized and we hope that, by bringing civil engineers and senior research staff involved in materials selection and use in construction in developing countries to New Zealand, we can increase the role that this renewable and locally available building material could play in the development of your countries. We know that many countries have long traditions of woodworking and carpentry - whether blessed with

forest resources or not - but modern technologies have allowed materials such as steel and concrete to predominate for many structural purposes, even if steel has to be imported and wood is available locally. Yet wood may also compete if structures are efficiently designed, if processing is carried out properly and if certain industrial practices are followed. It is our confidence in wood as a structural material that prompted UNIDO to organize this specialized course; and it is our hope that the considerable experience gained by New Zealand in using wood in construction will prove valuable. I should point out here that we are particularly pleased that New Zealand is hosting this workshop due to its long experience in the use of timber in many aspects of construction work and its particular interest in developing countries of the Asia and Pacific Region.

We are also very appreciative of the efforts of WOOD-INGE in organizing a full and varied programme which includes lectures, visits to both wood conversion factories and to building sites, discussions with experts, and we hope, amongst participants as well as assignment work that will be done in groups.

It is most fortunate that the organizers of the Pacific Timber Engineering Conference have cooperated in permitting the second half of this training course to be, in fact, in full attendance at the Conference. We expect you to make your presence felt during the proceedings and to put forth your views as representing the special needs and conditions of developing countries. In this way we hope that you will discover better the potential of wood in satisfying your country's building needs - for housing, for industrial, commercial, agricultural and institutional buildings, and for special structures such bridges, wharves and temporary works. We hope that you will share and exchange your own experiences with each other and with lecturers and organizers both during the introductory course and at the Conference since in this way you will all benefit from broader outlooks. You can be sure that the many examples you will see of

timber structures here in New Zealand are matched by similar ones in Australia, North America and Europe, in countries both with and without great forest resources. This is because of the many advantageous properties of wood, which we firmly believe outweigh the disadvantages and which, when coupled with modern timber engineering practices permit this fine material to be economically and safely used around the world.

I wish you every success in your deliberations and endeavours.

ANNEX 4

A. SUMMARY OF PARTICIPANTS' REPLIES TO EVALUATION FORMS

This summary has been drafted by the author based on the detailed Evaluation - Group Training Programme forms filled in by 19 participants - the 18 sponsored by UNIDO plus one of those attending at his own cost.

Most of the responses were positive with regard to the general aims, format and conduct of the course. Several participants were informed about the course and their acceptance too late to make proper preparations, but managed none the less to benefit.

Virtually all noted that the course was:

- Too tightly scheduled with insufficient time for proper discussions. Evening programmes should have been optional.
- Too slanted towards softwood use and not enough towards hardwoods. (New Zealand experience over-emphasized was a common comment.)
- Too oriented towards lectures and theory without enough time spent on panel discussions on applications and problems in their own countries.

As for specific topics, several found that wood preservation was most interesting and that the lecture on timber design for housing, fingerjointing, glulam making, stress grading and the use of poles for foundations and retaining walls were most useful. Others felt that timber's competitive position with respect to concrete and steel should have been discussed more, with more economic case studies.

In as much as the course was primarily intended as a lead-in to the PTEC, it clearly served this function well. In general it tried to accomplish too much in too short a time.

Some inconsistency between the levels of the introductory course and the PTEC itself were noted by one participant in the context of the question on "general level of training". He pointed out that for him (a senior, experienced architect familiar with wood construction) the introductory course was at a too low level whereas the conference was at the right level. On the other hand, less experienced professionals would have benefitted greatly from the course but found the conference a bit above them. Design code philosophy and response/behaviour of timber structural components, for example, should have been included in the course in his view.

Topics which were mentioned as not having been sufficiently covered included mass production of low-cost, prefabricated housing and "Financial relativity", i.e., cost comparisons between competing materials, as well as marine applications. Least useful or relevant lectures included the ones on horticultural applications, New Zealand softwood research and standard units.

B. SUMMARY OF OPINIONS ON CONFERENCE PAPERS

The participants of the UNIDO Introductory Course were requested to give their opinions on the relative merits of the papers presented at the PTEC, especially regarding the relevance and value to them and their own countries.

Forms were thus distributed to four sub-groups with the paper numbers shown, against which the participants were to mark:

- R: Relevant to your problems
- I: Interesting but not relevant
- N: Not relevant

Unfortunately not all participants filled in the input sheets but at least 19 of the 23 did. The total number of votes cast was 565 indicating an average of 33 lectures attended per participant. Of these, more than half (303) were considered relevant while only 28 non-relevant lectures were attended (234 were classed as "interesting" or simply "useful").

OPINIONS OF PARTICIPANTS ON RELEVANCE OF CONFERENCE PAPERS
BY COUNTRY GROUP

(R = Relevant, I = Interesting, N = Not relevant,
x = Hard to understand)

CONTENTS

Author Index Subject Index	(v) (xi)	THA, PHI		FIJ, TON		NZ, AUS CPR, MAL		SRL, PNG		SUB-TOTALS			TOTALS
		R	I	R	I	R	I	R	I	R	I	N	
No. Title Authors Page No.													
004 "A Samoan Fale - Using Glue Laminated Timber Arches" Mr A.V. King/ Dr J. Webster 511		-	-	-	-	-	-	-	-	-	-	-	-
021 "May the Force be With You" Mr G.J. Cooper 7		I	I	R	R	I	I	R	R	4	4	-	8
031 A) "Ingrade Strength of Radiata Pine" Dr G.B. Walford 561 B) "Selection of Poles to ANSI US.1 Dr G.B. Walford 346 Specification"		R	I	R	-	R	I	R	R	5	2	-	7
			I	-	-	-	-	-	-	-	1	-	1
041 "Cyclic Load Testing Timber - Sheathed Wall Panels" Mr S.J. Thurston/ Mr O.L. Hutchinson 496		I	I	I	I	R	I	R	Rx	3	5	-	8
052 A) "Heavy Timber Construction in Japan" Prof. H. Sugiyama **		R	I	I	I	I	I	I	I	1	11	-	12
B) "Japanese Experience and Research on Timber Buildings in Earthquakes" Prof. H. Sugiyama 431		R	I	I	N	R	I	I	I	2	9	3	14
C) "An Overseas Assessment of P. Radiata for Structural Applications" Prof. H. Sugiyama 735		I	N	I	I	R	I	R	R	3	4	1	8
059 "Wood Housing in Chile" Dr H.T. Fox 283		-	-	-	-	-	-	-	-	-	-	-	-
060 "Historical Timber Structures in Chile and their Conservation" Mr Fang Fu 402			N							-	-	1	1
068 "Withdrawal Resistance of Grooved Nails in Seasoned Pine" Mr G.F. Reardon/ Mr G.N. Boughton 907													
072 "Pole Strength Assessment for Artificial Shelter" Mr G.C. Pinnell 354		I								1			1
073 "Wood Science and Forestry in the World's Southernmost Plantation" Mr A.G. Coppens 727							N					1	1
075 "Some Practical Issues in the Development of a Limit States Design Code for Engineered Timber Structures" Dr J. Webster 923		R				R	N	N		2		2	4
078 "Rural Structures - The Challenge" Mr M.D. Robinson 309					I		I				2		2
080 "A Suggested Method to Assess Potential Sawn Timber use in N.Z. or Asian Countries" Mr J.S.F. Nicholls 421		R		R	R	R	I	I		4	2		6

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			R	I	R	R	R	R	I	N	R	I	N				
085	A) "Curved Ganglām Arches"	Mr R.F. Gale/ Mr J. Kroonenberg							I					2		2	
	B) "Gang-Nail Applications"	Mr R.F. Gale	R	I	R	R	R	R	I	R	R			7	2		9
088	"Residential Pole Housing"	Prof. E.L. Ellis/ Dr J.C.F. Walker	R	I	R	R	I	I						3	3		6
089	"Compression Rolling of Nothofagus Fusca"	Mr K. Whybrew/ Dr J.C.F. Walker/ Mr H. Gunzerodt/ Mr G.R. Johnson							I	N	R			1	1	1	3
091	"Nail Joints for Timber Structures"	Mr R.D. Hunt/ Mr A.H. Bryant				R								1			1
092	"Plywood Diaphragms and Shear Walls"	Mr G. James/A.H. Bryant		I			I	I		R	Rx			2	4		6
093	"Determining the Racking Resistance of Timber Framed Walls"	Mr D.R. Griffiths	I	I	I	I	R	I		R	Rx			3	5		8
095	"Bolted Timber Joints"	Mr N. Harding/ Mr A.M.R. Fowkes	R						R		I			2	1		3
096	"Plate Behaviour of Plywood and Particleboard"	Mr D.P. Hanley/ Mr R.H. Thomas		R				R	I					2	1		3
099	"4dm Glued-Laminated Timber Highway Bridge"	Mr G.A.J. Szakats/ Mr G.W. Butcher		I				R	J		R			2	2		4
101	"Testing of Bolted Timber Joints"	Mr D.D. Spurr/ Mr M. Phillips	R						R		I			2	1		3
103	"Continuous Timber Diaphragms"	Mr T.S. Tarpay Jnr															
105	"Fire Resistance of Load-bearing Timber Stud Walls"	Dr H.L. Baber/ Mr A.H.R. Fowkes	I	I				R	R	I		R		3	3		6
107	"The Specification of Timber for Large Span Roof Trusses and Similar Structures"	Mr P.A. Campbell	R	I	R	R	R	I		R	R			6	2		8
109	"The Use of Structural Timber in the Fertilizer and Related Industries"	Mr C.N. Grove							I						2		2
110	"Qualitative Assessment of Whole House Structural Response to Lateral Wind Loads"	Mr C.G. McIlwain	R	I	R	R	R	R		R	R			8	1		9
111	"Discussion on the Design of Nail Plate Connections"	Ir J.A.C.M. Van der Put	R	I		R			I		R			3	2		5
112	"Damping Characteristics of Sheathed Wood Diaphragms"	Mr C.K. Cheung/ Prof. R.Y. Itani		I	I	I			I		Rx	I		1	4		5

**OPINIONS OF PARTICIPANTS ON RELEVANCE OF CONFERENCE PAPERS
BY COUNTRY GROUP**

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	THA, PHI	FIJ, TON	NZ, AUS		SRL, PNG	SUB-TOTALS			TOTALS
			CPR, MAL			R	I	N	
114 "Experimental Investigation of the Diaphragm Action of Ceilings in Resisting Lateral Loads on Houses"	-	I	-	-	R R Rx	3	1	-	4
115 A) "Wood Properties and Seismic Design of Timber Structures"	-	R R R R	I	I	R R R I	7	3	-	10
B) "Design of Sawn Timber Members for Combined Bending and Axial Loading"	R -	R	-	-	-	2	-	-	2
C) "Effect of Member Size on the Strength of Timber"	-	-	-	-	-	-	-	-	-
117 "Timber Engineering in Zimbabwe and S.A.D.C. Regions"	R I	R I	I	I	-	2	4	-	6
137 "The Prospect of Timber Construction in Indonesia"	-	-	-	-	-	-	-	-	-
140 "Particleboard for Commercial and Industrial Flooring Systems"	-	-	R	R	-	2	-	-	2
143 "Simulated Cyclone Wind Tests on a Timber Framed House"	R I	R R R R		I	R R	7	2	-	9
144 A) "A Design Code for Contemporary Timber Engineering and its Implications for International Timber Trade"	I	R R R	R	I	R R	6	2	-	8
B) "Moisture Content Effects in Timber"	I	R		R	R R	4	1	-	5
C) "Duration of Load"	I	R	R	R	R R R R	7	1	-	8
145 A) "Structural Grading Systems"	R R	R R	R	R	R R	8	-	-	8
B) "Proof Grading"	R I	R R R	R	N	R	6	1	1	8
C) "Ultimate Strength of Plywood Webs"	R I	-	-	-	-	1	-	-	1
146 "Lockwood Humes"	-	-	-	-	-	-	-	-	-
147 "The Potential for Timber Engineering in the East Asia and Pacific Area"	I	R R R	I	I	R I	4	4	-	8
148 "Design Procedure for Rectangular Openings in Shearwalls and Diaphragms"	R I	I I	R	I	R Rx	4	4	-	8
149 "Retaining Walls in Timber Height Range 1.2 - 3.6m"	R R	R R R	R	I	R R	8	1	-	9
150 A) "Structural Plywood Design"	-	-	-	-	-	-	-	-	-
B) "J. Rich Dome Systems"	R I I	I I	N	N	I I I	1	7	2	10

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						CPR, MAL			R	I	N	
151	A) "Use of Large Timber Members in Horticulture for Artificial Shelter"	Mr G.D. Lawn	338	-	I		I	-	-	2	-	2
	B) "Use of Small Timber Members in Horticultural Crop Support"	Mr G.D. Lawn	361	I	-		-	-	-	1	-	1
152	A) "Qual. Control of Glulam Timber Manufacture"	Mr P. Hill	814	I	-	R	R I	I	2	3	-	5
	B) "Laminated Timber Floor and Ceiling Panels: Design, Manufacturing and Installation"	Mr P. Hill	81	I	-	R	R	-	2	1	-	3
155	"Senton Sawn House Piles"	Mr R. Hansen	58	-	I		-	-	-	1	-	1
156	"Fire-Rated Construction"	Mr K. Golding	703	R	I	-	R R R	R	5	1	-	6
158	A) "Design and Construction of Kinleith Dry Drum Building"	Mr E. Willson/ Mr E. Phythian	571	-	-	R	N	-	1	-	1	2
	B) "The YMCA Gymnasium, Tokoroa"	Mr E. Willson	573	R	I I	I	I	I I I	1	9	-	10
	C) "Design Decisions based on Economics"	Mr E. Willson	576	R	R	R	I	-	4	1	-	5
159	A) "Harmonization of European Timber Codes"	Prof. H.J. Larsen	915	R	-	I	N	I	1	2	1	4
	B) "Instability of Columns and Beams"	Prof. H.J. Larsen	569	R	R	R	R	N R x	7	-	1	8
	C) "An Overview of Timber Construction in Europe"	Prof. H.J. Larsen	381	I	I	I	I	I	-	6	-	6
160	"Design of Wood Stave Culverts"	Mr R. Anderson	207	-	R		I	-	1	1	-	2
161	"Loading Upon and Design of Timber Retaining Walls"	Dr D.V. Tuan	553	R	I	R R R		I R R	6	2	-	8
163	"Fibrous Plaster on Timber Studs as Diaphragms"	Mr A.W. Pidgeon	75	I	-	R	I	-	1	2	-	3
164	"Timber Buildings using Solid Timber, Glulam and Plywood Web Beams"	Mr G. Dainty	142	R	I	-	R	I R R	4	2	-	6
166	"Timber in Fires - Review of Chemical and Physical Characteristics"	Mr C. Barnett	691	I	N	-	R	R R	3	1	1	5
167	"Physical Examination and Evaluation of Residential and Light Timber Buildings"	Dr A.K. Sharma/ Mr A. Joseph	299	-	-	-	-	-	-	-	-	-
169	"Design of Low Rise Buildings in Heavy Timber Constructions"	Mr P.C. Smith	159	R	I	R	I	-	2	2	-	4
170	"Design of Timber Structures to Resist High Wind and Earthquake - State of the Art Summary"	Mr R.L. Williams	439	R I I N	R R R R	R	I	R R R I	9	4	1	14

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	THA, PHI	FIJ, TON	NZ, AUS		SRL, PNG		SUB-TOTALS			TOTALS		
			CPR, MAL				R	I	N			
171 "Duration of Load - A Fracture Mechanics Approach Tested Experimentally"				R	R	I	I	I	2	4	-	6
172 A) "Cost of Manufacture with Particular Reference to Glulamined Timber in New Zealand"	R	R	R	R	I				4	1	-	5
B) "Wood Stave Reservoirs"	R	R	R	R	R			I	5	1	1	7
C) "New Zealand Timber Review"	R	R	I	I	I	I	I	I	2	11	-	13
173 "The Timbertek Building System - Its Design and Application"	R	I		R	R	R	R		5	1	-	6
174 "Timber Stave Tanks for Above Ground Water Storage"		R	R	R	R		I		4	1	1	6
177 "Design and its Effect on the Manufacture and Erection of Engine'd Timber Components"	R	R	R	R	I				4	1	-	5
178 "Review of Future Wood Supply and Quality - a Private Company Perspective"					N						1	1
179 "Grading Timber for Specific Application"	R		I		R	R	R		4	1	-	5
180 A) "Structural Panels - Development and Transition in North America"				R	R	I	I		2	2	-	4
181 "Fire Design of Timber Structure"				I	N	N		R	1	1	2	4
182 "Opening Address"												
183 "N.Z. Forest Service Timber Bridges"	I			R	R		R		3	1	-	4
185 A) "Nailed Plywood Gusset Joints for Timber Portal Frames"			R						1	-	-	1
B) "Improved Plywood Gusset Joints for Timber Portal Frames"												
186 A) "Shear Strength of Notched Timber Beams"			I			R	R _x		2	1	-	3
B) "Design of Radially Reinforced Tapered and Glulam Beams"	R		I		I	I	I		1	4	-	5
C) "State of the Art - Analysis and Design of Nonprismatic Glue Laminated Beams"	R		I		I	R	I		2	3	-	5
189 "Performance of Mechanical and Glued Connections with Malaysian Keruing"	R			R	R	I		I	3	2	1	5

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			R	I	N	x	R	I	N	R	I		N
191 "Influence of Density on Nailed Joints in Radiata Pine"													
192 "The Shear Properties of some Radiata Pine Plywood"	N										1		1
194 "The Seismic Performance of Plywood Sheathed Shearwalls"	R	I I			I		I I			1	5		6
196 "Design and Construction of Pole Housing in the Wellington District"	I I	R R R			I	I				3	4		7
198 "Design, Erection and Investigation of Wooden Shells in Estonian SSR"													
200 "Some Observations Concerning the Behaviour of Glued Laminated Timber Beams Subjected to Repeated Statical Loads"													
203 "Design Aspects of the Mount Wellington Borough Council Footbridge"	I				R	N		R		2	1	1	4
204 "Theoretical Analyses of Seismic Response of Wooden Dwellings in Japan"		I I I I			I	N		I I I I			9	1	10
207 "The Structural Use of Wood-Based Panels in Building Components"	R				R	I				2	1		3
208 "Steel Reinforced Timber Structural Elements"	R I I		R		R	I		I I		3	5		8
215 "Interaction Diagrams for Design of Plywood Web Box of I Beams"													
216 "Studies on Hysteretic Properties in Trinidadian Timber"													
219 A) "Effects of interface Characteristics on the Behaviour of Timber Joints with Multiple Nails"													
B) "Analyses and Design of Solid and Built-up Timber Compression Members"													
221 "Simulation of the Probability Distribution of Wood Properties"	I I	R R			R	R		R		5	2		7

107

OPINIONS OF PARTICIPANTS ON RELEVANCE OF CONFERENCE PAPERS
BY COUNTRY GROUP

(R = Relevant, I = Interesting, N = Not relevant,
x = Hard to understand)

	THA, PHI	FIJ, TON	NZ, AUS		SRL, PNG	SUB-TOTALS			TOTALS
			CPR, MAL			R	I	N	
222 "Behaviour of Timber Building Structures during the Coalinga, California, Earthquake, 2nd May 1983"	-	-	-	-	-	-	-	-	-
223 "U.O.S.P. Preservation of Building Timbers"	R R	R R	I I I		R	5	3	-	8
224 "Timber Moment Frames and their Use"	R I	-	R R		R R	5	1	-	6
225 "Radio Frequency Curing of Finger-Joints and Glulam Beams"	-	-	R I N		I	1	2	1	4
227 "Aspects of Ductility in Nailed Timber Connections"	-	I	-		-	-	1	-	1
230 A) "Plain Stress Analysis of a Bolted Joint in Wood"	R	-	R		I	2	1	-	3
B) "The Seismic Performance of a Multi-storied Timber Frame having Moment-Resisting Nailed Joints"	-	R	-		R	2	-	-	2
C) "Torsional Response of Low-rise Timber Structure Subjected to Seismic Ground Motion"	-	R	-		R	2	-	-	2
232 "Use of Pinus Radiata in Foundation Reconstruction of Government Building"	I	I	-		-	-	2	-	2
234 "Development of Medium Rise Multi-Purpose Timber Frames for a Simulated Structural Performance in N.S.W."	-	R	-		R	2	-	-	2
265 "Design of Cross-Lapped Glued Joints for Glulam Portal Frames"	-	-	-		-	-	-	-	-
328 "Economic Multistorey Timber Buildings using Poles and Diaphragms"	I	R R	-		-	2	1	-	3
329 "Timber Preservation Quality Control as an Aid to Marketing"	R I	R I	I I		R	3	4	-	7
330 "The UNIDO Timber Bridge"	R R I	R	R N		R R	6	1	1	8
332 "Quality Control of Structural Timber in New Zealand"	R	-	-		-	1	-	-	1
333 "Derivation of Timber Design Stresses in N.Z."	I N	I I	R		R	2	3	1	6

OPINIONS OF PARTICIPANTS ON RELEVANCE OF CONFERENCE PAPERS
BY COUNTRY GROUP

(R = Relevant, I = Interesting, N = Not relevant,
x = Hard to understand)

						SUB-TOTALS			TOTALS		
						THA, PHI	FIJ, TON	NZ, AUS CPR, MAL		SRL, PNG	R
335	"Bond Durability and its Implications for New Adhesives for Wood"	Mr I. Feder	791	R	-	R R	I	3	1	-	4
336	"Review of Future M.Z. Wood Supply and Quality"	Mr I.D. Whiteside	715	-	-	N	-	-	-	1	1
337	"Exterior Surface Coatings on Timber"	Dr D.V. Plackett	168	-	-	R I	-	1	1	-	2
374	"Long Term Field and Service Performance of Treated Exotic Species"	Dr M.E. Hedley	183	R I	R R	R R R I	R	7	2	-	9
464	"Timber Structures in Developing Countries"	Mr R.M. Hallett	51	R R I	R	R I	R R R	7	2	-	9
											565

ANNEX 5

OPENING REMARKS ON BEHALF OF THE EXECUTIVE DIRECTOR

Honourable Minister, Mr. Chairman, Distinguished Guests, Ladies and Gentlemen:

I am delighted to have been asked to say a few words at this opening ceremony and, on behalf of the Executive Director of UNIDO, I would like to express our appreciation of the effort and initiative taken by the Timber Design Society of the Institution of Professional Engineers of New Zealand in organizing this conference.

That so much experience and talent has been attracted to it, underscores and pays tribute to the impressive developments that have been made by timber engineers and the wood-based industries of New Zealand. This has been clearly demonstrated during my short time here by the existence of a great many timber buildings, including those which have stood the test of time for many years.

Some, or even many of you, know that the United Nations Industrial Development Organization - UNIDO - is part of the UN family, and was created in the late 1960's to assist in the industrialization of developing countries. This assistance has taken a great variety of forms but has centred on providing technical advice and expertise, specialized equipment and machinery and training - especially at the technical and middle management levels. We have also set up programmes to promote investment and joint ventures as well as to create the infrastructure and institutions so necessary for industrial growth.

In the wood processing and wood products sector, UNIDO assistance covers both structural and non-structural uses. This has included direct help to factories making furniture and joinery items, in production planning and control, product design, quality control and machinery selection and maintenance.

We have also been active in promoting the use of wood in construction and lately in developing the structural use of rubberwood and coconut wood, and are very interested in working on internationally acceptable timber engineering practices and codes.

Thus, we are particularly pleased that, through the generosity of the New Zealand Ministry of Foreign Affairs and with the enthusiastic support of the organizers of this conference, UNIDO has been able to co-sponsor a training course on timber engineering. This has been for 18 civil engineers and technologists from developing countries of the Asian and Pacific Region and began last week with an introductory course of lectures and field visits and continues this week with participation in this conference.

We feel it is important for the voices of developing countries to be heard in such fora as this so that their special needs and conditions may be taken into consideration when decisions are being made on new research initiatives and on harmonization of codes and standards at the international level. It is also important for engineers and scientists from the industrialized countries to come into professional and personal contact with their counterparts in developing countries so that they might better appreciate the scope and types of problems confronting their colleagues in the tremendous task of upgrading their peoples' standards of living, and also to establish a continuing rapport.

The role that the forest-based industries, timber engineers and technologists could play in solving these problems is enormous. The transfer of appropriate technology through such activities as this conference and the UNIDO/MFA training course can help them to achieve real, tangible benefits in the form of reliable, durable and cost-effective buildings and structures of many kinds. Mr. Elworthy's remarks on this subject are certainly welcomed by UNIDO.

And so, in closing, I would like to thank the Ministry of Foreign Affairs for co-sponsoring the training course; the New Zealand timber industry and professional engineers who co-operated in it; and especially

the directors of Wood-Inge Timber Engineering Advisory Service and the lecturers who worked so hard to make it a success.

Finally, I must thank the Timber Design Society of the IPENZ for its gracious assistance and congratulate the organizers for what shows every indication of being a most successful and memorable conference.

Ladies and gentlemen, I wish you every success in your proceedings.
Thank you.

R. M. Hallett
UNIDO
Vienna

ANNEX 6

UNIDO SECRETARIAT PAPER NO. 464 - PTEC

TIMBER ENGINEERING IN DEVELOPING COUNTRIES

Abstract

This paper presents some aspects of the use of timber in construction in developing countries based on UNIDO's experiences under a wide range of circumstances. It includes some general comments plus discussions on technical and design problems, the legal framework as it affects construction and touches more briefly on financial, production and commercial aspects relating to application of timber engineering. Coordination of efforts in all these areas is seen as essential for progress.

1. INTRODUCTION

A great many technicians, scientists and engineers around the world know and appreciate the value of wood as a structural material. However, many millions don't know, don't believe this, nor do they particularly care. There are a great many reasons for this which continually frustrate those trying to increase the use of wood in construction but one particularly significant reason is the very large scale of both cement and steel production and construction activities which are usually well-integrated and which tend to enjoy strong support from government ministries owing to their relatively greater economic contribution to the economy when compared with the normally fragmented and smaller timber concerns.

Therefore, aside from the many technical problems of using sometimes strange and mixed species and of ensuring safe, efficient structures, there are many obstacles to overcome in trying to change the status quo.

UNIDO's main objective is to promote industrialization of developing countries and in this current context to try and get timber introduced and used to the appropriate extent. Our views on the current situation, some of the obstacles and how they may be overcome are as follows.

* This paper was prepared by Mr. Robert M. Hallett, Agro-Industries Branch, Division of Industrial Operations, United Nations Industrial Development Organization (UNIDO); Vienna, Austria, in close collaboration with Mr. Chris J. Mettem, Head - Materials Section, Engineering Department, Timber Research and Development Association (TRADA), United Kingdom.

2. CURRENT SITUATION AND GENERAL PROBLEMS

When considering the use of timber in construction in developing countries it is necessary to begin looking at the earliest stages of forest industry development. In most cases elementary knowledge of the raw material is lacking and proper inventory information is restricted to either a few accessible areas or to the better known, exportable species. Thus the development of domestic use of timber for structural purposes has been largely ignored and where timber has been used it has been restricted to the poorer quality material due to the creaming or hi-grading of forests for export.

A related problem concerns the structure of trade and the ownership of logs or the right to exploit forest concessions. There is very little saving for stock and rarely sufficient interest in control. Furthermore, if grading rules do exist, they are normally of the non-structural or shop grades and stress grading is rarely practised. Thus wood has gained the reputation in many countries of being expensive and uncompetitive compared with other materials. (It is often a case of build cheaply and risk collapse or price the wood design out of competition!)

Because of the great emphasis on export (whether of logs or sawn wood or other primary wood products), the domestic trade and marketing channels are not well-developed, i. e., a sawnwood market does not exist per se. When timber houses or other buildings are built, they tend to be of the one-off type designed by an architect and in the upper price bracket. Very few large scale projects are therefore undertaken using wood as the main structural material, partly because of the uncertain supply situation.

Just as assured continuous availability of species is essential to create a sound export market, likewise this is essential on a general basis for development of domestic construction using timber.

Another general problem is that of transferring existing knowledge to engineers and architects on wood as a material and on particular design procedures. Not only is timber engineering not normally included in university curricula for civil engineers, but the language barrier often prevents specifiers and designers in Ministries and construction firms from gaining access to the necessary available technical information. Furthermore, in many countries, timber and forest products research work is far ahead of its application and greater emphasis should be placed instead on dissemination of existing knowledge and promotion activities. Examples of this situation may be found in Mexico, the Philippines, Costa Rica and the Andean Group of countries.

UNIDO's contention is that work on developing the use of timber in construction must be carried out on all fronts simultaneously - technical, legal, financial production and commercial - in a balanced programme with emphasis placed on one or the other only following careful deliberation within a coordinated development programme.

3. TECHNICAL ASPECTS

3.1 Species

In this century a great deal of research work has been done on species classification and determination of mechanical and physical properties. Many thick volumes exist including the basic properties of thousands of timber species - more than will ever be used by the mainstream of industrial timber use. We feel that for all species existing in sufficient commercial volume and qualities enough is known to permit structural usage, if appropriate. In the structural context the main goal is to provide acceptable strength information to engineers whether pertaining to a single species or mixed species. Although a few successful cases of introduction of mixed species onto world markets can be cited (Lauans from Malaysia and spruce-pine-fir from Canada), we are reluctant to recommend this course of action for general usage owing primarily to difficulties in identifying species within the groups.

At the other extreme (from identifying and using single species) is Brazil where it has been proposed to put all Amazonian species into three groups. While this is a laudable attempt at simplification, for many cases primary exploitation took selected species first for a good reason, and there is a danger that the resultant groups will be of a lower average quality than buyers are willing to accept.

Another example which appears to be successful is that of the Australian standard AS1720 "Timber Engineering Code" which includes "unidentified hardwoods from Queensland" or Victoria, and "unidentified softwoods" as groups and assigns them strength classes. There is some feeling in developing countries that the Australian grouping system is too complex and includes too many groups. The Andean Group of countries has settled on three strength groups and only one stress grade as in the United Kingdom.

UNIDO would like to see more uniformity or at least compatibility amongst the various approaches to the question of dealing with varying strength, durability and shrinkage of timbers used for construction.

3.2 Drying and Preservation

These two items are treated together due to certain similarities in treatment from the management and specification points of view. As with species identification and properties, sufficient research has probably been done on an individual basis in both these areas, but we feel that development work on strength grouping, that is, following a "species independent design approach" has gone ahead faster than similar work applied to drying and preservative treat-

ment which has heretofore been almost entirely species-oriented or species-dependent.

UNIDO believes it is now important to re-appraise the species differences and the sensitivity of current treatment procedures to species-related characteristics and to determine whether more robust or species-independent approaches suitable for large volumes of construction timber would be possible. The aim would be to minimize species differences for commercial reasons so that local markets could be presented with properly dried and durable sawn wood with clearly marked strength characteristics so that large scale construction use might be considered.

3.3 Joints

Many engineers believe that joints are the key to successful, efficient structures and joints in timber could be seen as a major disadvantage of the material by structural engineers. The characteristics of timber have therefore caused considerable ingenuity to be used by timber engineers for clean, simple joints that do not add unduly to the cost of the total structure. In developing countries, it is particularly important that unavailable and costly hardware is avoided and UNIDO's recommendation is to rely on nails, bolts or pins rather than glue and connectors which may require special machining or pose difficulties on site. Whichever joint type is selected quality control must be easy and joints readily inspected.

Thus the limitations with respect to joints in the real world, especially developing countries, pose definite constraints to the adoption and application of sophisticated designs and even the use of probabilistic theory. It is very much a case of learning to walk before running and avoiding indiscriminate application of technology.

3.4 Design

The main point under this heading is that traditional and vernacular buildings in developing countries usually contain very successful design details and building solutions appropriate to the needs and conditions of the region. It is therefore a mistake to start designing from scratch as if these designs, which often evolved over centuries, did not exist. This is not to say that many improvements can not be made from considered application of modern timber engineering methods but instead should be taken as a cautionary word. Designers must not simply calculate loads, deflections and sections but must also be sensitive to local traditions, environmental requirements and other non-structural factors. Also, traditional building materials such as nipa have useful properties which modern designers must not overlook.

In summary, while technical aspects may have in some ways been overworked and over-researched, UNIDO's view is that a certain re-direction of effort is required to lay a foundation for greater use of timber in construction in developing countries.

4. LEGAL ASPECTS

This is an important area affecting choice of materials and building design which UNIDO feels has been neglected in comparison to the possibly more straightforward research work on technical aspects as referred to above. Under this heading is meant the whole process of obtaining someone's permission to build. And it includes concepts of cost and reliability with respect to decisions as to whether the objective is to save life or property, for example, in case of fire, earthquake or very strong winds.

As with the general problems referred to earlier, it is useful in this context to start consideration with the urban or rural planning procedure so that early decisions do not preclude the use of wood due to specifications with regard to housing density, style, unjustified fears with respect to fire or overall building or zoning regulations.

Legal control varies from country to country, from central planning to free enterprise systems and mixtures of these with centralized authorities at local, regional or national levels. UNIDO's view is that timber should be given a fair chance to compete either alone or in mixed construction types as is appropriate for each case and the law should be drafted in such a way as to permit this. That is to say a document should exist which states what sort of performance is required for what type of building (within realistic bounds), and this should refer to various codes produced by materials experts in timber, concrete and steel, for example. It should not simply state what materials may or may not be used since even a species list can deter the introduction of new species or wood products as technological advances are made. In too many countries, old colonial laws are still in force which no longer suit the current circumstances.

An important point to note is that, although wood has a great many useful properties, it is often necessary to use it in combination with other materials to enhance its properties, performance and usefulness. Therefore timber engineers have to be familiar with these materials and their interaction with timber since very few buildings are completely made of wood.

UNIDO believes that much greater effort should be directed towards convincing local authorities and those responsible for enforcing or drafting new building regulations that timber can be used as a safe, efficient and cost-effective building material.

Furthermore, since traditional skills do exist in many countries - they should be made use of through proper instruction.

5. OTHER ASPECTS

5.1 Financial

Not only is it necessary to obtain permission to build but funds must also be found whether private, group or governmental. Thus there is the need to convince the financial world with regard to the viability and long service life of timber construction. It must be emphasized that the total all-in cost comparison of finished buildings is important including the financing costs during construction where timber usually has a natural advantage.

With regard to insurance this is usually a very small percentage of total costs and it is important that it be obtainable in the first instance even if a premium must be paid over similar construction with other materials. The poor image of wood construction brought about by the use of very poor quality materials in slums and shanty towns has made it difficult to promote its use in officially sanctioned housing projects.

In this context coordinating agencies have been created in some countries, such as Mexico, with some degree of success. The Central Bank of Mexico has architects and technical advisers on staff and arranges all mortgages in the country. Various other solutions have been found in developing countries including the creation of materials banks for self-help and cooperative building projects.

There is a tremendous housing shortage in many developing countries and innovative solutions must be found and put into practice with the minimum of delay. The potential of wood for solving these social problems must be considered tremendous.

5.2 Production

It is obvious that the building material must be produced before it can be used but this problem will not be dealt with in any detail in this paper. Suffice it to say that sawing accuracy must be acceptable and that producing mills must be familiar with the needs of the construction industry and, for example, introduce stress grading in addition to the appearance grading that has normally predominated.

Some difficulties are not restricted to developing countries. It is difficult for a mill to change production programme from one or a few favoured species to include new species with different characteristics and requirements not only for sawing but for handling

and preservative treatment. There is also the attendant problems involved in holding greater product stocks and dealing with new market channels. Also, this calls for action even at the forest inventory level where coordinated planning must ensure continued availability of the new species.

5.3 Commercial

Many commercial problems are closely related to production problems in that the sawmill or factory must decide what kind of products to produce and what level of sophistication should be followed. It must be remembered that there is competition not only between wood and other structural materials but also between the various potential end-uses of wood and from the commercial point of view if it is more profitable to convert raw material into non-structural products then this is what will tend to happen. In other words, someone has to make a living out of the business.

A particular problem notable in developing countries is the usually low credit rating of the small building firms which, if they were in more industrialized countries, would produce the majority of domestic, agricultural and light industrial buildings. And, aside from the normal production management problems of control, planning, costing, inventory, selling, personnel, etc. there are a great many other problems that the building firms and the timber conversion firms must deal with which are related to currency restrictions, extra regulations and procedures to follow, restrictions on importing spare parts and ancillary materials and often requirements to use labour-intensive methods.

6. ACTION TO BE TAKEN

It is easier to point out problems than it is to solve them and it is also easier to recommend a course of action than to finance and implement it. While appreciating that others have made recommendations related to the forest-based industries in general and also in particular on research, UNIDO nevertheless feels that a concerted effort made in the following areas would contribute greatly to ensuring that wood construction plays an increasingly significant role in developing countries.

An internationally accepted stress grading system should be adopted that would lead into a strength grouping system and timber engineering code of sufficient simplicity for general adoption by developing countries.

This implies a programme of training stress graders and educating engineers and specifiers as to the merits of wood as a material and in timber engineering procedures. Coupled with this, a considerable public relations effort is needed to convince building authorities and large "specifying ministries" that wood, if not naturally durable, can be treated to enhance greatly its service life.

Designers and architects need to be trained to include timber and traditional building materials in their repertoire and to produce building designs for simple prefabrication, production of units in kit form or production on site by cooperatives or small groups.

It is also necessary to see to the creation of linked industries such as the production of gypsum board and nails, bolts and simple metal connectors.

Finally, in order to convince financiers of the benefits of timber construction, it is necessary to make studies in each country or region on maintenance and comparative building costs including the benefits of speed of construction and other features such as the ability to design for resistance to earthquakes and very high winds. In general, scientists and engineers involved in wood and timber engineering research must make greater efforts to ensure that their work is first of all useful to the construction industry and second that it is followed up and applied in tangible forms.

UNIDO's programme of technical assistance bears these points very much in mind in pursuing its aim of aiding the industrialization of developing countries and we hope that this action programme has the support of this important Conference.

ANNEX 7

Auckland
New Zealand
May 1984

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Recommendations for Timber Construction Development

from
The Training Course on Timber Engineering
to the
Pacific Timber Engineering Conference

1. There is a need to create a 'Timber Construction Development Co-ordinating Committee' amongst civil/structural engineers and related professionals concerned with design and use of timber. This Committee would be composed of representatives of national Timber Design Societies or equivalent and it is recommended that countries without such bodies take immediate steps to form them within the structures of their national Institutions of Professional Engineers.

The main aim would be a general interchange of experiences and information for the transfer of appropriate technology. It is understood that, there is a pressing need on the one hand, for developing countries to learn of and make suitable use of both basic and advanced timber technology and design procedures, and on the other, for consulting engineers and the timber industries in developed countries to become familiar with the timber resources and construction needs in developing countries.

It is proposed that initial work be on a regional level. Co-ordination is expected with other regional and international bodies.

2. Priority activities of the T.C.D.C.C. would include:-
 - a) The development and formulation of a design philosophy leading to separate codes for light timber framing and for engineered structures.

These would cover inter alia:-

 - . standard dimensions
 - . strength grading and grouping
 - . preservation
 - . safety and risk factors
 - . materials
 - . joints
 - b) A 'Guide Code' would be drafted, for use by individual countries to help formulate national codes and standards and for international bodies such as the I.S.O. so that the needs and conditions of developing countries might be fully represented.

UNITED NATIONS



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- c) The co-ordination of national societies and professionals in gathering, estimating and developing data on economics of timber construction. It is suggested that a standard range of building designs for industrial and agricultural use, eg, be created in a limited range of spans and types, to serve as a basis for comparisons of materials use and overall costs. The results would be of great use by consultants and builders in promoting the use of timber as and when appropriate.

Furthermore it is suggested that a study be made of the appropriate level of technology to suit the varying conditions existing in countries without advanced timber and timber construction industries. This will look into such aspects, as markets, support facilities, material supply and production, facilities for fabrication and erection, professional and technical capabilities.

- d) Advice to research/technical institutes and universities on appropriate programmes that would provide practical guidance to the construction industry in this field.



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