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14981

Distr.
RESTRICTED

UNIDO/IO/R.188
10 October 1985

ENGLISH

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

Chile.

DEVELOPMENT OF TIMBER CONSTRUCTION.

Mission report*

to the Republic of Chile

Prepared by the
Agro-Industries Branch
Division of Industrial Operations

R. M. Hallet

* This document has been reproduced without formal editing.

CONTENTS

1. Introduction

Mr. Robert M. Hallett, Agro-Industries Branch, spent 12-19 March 1985 in Chile to co-ordinate the start-up of implementation of project SI/CHI/84/803 "Tecnología para la Construcción de Puentes de Madera" and to discuss with representatives of Government, industry and the University of BíoBío the longer term development of the timber industry. The emphasis was on developing the domestic use of timber in construction as a complementary activity to the export trade. Mr. José Carlos Cano (bridge expert 11-01) was in the country at the same time doing the first 2 weeks of a 2 month split mission.

2. Programme

The Director of Research, University of BíoBío, Mr. Marcial Cortés, arranged for visits to the following sawmills and wood industries

2.1. Forestal Mininco S.A. - Aserraderos Mininco, Mulchén, - producing 10,000 m^3/mo sawnwood plus chips, 90% for export, using Linck frame saws and heavy, sophisticated equipment (Mr. Pedro Schlack).

2.2. Forestal Mininco S.A., Forestanac Sawmill, Mulchén - producing 5-6000 m^3/mo, mostly squares for Japan but also planed, profiled cladding and fruit boxes. Very old mill but new manufacturing plant. (Mr. Pedro Schlack).

2.3. Maderas Nacimiento S.A., Nacimiento, - large integrated operation, 100,000 Ha forests, pulp/paper mill and sawmill, kilns, manufacturing plant producing 10,000 m^3/mo sawnwood, including export of structural grades (F-5) to Australia (Mr. Guillermo Doepking)

2.4. Viviendas Tomé Ltda. (plus Sawmill) Tomé, - primitive sawmill producing nevertheless 2000 m^3/mo sawnwood which goes 1/2 for export and 1/2 for remanufacture into timber frame houses of a basic style and quality. Each 3 m x 3 m unit uses 0.25 m^3/m^2 of CCA pressure treated wood but control of moisture content is poor. They also make wood-wool cement infill panels with an excelsior machine and hand labour. Production planning and use of jigs and templates could be much improved. They do no grading but rely on load sharing and probably over-design (Mr. Alejandro Quiero).

2.5. Soma Teja Ltda., Tomé

Small, basic sawmill producing 500 m^3/mo sawnwood and planed/profiled boards for export and domestic markets.

2.6. Korach Sawmill and ARCOLAM, Concepción.

A medium-sized, well run sawmill producing 4500 m^3/mo from its own forest concessions which permits better selection of logs. They control stocks by computer but do not grade until an order is received and made up from stock. Yield at this stage is 75-80% with the rejects being sold for stowage/packing on the ship. Have a Cook-Bolinder finger jointer and produce small quantities of finger-jointed glulam beams and crossarms but do not stress grade nor control finger joint strength. They do however, test glue line of beams by splitting test. Attempts are being made to upgrade products such as by salvage of slabs and finger-jointing these good quality pieces into longer fascia and barge boards and clears (German Tamm Jensen).

2.7. Cimientos BíoBío, División Maderas, Aserradero Loma Colorada, near Concepción.

Large, modern but somewhat irregularly laid out sawmill producing 8-10,000 m^3/mo, 90% for export mostly to Arab Gulf States. Have 4 large high temperature kilns and prefer to sell kiln-dried timber even though no premium is paid in order to ensure good reputation for quality.

Interested in upgrading products such as by stress grading and are participating with 500 m^3 in the export order to Australia of F-5 grade (Helmuth Rademacher Ried).

2.8. Forestal Carampangue Ltda. Laracleta, south of Concepción.

Probably the largest sawmill in South America producing 180.000 m^3/yr sawnwood for export, plus chips. French owned and using Linck frame for large logs and a thick chipper-canter for small logs. Good Vollmer sawdoctoring equipment but kilns are not used due to clients unwillingness to pay premium. Very efficient production but relatively inflexible. (Jorge Rojas).

2.9. Colcura S.A., south of Concepción.

The only large mill processing Eucalyptus globulus into high quality mouldings, profiled boards, dimension stock and graded sawnwood. Selling prices for sawnwood ranges from Pesos 144/bd.ft to Pesos 36/bd.ft. Since Pinus insigne is rather weak, it was felt that the stronger Eucalyptus or other indigenous hardwoods might be considered at a later stage for longer span bridges.

2.10. Cámara Chilena de la Construcción, Concepción.

- Sr. Luis Smith González, President
- Sr. Carlos Yacoman Godoy, Manager

They reported that wood houses have bad reputation and that export quality sawnwood is too expensive for the local market (Export grade: $ 0.20/bf, local poor grade $ 0.12/bf, would pay $ 0.15-0.17/bf for better quality). They admitted that there was a serious lack of familiarity amongst builders about the potential of wood in construction, properties, design and building practice. People do not know that timber framed houses can be earthquake resistant. They would appreciate invitation to attend a seminar on use of wood in construction if organized as extension to the bridge project.

2.11. Fundación Chile, Santiago.

Its origins are ITT and Government, concerned with food production and telecommunications.

There have been involved in wood industries since 1982 and work with a multidisciplinary team of some 20 professionals.

They have confirmed, with Instituto Forestal, that very large volumes of Pine will be available by 1990 and hope to increase domestic uses as well as export. Co-operation with New Zealand has been developed in the belief, on both sides, that this is better than competition so that together they can promote Pine against other materials.

Some 20 international experts have been brought to Chile since then in the fields of Forest Management, Primary Processing. Wood Energy and Markets (new product development and export related aspects such as a quality certification scheme.

They have good relations with University Chile, especially the Faculties of Civil Engineering (for testing), Architecture, and Forest Engineering. The problems of promoting wood for domestic housing market are recognized and include lack of training to architects and engineers, skepticism of financial bodies and current high costs due to export orientation.

The main problem is seen as lack of a national grading system and the very restrictive building code of 1939, but are working with the Cámara Chilena de la Construcción to eliminate unreasonable clauses.

They have developed some prestige town houses designs (3-1/2 storeys) for rebuilding near central Santiago in philosophy that the middle and lower classes will learn to appreciate wood buildings. They have also done middle-class designs and apparently are close to starting construction. The recent earthquakes have helped focus attention on wood houses as have higher energy costs.

They are promoting a Quality Certification scheme and have proposed an ambitious programme to the sawmilling industry for a full in-grade testing programme and inspections of graders funded on a royalty basis. This is now being considered by CORMA (see below). They feel that they and the University of Chile have the necessary prestige and competence to run such a scheme and believe that the relatively new University of BíoBío should play the role of technical institute and provide extension services and training to industry.

2.12. Consorcio Madera Ltda., Santiago.

Mr. Guillermo Guell: Vice-President
Mr. Hugo Zunino Z.: Chairman
Mr. Hernán Cortés S.: Vice-President

The Consortium includes the first (1976) large mills to export significant volumes of pine and now sell $US 40 million per year and are thus very influential in the Corporación Chilena de la Madera (CORMA).

They feel that the time has now come to make a serious attempt to introduce an internationally recognized grading system for export but also for domestic uses and Sr. G. Guell has been appointed chairman of a 4-man committee in charge of studying how to implement it. In fact a meeting was held the preceeding day with industry representatives and Fundación Chile to discuss the Fundación Chile proposal.

A commission has been formed to look into structural uses of pine with two objectives: a) In the short term, to make a lot of emergency houses using Australian/New Zealand grades, and b) to define a complete solution in the long term. The main question is: what is the distribution of actual strength properties of sawnwood, graded by either Australian or New Zealand stress grading rules, compared with the distributions of other sources of Radiata Pine? The commercial implications are very important since Chile would be at a disadvantage if their pine were to be significantly weaker. Yet, the need to use an internationally recognized system is understood. Furthermore, aside from a large Radiata Pine programme, sawmilling patterns must change.

2.13. Cámara Chilena de la Construcción, Santiago.

Mr. Germán Molina Morel: President

Many of the opinions of the Concepción section of the Cámara Chilena de la Construcción were reiterated but Mr. Molina felt that the builders appreciated the value of wood but the public did not. He did feel, however, that the industry could benefit from more courses, seminars and design aids (such as a light timber framing code) coupled with a real improvement in sawnwood quality. They resented buying 20% extra wood to allow for rejects.

Apparently steel trusses are cheaper now for industrial buildings,

although it was recognized that with a change in the sawmilling industry this might change. Mr. Hallett suggested that glulam beams would likely be a good solution in 5 or 10 years since knotty wood was a main defect in Chilean Pine and fingerjointing and glulam techniques could make a substantial improvement in strength properties.

Mr. Molina appreciated that timber frame building would contribute to employment and that the new labour laws made co-operation between workers and management more likely. He would like to be able to build, with international assistance, a typical timber framed house for demonstration purposes - left open in places to show structural details. He was also interested in the potential of pole houses and storage buildings as are common in New Zealand and would appreciate attending a seminar such as will be proposed at the University of Bío Bío.

2.14. PROCHILE - Santiago, Mr. Alexis Avetikian M.

A short visit was paid on the first day to PROCHILE's adviser on the wood industry who supported the need to develop the domestic markets to create a sound base for exports of higher value. He gave some background information on the industry and on the institutional framework.

3. State of sawmilling industry and development plans.

A wide range exists in terms of scale of operation and investment with all mills confronted with the inherent problems of the Pinus insigne raw material - many large or clustered knots, complex sloping grain and a large proportion of juvenile wood which causes distortion on drying, and is very weak.

The domestic market is very weak and almost all mills are oriented towards export so yields are low since little opportunity exists to salvage smaller dimensions from slabs and edgings,

e.g. for tile battens, furniture stock or joinery material.

There is no stress grading practised for domestic use. Exporters grade specifically for each client/order rather than using national grading rules which would be accepted as equivalent to those in the importing country. Consequently there is a quite large loss in picking out from stock sawnwood for export orders - up to 20 or 25% - which is often sold only as stowage or packing on ships. Sales to local buyers are basically 'mill run' with selection and negotiation on price to compensate for quality differences.

A large proportion of production is of large squares for the Japanese market, which incidentally includes the worst part of the stem and leaves the older, better wood for boards and structural pieces. Two groups were preparing a 1500 m^3 order of structural sizes (2" by 3", 4", 6") for Australia and were having difficulty meeting the stress grading rules. This was the only case known of using stress grading. There was a notable lack of familiarity with this field and with the various means of grading by visual or mechanical means except amongst the few leading exporters and the committee formed by CORMA to study this problem.

The larger mills use conventional kilns but the smaller ones only air dry to 'shipping dry' or 22 - 25% moisture content. Only a few sawmills visited had moisture meters with the remainder apparently relying on experience.

Preservative treatment was often inadequate for sophisticated uses since control of moisture content was poor. However, for low-cost housing this was no doubt adequate. A standard apparently exists for treatment requirements but is seldom used.

One firm was making glued-laminated products of kiln-dried, moisture content controlled wood. The automatic, high capacity

finger jointing machine was greatly underutilized since the market was just starting to be developed. Regrettably there was no quality control of the finger-jointing process aside from normal handling and no formal stress grading of sawnwood input. Glue lines of beams were tested by splitting, however. A good idea was being pursued - salvaging high quality board from slabs for finger jointing into clears for fascias or barge boards.

The visit was very timely since the industry is currently studying how to introduce Pine onto structural markets. The question of who should do the testing programme, the training of graders and the quality assurance (QA) or certification scheme are all up for consideration. Whether the industry (CORMA) itself should run a QA scheme with technical input from various sources or whether Fundación Chile (FC) should, and how much it would cost seem to be the main questions.

There are mixed feelings about cost since some believe the FC proposal is too expensive while others, notably Mr. Guell, believe that the industry can support whatever cost is necessary to get into the more sophisticated markets.

The role of the University of Bío Bío is uncertain since the Development Centre is very new and most of the few staff are inexperienced. With international assistance they could manage a full-scale in-grade test programme with support of the industry but it is probably better that the FC and the University of Chile do it. This would leave the University of Bío Bío to the tasks of training graders (via 2 or 3 week courses), developing, testing and demonstrating structural components and products, and undertaking consultancy and extension services for the sawmilling and building industries. They would concentrate on improving the operation of the smaller sawmills in the fields of production engineering and management, marketing, saw doctoring, drying and preservation plus production of joinery and housing.

Finally, it is quite evident that the sawmilling industry is a powerful sector and will determine its own destiny within the international scene. No standards or development plans will be foisted upon them since, within the industry there are highly qualified and experienced people in charge. That is not to say that some international advice and expertise is not required, but that the industry itself is capable of recognizing its deficiencies and of identifying areas where such help is needed.

4. Project SI|CHI|84|803 - Wooden Bridges:

Mr. Marcial Cortés: Director
Mr. Carlos Illabaca: Engineer
Mr. Manuel Barrera: Engineer
Mr. Guillermo Hernandez Vasquez: In charge of Industrial Production

The counterpart agency, Development Centre for Forest Industries, University of Bío Bío, is seriously trying to develop its role between the sawmilling and construction industries - especially in the Concepción area which is the main timber producing one. As part of its strategy, it is learning the technology of UNIDO's low-cost, prefabricated, modular wooden bridge system and will build a prototype bridge this year.

The expert, Mr. José Carlos Cano was in Chile during Mr. Hallett's visit and together they agreed, with the counterparts, on several main points. The details of Mr. Cano's work will be reported separately by him, but by the time of Mr. Hallett's departure:

i) Two possible sites had been selected and three others been discussed.

a) nails were easily available locally (galvanized and with annular shanks for greater withdrawal resistance) and

b) the metal parts could be fabricated locally.

ii) It was decided that the timber was probably better purchased from a large sawmill accustomed to producing stress-graded sawnwood (eg. one of those exporting F-5 grade to Australia) rather than being produced on the old University of Bío Bío sawmill, at least for the first example and re-selected after treatment.

iii) The Ministry of Public Works confirmed its interest in using the system following a seminar|discussion presentation attended by 58 people.

Unfortunately, the Pine is rather weak and 'full of defects' so that the likely maximum span will be 15 metres. Also, at maximum load no reliable data existed for determing the allowable working stresses since no stress grading system exists. Estimates are that, using Australian or New Zealand rules, a 48% grade ratio would yield F-5 grade, and that a better selection, say 65%, would yield F-7 grade.

A small test programme was set up by Mr. Cano to break some 20 pieces of green 2" x 4" on a 2.5 m span. Early results confirmed the above but a better test should eventually be conducted, using dry wood and a larger sample. Also, the test apparatus is rather basic and inadequate for a larger programme - consisting only of a hydraulic jack mounted on a steel frame, with a proving ring and graph paper for a gauge. The maximum load that can be applied is about 120 kg. This is one area in which the University of Bío Bío could be strengthened.

5. Possible extension of SI|CHI|84|803

The original request was for $US 60,000 including 4 months of expert services and $US 7000 for equipment. This was reduced by the Project Review Committee to $US 34,000 . The University of Bío Bío is a new entity but, although very keen to secure a useful role as described above, lacks basic equipment for timber testing and development work and the staff needs more guidance in timber engineering than may have been presumed earlier.

Therefore, they will reiterate their need for an increased international input together with evidence of support from the industry for their objectives. This will probably entail a further 1-1|2 months of expert services and $US 5 or 6,000 of equipment, for a total increase of $US 19 or 20,000.*

A key part of the expert's duties will be to organize a 'timber construction seminar' for engineers, architects specifiers|users and builders, to introduce to them the potential advantages of timber and to explain some of the relevant technology. He would supervise the establishment of an improved timber and timber component test and development programme that would strengthen the Development Centre's activities. He would also advise on an appropriate training programme for timber stress graders (2 or 3 weeks) to be done by the Centre.

This would allow the University of Bío Bío to promote stress grading and Quality Assurance at a more competent level. The Centre also wanted one or two fellowhsips (which would probably be financed from the Regular Budget) to study small scale plantation timber conversion. Countries that would be suitable are: United Kingdom and Eire; Australia and New Zealand, and Mexico, to learn new concepts and solutions in sawmill planning, management and technology.

Finally, a survey of the furniture industry is expected to be completed by the end of April and this could form the basic back-

* The budget was subsequently increased to $US 61,500.

ground information for a training seminar of the type sponsored regularly in the past by Finland on furniture and joinery production. This was discussed with Thomas Reich, Programme Officer, UNDP Santiago, who felt it would also be implemented as a sub-regional project for Chile, Argentina, Perú, Bolivia and Ecuador.

6. Acknowledgements

Grateful thanks are due to Mr. Marcial Cortés, University of Bío Bío, for his constant attention and support in arranging for and accompanying Mr. Hallett on the many visits arranged in the Concepción area. Thanks are also due to Carlos Ilabaca and Manuel Barrera of his staff for their contribution to making the mission a success and to Mr. José Carlos Cano, UNIDO expert, for contributing significantly on technical matters.

Special thanks should also be given to Mr. Víctor Lobos, Rector, University of Bío Bío for his great interest in this sector and his kind hospitality.

The logistic support of Mr. Thomas Reich, UNDP, Santiago, was also much appreciated as was the support given by the industry representatives and others visited who spent much of their valuable time in discussing the development of the forest industry sector and timber construction in Chile.