

TWP

**Timber and Wood Products
Research Centre**

PARTICLEBOARD FORMWORK DEVELOPMENTS
IN BRITAIN, CANADA, & SOUTH AFRICA

TWP Report No. 110
M.H. Murray
May 1984

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1. INTRODUCTION

This report is of a funded consultancy trip undertaken between 11 May and 27 May 1984 on behalf of and sponsored by the Australian Particleboard Research Institute. Research and teaching organisations were visited to discuss present and projected use of particleboard as concrete formwork and to establish and confirm overseas contacts in this area of wood products technology. Objectives were achieved.

Following is a summary of the trip itinerary; Section 2 of the report gives details of each visit; Section 3 of the report is a summary of accomplishments.

Friday 11 May 1984	Rockhampton to Sydney
Saturday 12 May	To Johannesburg
Sunday 13 May	In and around Johannesburg
Monday 14 May	At National Timber Research Institute in Pretoria
Tuesday 15 May	To London
Wednesday 16 May	At Cement & Concrete Association and at Chipboard Promotion Association
Thursday 17 May	At Timber Research & Development Association
Friday 18 May	
to	On leave
Monday 21 May	
Tuesday 22 May	Visited sites in Bristol and Southampton.
Wednesday 23 May	Tour of University of Southampton.
Thursday 24 May	To Toronto via Amsterdam
Friday 25 May	To Vancouver
	At University of British Columbia and Forintek. To Sydney.
Sunday 27 May	Arrive Rockhampton

2. VISIT DETAILS

2.1 South Africa

Sunday May 13

Having hired a car, I spent most of the day driving around and beyond Johannesburg taking photographs of roads, bridges, buildings and housing construction, as well as simply being a tourist. The highway system is superb with a reasonable balance between concrete and asphalt as the pavement material. Concrete block and clay brick are predominant in both high and low cost housing with timber construction being virtually non existent.

Monday May 14

Mr. Peter Sorfa is Head of the Wood Processing and Products Division of the National Timber Research Institute, a part of the Council for Scientific and Industrial Research. I had been corresponding with him during the past year about particleboard formwork, and he had kindly organised a full day of meetings with senior staff of NTRI.

Mr. Sorfa made it clear that the lack of aggressive marketing and of a united front by both the particleboard and plywood manufacturers had allowed the steel producers to obtain more than 70% of the formwork market. Only over the past two months, in fact, had he and others been able to bring various timber and wood panel products people together into a something of a loose alliance. He felt that given the small size of particleboard plants in South Africa and the unwillingness of producers to change the market, no particleboard would be used as formwork sheathing in the foreseeable future. Nevertheless, he believed that there is potential for particleboard, should circumstances change. He held out most hope for a 5-"ply" board using a particleboard core and veneer surfaces which was successful in preliminary trials three or four years ago, but which the company withdrew for other reasons.

Mr. Sorfa's Division is very active in developing wood chip/cement composite building block, brick and panels for use in upgrading the low quality (temporary) housing in which most blacks live. These blocks and panels are not only cheap to produce, but are a very good thermal insulation, are light to handle and utilise currently wasted resource of wood shavings and sawdust.

I spent half an hour with Mr. Mike Singman of the Timber Economics Division on computer simulation of sawing of logs, production planning and industry forecasting. Mike described development and implementation of their SIMSAW log sawing simulation program which helps sawmillers obtain maximum utilisation of any log, with minimal wastage. SIMSAW runs on a CDC main frame computer, but simpler versions are available for individual millers to use on HP85 or IBM microcomputers.

Mr. Franz Louw is researching chemical jointing of timber, particularly glulam and finger joints, and mechanical properties of joined timber. *Eucalyptus grandis* (rose or flooded gum) is used for custom made glulam beams for public buildings and NTRI has established safe working stresses for these. Patula pine is used in "stocklam", an off the shelf glulam beam for non-engineered uses, although NTRI is considering a working stress specification for this also. Franz's and others' research into finger joints has shown that in timber below grade F8, joints have strengths equal to typical defects. Above F8 grade, however, the typical regular milled joint is an undesirable weak point for members in tension. He has developed and is studying a joint which is milled to give a staggered joint line and preliminary tests have shown a 30% increase in strength over the regular joint. My discussions with Mr. Louw finished with him commenting on the problems encountered in connecting rail lines to glulam softwood sleepers.

Mr. Don Priest described sawmilling research. He concentrated particularly on the sawing of *Eucalyptus grandis* since South African softwood sawmillers are very professional in production. Grandis is used increasingly as a substitute for imported meranti furniture, but the bulk of grandis sawn is used for mine props. Problems have been encountered (and overcome) with end splitting, drying, waste and in obtaining pieces thicker than 25 mm.

Ms. Flora Cameron of the Wood Chemistry Division discussed new fast setting cold set adhesives developed especially for finger jointing and, in the future, for glulam joints. Press time is reduced to 2-3 hours and throughput at mills has been increased greatly. The adhesives are a 2-component phenolic wattle system in which pH is adjusted.

The day was completed with a very interesting talk with Messrs Paul Bryant (Head) and Frans Pienaar of the Timber Engineering Division. They were most interested in CIAE's Timber and Wood Products Research Centre and in our Graduate Diploma in Structural Timber Technology. They were keen to organise a regular exchange of reports with TWP for mutual benefit. We spoke of development of unit stresses in timber and wood products, of performance testing of nailed, bolted and nailplate joints, of ingrade testing of timber, and of visual and machine grading of timber. Continued contact with this division should be very useful.

About twenty reports and papers were provided, most of which are coming by sea freight. A full list of publications received from NTRI and other organisations will be available early in July 1984.

2.2 Britain

Wednesday May 16

The morning was spent at the Cement and Concrete Association's headquarters at Wexham Springs in Berkshire. Dr. Bill Cranston, Director of Technical Applications, Dr. Tom Harrison and Mr. Chris Clear were most informative about concrete research at C & CA in general, and about concrete formwork, particleboard in particular.

From theoretical studies and site measurements, they have established that the pressure of water in the pores of a mix of fresh concrete contributes 90% of the overall pressures on a form face. Simple devices using pressure transducers and hypodermic needles were used to study these pressures and similar devices will be adopted at CIAE in any future studies of formwork pressures. New charts are being developed at C & CA to upgrade the old CIRIA standards on which the Australian Formwork Design Code is based.

Of great use was their knowledge of where particleboard was being used in Britain as formwork sheathing. Contacts were supplied in six major building contractors to whom a questionnaire will be sent to ascertain opinions of particleboard when used as concrete forms.

After lunch at the C & CA, I spent the afternoon in very fruitful and cordial discussions with Mr. Ian Lee, Technical Director of the Chipboard Promotion Association at High Wycombe, Buckinghamshire. He had some important views regarding particleboard formwork:

- (a) TRADA comparative tests showed overall that particleboard is no worse than plywood as formwork.
- (b) TRADA tests probably take too long.

- (c) Availability of particleboard in sizes larger than 2400 x 1200 (the usual maximum formply sheet) is a distinct advantage.
- (d) The Concrete Society is concerned about formply pieces being used to span across supports, in its weak transverse direction. Particleboard has no "weak" direction and is superior to ply wrongly so used.
- (e) Proprietary formwork suppliers (e.g. ACROW, RMD) would like to use 12 mm thick particleboard. If designed as a plate, it may be possible.
- (f) Little feedback has occurred as yet regarding the susceptibility to damage of particleboard edges.
- (g) Crane handled made-up panels are the most common way in which forms are used in the UK, which therefore allows the ready adoption of particleboard as a substitute for ply. Particleboard is used occasionally in Europe as "loose" panels fixed in place (typical Australian means of form construction), but it is not recommended.
- (h) In order to ensure minimum objections to the adoption of particleboard by industry, careful preparations are needed:
 - (i) a joint working party is needed with both prominent concrete and prominent timber people as members;
 - (ii) a prominent concrete person must be Chairman;
 - (iii) timber people involved in the exercise must first be fully briefed on demands of the concrete market;
 - (iv) preparation of a paper is needed showing statistics of formwork usage and potential savings possible with particleboard;
 - (v) a working party may be needed to investigate panels on prepared frames;
 - (vi) relevant timber people must be schooled in to thinking along the same lines as the concrete industry, and the two industries must be brought together bringing in timber and concrete engineers.
- (i) Published, accepted data and information must form the basis of discussions.

Ian Lee also spoke briefly about a company in Zurich which reduces edge swelling by injecting resin into the edges, about codes and books being reviewed now, and about a TRADA, CPA and Princes Risborough project starting soon to establish working stresses for particleboard.

Thursday May 17

The day was spent at the Timber Research and Development Association (TRADA) also at High Wycombe. Messrs Harold Burgess and Charles Soothill gave me a guided tour of the premises, as well as introducing a number of other colleagues involved in timber research and the study of formwork.

Charles Soothill is doing much work on the punching shear strength of particleboard, and soon on safe working stresses. He was very interested in Dennis Hanley's work on plate behaviour.

Mr. Richard Hare is the person responsible for improving TRADA tests for comparative evaluation of formwork linings. They are doing a great number of tests on particleboard formwork, and results should be of significance to the APRI/TWP formwork project - they will be available in 1985. I will be keeping in contact with Mr. Hare.

I also spoke with Mr. Chris Mettem about structural uses of wood, especially a timber bridge concept developed for and adopted by developing nations. This information will be useful in teaching timber to undergraduates.

Tuesday May 22

I had intended spending this day with the Cement and Concrete Association, but circumstances at the C & CA made this difficult. Instead, I drove to Bristol to take some photographs of the internationally famous Severn Bridge and of Brunel's 19th century steel suspension bridge. I also managed to obtain photos of some concrete roads and of a bridge construction site in Southampton which showed typical ways in which concrete forms are assembled and handled. In the afternoon I was given a fairly quick tour of Engineering at Southampton University, but it was of limited use as none of the staff interested in timber and concrete were available at that time.

2.3 Canada

Friday May 25

Dr. Ricardo Foschi, Professor of Civil Engineering at the University of British Columbia in Vancouver, devoted the whole day to showing me around the University and their well equipped Engineering laboratories. The work being done on the mechanical properties of timber by himself and by Prof. Borg Madsen is widely recognised as being of the forefront of timber engineering, and it was very rewarding seeing this work "in the flesh".

Dr. Foschi also took me through Forintek's labs where thousands of pieces of lumber are being tested for mechanical properties. Sophisticated data logging and processing facilities at Forintek are very impressive and will be of assistance in present production and commissioning of similar equipment at CIAE.

Dr. Dave Barrett of Forintek met me only briefly, but was able to pass on the address of a contractor who he knew had been using waferboard as concrete formwork in Canada.

3. SUMMARY

This trip was made possible by sponsorship of the Australian Particleboard Research Institute and thanks are expressed to the APRI Council.

It was possible to obtain first hand information about particleboard formwork from people directly involved in research, marketing and use of this material. Further contacts were established to allow follow up with a questionnaire direct to contractors in Britain and Canada.

Standing of the CIAE and the TWP Centre in particular as a centre of excellence in timber research was enhanced by the trip. The NTRI in South Africa was very interested in maintaining contact, and people in TRADA in the UK wished to exchange information in a number of areas.

Finally through the taking of slide photographs of Civil Engineering projects and through talking with engineers in three nations, the writer's teaching of concrete, timber and highway engineering courses will be assisted in being kept relevant and current. Copies of slides will be made available to Dr. A.F. Halligan/APRI.