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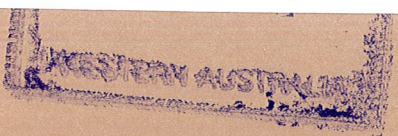
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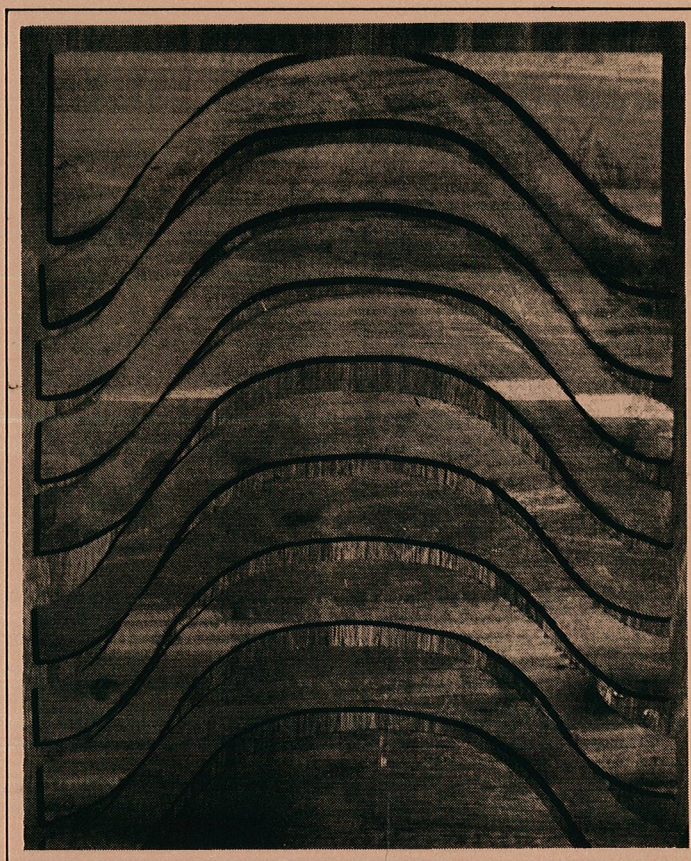


Small Eucalypt Processing



Survey of Solid Wood Sizes Used by the Furniture Industry in Western Australia

by D.J. Challis



Report No 9

March 1989



Wood Utilisation Research Centre
Department of Conservation and Land Management

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by D.J. Challis *

*Present address:

Department of Transport
136 Stirling Highway
NEDLANDS W.A. 6009

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This report is part of a program of industrial research and development aimed at establishing techniques and developing equipment to allow processing of small eucalypt regrowth logs in a commercially viable manner, particularly with a view to use in high quality furniture. The research program is funded jointly by the Commonwealth Government under a Public Interest Project, the Department of Conservation and Land Management, and the Western Australian timber industry.



Wood Utilisation Research Centre

Department of Conservation and Land Management

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SUMMARY

The concept of manufacturing furniture blanks from regrowth jarrah (*Eucalyptus marginata* Donn ex Sm.), to improve the efficiency of utilisation, is being researched by the Wood Utilisation Research Centre. To assess the required dimensions of such blanks, ten furniture manufacturers in the Perth metropolitan area were surveyed and data were collected on solid timber size requirements for constructing furniture. Fifty-five different pieces of furniture were examined.

The survey indicated that the maximum solid timber length required was 2200 mm, but 84 per cent of lengths were less than 1000 mm. Ninety-five per cent of components were less than 35 mm thick (with 70 per cent being under 25 mm) and 76 per cent were less than 100 mm width.

The data were compared with furniture component thicknesses from a U.S.A. survey, which indicated that local component sizes tended to be larger.

INTRODUCTION

The major hardwood species in Western Australia are jarrah (*Eucalyptus marginata* Donn ex Sm.) and karri (*E. diversicolor* F. Muell.). Markets for sawn timber obtained from the old growth eucalypt forests of W.A. are well established. Buyers of sawn timber as raw material for manufacturing are, however, generally restricted to ordering sawn sizes traditionally associated with the building industry. Wood production for the manufacturing industry does not usually include a rational approach to reducing waste and improving productivity in those industries. This is largely due to the wide range of markets served by sawmillers.

Recent research by the Department of Conservation and Land Management at the Wood Utilisation Research Centre at Harvey assessed conventional sawmilling and seasoning methods for producing regrowth jarrah timber. The results indicated that new markets will be needed to ensure success with utilising this regrowth resource in a viable manner. Alternatively, traditional markets may be served with regrowth products that are presented in a different and more appealing form.

The concept of supplying furniture manufacturers with standard size furniture blanks produced from kiln-dried hardwoods, edge - or face-glued where necessary, is being developed as one method of utilising timber from eucalypt regrowth forests.

Research in the USA has shown that small diameter and short logs, yielding low to medium quality timber, can be converted to standard size blanks in which boards are edge- and perhaps butt-jointed with adhesives. These standard blanks can then be processed into the individual parts desired by manufacturers with only small end trim loss (Araman 1982; Araman *et al.* 1982). A survey of 32 major US furniture and kitchen manufacturers revealed that thousands of individual furniture parts were required to construct a wide range of furniture. Subsequent analysis found that if furniture parts could be grouped by width, length and thickness then all the individual furniture parts could be produced from a limited range of standard panel sizes (Araman *et al.* 1982). Reynolds and Araman (1986) then developed a computer program to determine the number of edge-glued standard sized blanks needed for specific components for a given cutting bill.

The concept of dimensioned standard size panels, produced with users' needs in mind, is an attractive option. Consequently, the Department of Conservation and Land Management has established a pilot composite panel production plant at the Wood Utilisation Research Centre at Harvey. For maximum benefits to accrue from this work, it is essential to pursue the marketing concept and examine in detail the requirements of potential markets. The then Forests Department had conducted a broad scale survey in 1983 (Glass and Shedley 1983). This included an assessment of volumes, physical properties required, sizes and grades, and marketing considerations. However, more detailed data on the components were required.

The aim of this present survey was to estimate the current timber size requirements used by furniture manufacturers in Western Australia and to use this information for panel production and marketing.

METHODS

To obtain data on industry-wide wood size requirements, ten furniture manufacturers were surveyed. Each company surveyed cooperated by supplying data on final size requirements for all solid wood components required to construct selected pieces of furniture. Data on 15 pieces of outdoor furniture and 40 pieces of indoor furniture were collected, considering those items in greatest demand. The pieces examined included beds, various dining tables, chairs, lounges and outdoor furniture.

Manufacturers provided data on length and thickness as well as width requirements. Measurement of individual piece size was based on the dimensions of the smallest rectangular or square volume of solid timber purchased or built up sections that formed the component blank. In some cases most or all of the blank was used for the final component. However, where the component was curved only a fraction of the timber was used. Dimensions recorded were supplied by the manufacturer and were as near as possible to final blank size, and all dimensions were recorded in millimetres. There arose the obvious problem of *what constituted the finished size*. For example 25 mm green nominal size may be finished to a thickness between 18 and 22 mm. To simplify the problem, survey data were recorded using the manufacturers' judgement of size.

Unsuccessful attempts were made to record the grade of timber required for component blanks. Because of the wide variety of grading systems used by the industry it soon became apparent that there was a lack of standardisation. For example, different leading suppliers did not grade to the same specification. Timber can be graded to TAS-G4 (1985) (Forest Products Association (W.A.) 1985), to AS2796-1985 (Standards Association of Australia 1985), or to company grading rules. Secondly, grade requirements are further complicated when noting that some manufacturers purchase timber supplies with the intention of regrading to suit the particular application. Manufacturers may also purchase bulk quantities of lower grade timber for further processing at their plant. Selection occurs after the timber has been processed. The quality standards observed by furniture manufacturers are often subjective and prejudiced by the perceived quality and market of the final product.

RESULTS AND DISCUSSION

The frequency distribution of individual furniture components, and the volume of individual furniture components in cubic metres, are shown in Figures 1 to 6. Both number of pieces and volume are shown by the distributions. Normally, sawn timber production is measured by volume requirement for each grade and size (usually end section size). However, as the component size is small it is important to determine the number of pieces required, since handling costs are an inverse function of size. This is particularly the case for furniture sized timber.

The results given in Figure 1 show that 95 per cent of total component thicknesses are less than 35 mm, with 70 per cent being under 25 mm. A similar result is found when frequency is measured by volume, indicating 85 per cent of total volume is less than 35 mm thick, and 46 per cent under 25 mm (Fig. 2). The number of width requirements below 100 mm is 76 per cent of the total (Fig. 3) with 46 per cent of total volume also within this range (Fig. 4). Distribution of length requirements shows that 84 per cent of the total number required are less than 1000 mm (Fig. 5) and 60 per cent of the volume (Fig. 6).

Tables 1 and 2 show the distribution of total components required (by length and width) in six thickness classes for indoor furniture and two classes for outdoor furniture respectively. The data are expressed as a percentage of the total surface area.

Table 1 shows that in indoor furniture timber less than 18 mm thickness is not required over 1000 mm in length and 240 mm wide, with 66 per cent less than 160 mm wide. This thickness range accounted for only 6.8 per cent of total surface area requirements for all indoor furniture.

Component sizes for thickness range 19 to 25 mm indicate that 65 per cent of widths were less than 160 mm, with 40 per cent also less than 1000 mm in length. Wide components constituted the remainder of sizes with 24 per cent being less than 1000 mm long and 11 per cent over 1000 mm. This range of thickness constituted 38.5 per cent of the total surface area of indoor furniture.

For 26 to 35 mm thick components 52 per cent was less than 160 mm wide with 32 per cent less than 1000 mm in length. A further 32 per cent was in the width range greater than 160 mm and less than 1000 mm in length. In all 26 to 35 mm thick timber made up 28.3 per cent of the total surface area of indoor furniture.

The data for 36 to 45 mm thick components show clustering in the length range 400 to 1600 mm and width range 80 to 200 mm. These sizes accounted for 50 per cent of total surface area. Less than 2 per cent of lengths were below 400 mm. An estimated 20.8 per cent of the total surface area of indoor furniture fell within the thickness class 36 to 45 mm.

Components of thickness 46 to 55 mm accounted for only 3.3 per cent of the total with thickness greater than 55 mm falling to 2.3 per cent. The data show a scattered distribution of a limited number of sizes.

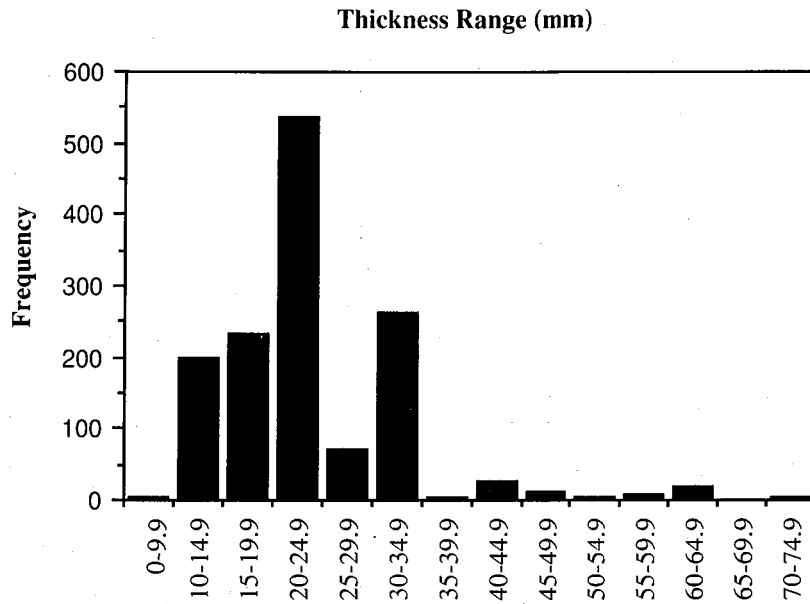


Figure 1: Furniture component thickness - Distribution by number of components.

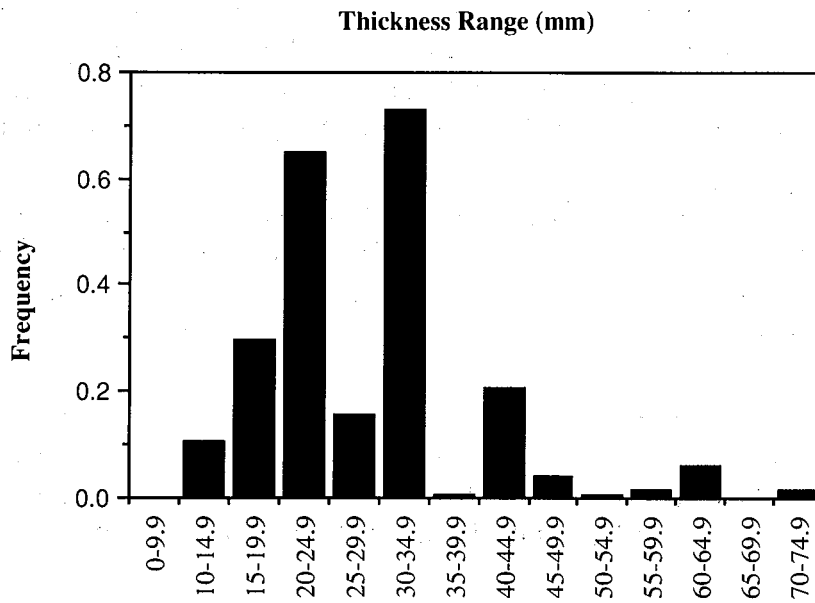


Figure 2: Furniture component thickness - Distribution by volume.

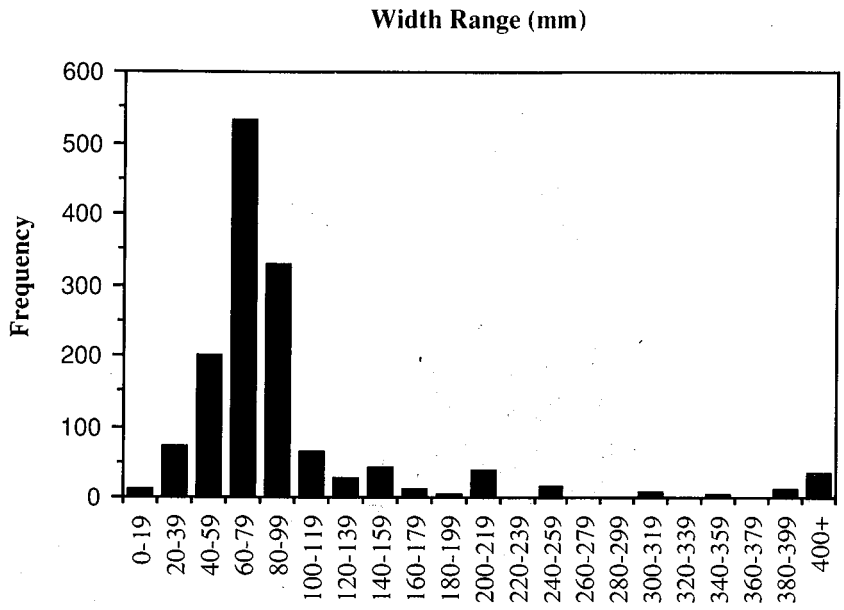


Figure 3: Furniture component width - Distribution by number of components.

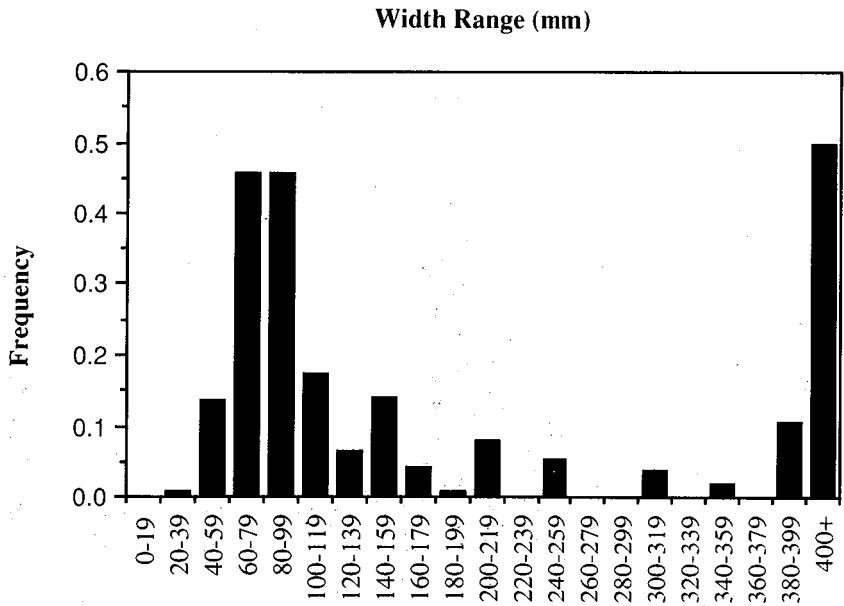


Figure 4: Furniture component width - Distribution by volume.

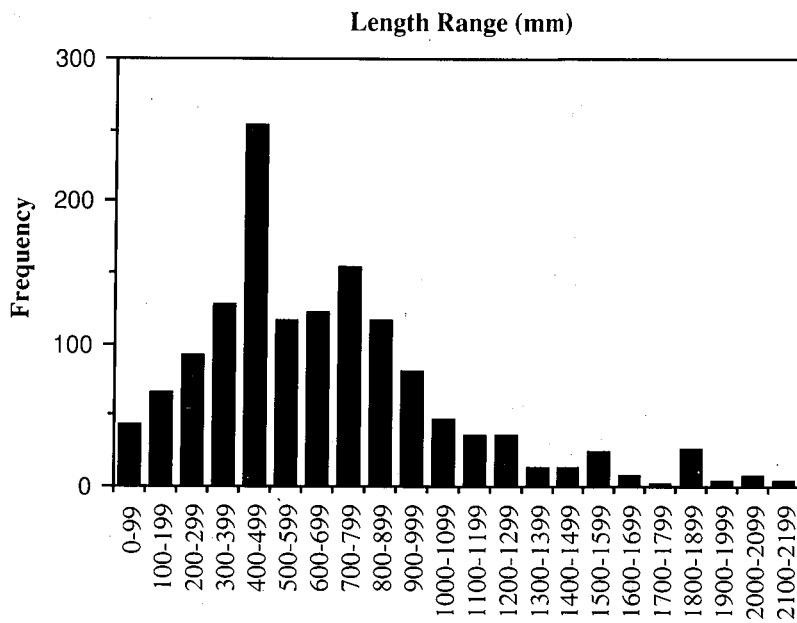


Figure 5: Furniture component length - Distribution by number of components.

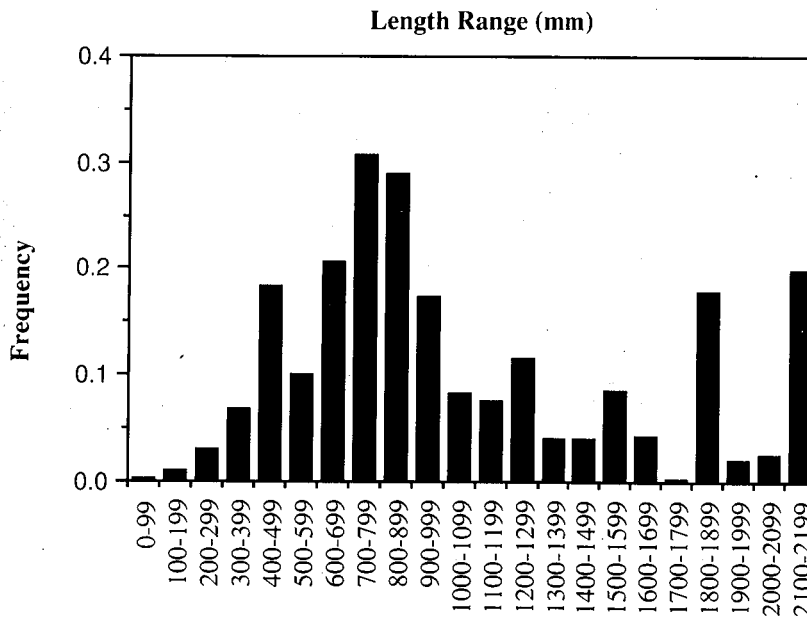


Figure 6: Furniture component length - Distribution by volume.

Table 1
Length/width distribution as percentage of surface area
for timber components of indoor furniture (by thickness class)

Width (mm)	Length range (mm)										
	0 -199	200 -399	400 -599	600 -799	800 -999	1000 -1199	1200 -1399	1400 -1599	1600 -1799	1800 -1999	2000 -2199
< 19 mm thick											
0-39			5.7								
40-79				0.8							
80-119		14.2	13.2		26.4						
120-159			1.9		3.8						
160-199											
200-239		10.4	19.8	3.8							
19-25 mm thick											
0-39	0.2	0.2		0.2	0.1		0.1				
40-79	0.4	4.6	7.5	8.1	5.2	1.5	1.3		0.3	3.4	
80-119	0.5	1.2	1.4	2.4	4.9	4.4	3.2	4.8	0.4	3.2	
120-159		0.8		0.5	2.2	0.4	0.9	0.5		0.7	
160-199											
200-239											
240-279		0.8	1.9		1.2						
280-319	0.1			1.0							
320-359				2.4							
360-399											
400 +				12.5	3.6				1.7	9.3	
26-35 mm thick											
0-39	0.3	0.2		0.1	0.2		0.1		0.3	4.6	2.5
40-79	0.6	5.3	3.0	5.1	1.6	1.6	1.8		0.6	3.2	
80-119	0.6		0.1	6.1	4.5	0.8		1.0		0.9	
120-159		1.1		0.7	3.0	0.6	1.2	0.7			
160-199			0.6								
200-239											
240-279		1.0	2.6		1.6						
280-319	0.2			1.4							
320-359				3.2							
360-399											
400 +				16.9	4.9				2.3	12.9	
36-45 mm thick											
0-39	0.1										
40-79	0.1	1.1	2.7	3.3	1.2	0.6	0.4	2.1	0.9		
80-119			1.8	5.1	5.8	0.6	2.4	4.1	1.6	1.7	2.9
120-159			1.3	2.2	5.8	0.7	2.5	1.9			
160-199			2.5	3.5							
200-239					4.5	3.3					
240-279			1.8								
280-319								2.1	2.0	2.6	
320-359											
360-399					15.7						
400 +							2.4			3.5	3.8
46-55 mm thick											
0-39											
40-79		0.5	0.8	12.1							
80-119			5.8				11.3			5.5	
120-159				11.3							
160-199			2.6								
200-239											
240-279											
280-319											
320-359											
360-399											
400 +				1.6							48.5
> 55 mm thick											
0-39											
40-79		1.4	9.6	28.7	8.7		12.6				
80-119			8.0	5.6							
120-159		1.7	8.5	7.9			7.3				
160-199											

Table 2
Length/width distribution as percentage of surface area
for timber components of outdoor furniture (by thickness class).

		Length range (mm)										
Width (mm)	0 -199	200 -399	400 -599	600 -799	800 -999	1000 -1199	1200 -1399	1400 -1599	1600 -1799	1800 -1999	2000 -2199	
< 25 mm thick												
0-39			0.1									
40-79		1.4	20.4	9.5	8.4	4.2	2.4	3.7				
80-119		2.0	1.9	5.3	12.3	9.6	7.4	6.2		1.4		
120-159			2.1	0.7	1.0							
160-199												
26-40 mm thick												
0-39			0.3									
40-79		3.7	24.9	15.2	5.6	34.2						
80-119				1.8		14.3						
120-159												
160-199												

Table 2 shows the results found for outdoor furniture. Component sizes are all under 160 mm wide. In the 26 to 40 mm thickness range the largest sizes required were up to 120 mm wide and 1200 mm in length. Based on surface area, the requirements for outdoor furniture were: less than 18 mm thickness - 7 per cent, 18 to 25 mm - 80 per cent, and 26 - 40 mm - 13 per cent.

The W.A. data were compared with furniture component thicknesses found through a survey at the U.S.A. International Wood-working Machinery and Furniture Supply Fair 1980 (Araman *et al.* 1982).

U.S. Survey Thickness Distribution*		W.A. Indoor Furniture Thickness Distribution		W.A. Outdoor Furniture Thickness Distribution	
Nominal size mm	%	Range mm	%	Range mm	%
16	5.5	<18	6.8	<18	7.0
25	59.4	19-25	38.5	19-25	80.0
32	16.0	26-35	28.3	>25	13.0
38	6.7	36-45	20.8		
50	6.7	46-55	3.3		
Other	5.7	>55	2.3		

* Percentage of total surface area

Araman *et al.* (1982) recommended hardwood standard panel sizes that conformed with the needs of furniture and cabinet makers detailed in the U.S. survey. Widths were set at either 26 inch (660 mm) or 20 inch (508 mm). Thicknesses were set at 1/8 inch (3.2 mm) over finished size required for the following sizes:

1/2 inch	(12.7 mm)
5/8 inch	(15.9 mm)
7/8 inch	(22.2 mm)
1 1/8 inch	(28.6 mm)
1 3/8 inch	(34.9 mm)
1 3/4 inch	(44.5 mm)

Recommended panel lengths ranged from 12 inches to 100 inches (305 to 2540 mm). The width parameter was set by the largest part width needed for each quality of product.

Results from the present survey show a range of furniture component size requirements which could be obtainable predominantly from short jarrah boards. These results agree with U.S. survey results and confirm that *short length timber is suitable for furniture manufacture*. This result is dependent on correct matching of the size requirements of furniture producers with sawmill production to ensure that waste is minimised.

Initial results from analysis of regrowth sawn production at the Wood Utilisation Research Centre indicated that the maximum thickness for any reasonable production of appearance grade material would be 40 mm. Widths for 25 mm boards are estimated to be up to 190 mm and narrower for thicker sections. The proportion of timber obtained from this regrowth resource that would be required to be edge-glued to meet the needs of furniture manufacturers surveyed is conservatively estimated to be 35 per cent of total sample volume. Fifteen per cent of the total sample volume would require face jointing to make up sections greater than 40 mm thick. Length restrictions are not considered a problem provided production is set to the needs of users, but may occasionally occur if the range of log lengths available is limited.

The concept of producing composite panels is, however, not only to enable the panel manufacturer to produce all the requirements of the furniture industry but also to produce wide sections that have the major benefit of improving efficiency and reducing waste. Cutting multiple matching sections from single panels clearly reduces the actual timber wasted. The purchaser of panels would also have lower inventory and handling costs.

Producing furniture blanks of specific dimensions, tailored to the needs of individual manufacturers, leads to a strategy of differentiated target marketing ie. targeting of specific markets. Yields would be higher and costs easier to determine for the furniture manufacturer. At the same time sawmillers would be adding value to seasoned products and upgrading recovery through docking to grade. The opportunities present in the timber market increase as the supplier recognises that it is made up of customer groups, not all of whom are necessarily receiving complete satisfaction from present market supplies. Producing furniture panels is one way of meeting the requirements of a particular target market.

This survey work highlights the need to establish an acceptable standard grading system for Western Australian furniture timber. Until a universal grading system is adopted it is not possible to accurately estimate the proportion of regrowth timber that would be suitable for furniture production. Rules for measurement and grading of hardwood dimensioned parts are also required to enable the panel manufacturer to meet customer needs.

Future research at the Wood Utilisation Research Centre will include the economics of producing and marketing standard-sized furniture blanks from regrowth hardwoods. Part of this work will involve an examination and application of various grading systems.

ACKNOWLEDGEMENTS

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