

METRIC GUIDE FOR FORESTRY

A GUIDE TO THE INTRODUCTION OF THE METRIC SYSTEM IN BRITISH FORESTRY



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INTRODUCTION

1. This guide outlines proposals for the introduction of the metric system of weights and measures in British forestry and has been approved by the Forestry Commission and the Home Grown Timber Advisory Committee as a basis for more detailed planning by the individual sectors of the industry.
2. This guide does not cover the needs of the sawmilling or other wood processing industries nor does it deal with the special needs of research or of engineering or construction work connected with forestry. A guide for the use of the construction industry was published by the British Standards Institution in February 1967 and one for the engineering industry in July 1968 (see p. 12. References 2*f.* and 2*h.*). The metric system is already widely used in forest research in Britain and further information is available in the National Physical Laboratory publication *Changing to the Metric System* which was revised in 1967. (Reference p. 12. 3*a.*)
3. In 1965 the Government announced its support for the change to metric measurement throughout British industry, partly because more than half our export trade is with countries which use the metric system and partly because the change offers an opportunity to rationalise and standardise the whole of the measurement system. In forestry, as in other industries, full advantage can be derived from the change to the metric system only if use is made of the opportunity to simplify the measurement system. (References: p. 12, 1*a* and 1*b.*)
4. There need be no direct connection between the change to metric measurement and the change to decimal currency which is to take place in February 1971. If, however, both changes could be made at about the same time, an awkward interim period of working with new decimal currency and traditional British measurement units can be avoided. For this reason a summary timetable presented as Table 3 on page 7 of this guide is based on a change to metric measurement in February 1971.
5. Other industries have decided on times for the change to suit their own requirements. The construction industry is aiming to complete most of the change by the end of 1972 and the engineering industry by the end of 1975. These programmes, including that for forestry, depend for their implementation upon co-operation within the industry.
6. Final proposals for the timber trade have not yet (March 1969) been published but the present position is summarised in Appendix IV, page 11.

UNITS OF MEASURE

The International System of Metric Units

7. The traditional metric units have recently been reduced in number and rationalised in the new 'Système International d'Unités' (SI) introduced by the Conférence Générale des Poids et Mesures (CGPM) in 1960. The basic SI units with which forestry is mainly concerned are the *kilogramme* (kg) and the *metre* (m) with its derived units, the square metre (m²) and the cubic metre (m³). These SI units and their multiples will soon be the only legal units of measure in many countries and the British Standards Institution (BSI) and the Ministry of Technology are recommending that they should be adopted in Britain in preference to the traditional metric units.

8. SI units are used in this guide unless the traditional metric units are more convenient (eg. hectares rather than square metres or square kilometres). Sometimes, even when the SI unit is the same as the traditional unit, the traditional name has been retained because the name is more familiar (eg. litre rather than cubic decimetre) or because the name is similar to that of the British unit of approximately equal value (eg. tonne rather than megagramme).

Basic SI Units and Recommended Multiples

9. Multiples and sub-multiples are denoted by prefixes but not all the possible units are in common use. The following table shows the basic SI unit and multiples recommended by the 1966 meeting of the International Standards Organisation (ISO), a recommendation which the Government supports.

The symbols are not abbreviations so they do not have full stops. It should be noted that the same symbol is used for both singular and plural expressions.

TABLE 1
BASIC SI UNITS

Multiplication factor		Prefix	Symbol	Recommended SI unit and multiples			
				Length	Mass	Area	Volume
1 000 000	10 ⁶	mega	M	—	Mg	—	—
1 000 ^l	10 ³	kilo	k	km	kg	km ²	—
100	10 ²	hecto	h	—	—	—	—
10	10	deca	da	—	—	—	—
1	1	—	—	m	g	m ²	m ³
0·1	10 ⁻¹	deci	d	—	—	—	dm ³
0·01	10 ⁻²	centi	c	cm	—	cm ²	cm ³
0·001	10 ⁻³	milli	m	mm	mg	mm ²	—
0·000 001	10 ⁻⁶	micro	μ	μm	—	—	—

Presentation of Numerical Values

10. **Decimal Marker** The decimal point will be retained for the decimal marker to avoid any confusion when mixing currency and measurement values. (The Decimal Currency Board has recommended the use of the point rather than the comma although the latter is used as a decimal marker on the Continent).

The following rules are to apply—

- (a) In printed and hand-written documents, the decimal point will be opposite the middle of the figure, for example 9.9.
- (b) In typewritten and other documents produced on machines, which have no decimal point, the use of a stop on the line is the acceptable alternative, for example 9.9.
- (c) When the value is less than unity, the decimal point should be preceded by zero.

<u>Correct</u>	<u>Incorrect</u>
0.1	.1
0.01	.01
0.001	.001

- (d) The appropriate number of decimal places should be used when it is necessary to convey a particular order of accuracy. Rounding off conventions are given in Appendix II.

11. **Thousand Marker** As the comma is in general use in most metric countries for the decimal marker, its use as the thousand marker is best avoided. Where it is desired to use a thousand marker, it will be provided by means of a space, although for numbers up to and including five figures a space is not essential unless, as in Table 1, it is a matter of aligning figures.

<u>Correct</u>	<u>Incorrect</u>
1 000 or 1000	1,000
10 000 or 10000	10,000
100 000	100,000 or 100000

It should be noted, however, that where money is concerned the Decimal Currency Board favours the use of a comma as the thousand marker because it contends that a space provides an opportunity for fraudulent insertion of extra figures.

FORESTRY USES FOR SELECTED UNITS

12. The following units have been selected for general forestry use rather than for specialist uses. SI basic units or approved multiples have been selected wherever practicable and the total number of units has been kept to a minimum.

(See Table 2 overleaf).

TABLE 2
FORESTRY USES FOR SELECTED UNITS

Selected Unit	Symbol	Suggested Use	Remarks	Equivalents	
				Metric	British
<u>Length</u>					
kilometre	km	Distances, road lengths etc.	--	1000 m	0.62 miles
metre	m	Surveying, tree and log lengths	This is the basic SI unit	1 m	{ 1.1 yards 3.3 feet 0.39 inches 0.31 inches— quarter-girth
centimetre	cm	Tree and log diameters, only	—	0.01 m	
<u>Mass</u>					
tonne	tonne	Pulpwood, etc.	Equivalent SI unit is the megagramme	1000 kg	{ 0.98 tons 19.7 hundred-weights 2.2 pounds
kilogramme	kg	General use	This is the basic SI unit	1 kg	
<u>Area</u>					
hectare	ha	Large topographic areas	The SI unit is the square kilometre	{ 0.01 km ² 10000 m ² }	{ 2.47 acres 11 960 square yards 1.2 square yards 10.8 square feet
square metre	m ²	Small topographic areas, basal area of tree stems	This is the basic SI unit		
<u>Volume</u>					
cubic metre	m ³	Timber volumes, solid and stacked	This is the basic SI unit	1 m ³	{ 35.3 cubic feet 27.7 hoppus feet 1.76 pints 0.22 gallons
litre	litre	Liquid measure	Equivalent SI unit is cubic decimetre	1 dm ³ 1000 cm ³	
<u>Specific Volume</u>					
cubic metres per tonne	m ³ /tonne	Pulpwood, etc.	—	1 m ³ /t	28.2 hoppus feet per ton
<u>Density</u>					
kilogrammes per cubic metre	kg/m ³	Density of timber, other materials	This is the basic SI unit	1 kg/m ³	0.062 pounds per cubic foot
<u>Volume per Unit Area</u>					
cubic metres per hectare	m ³ /ha	Standing volumes, thinning yields	—	1 m ³ /ha	11.2 hoppus feet per acre

CONVERSIONS

13. The British equivalents in Table 2 are approximate values and are intended only to convey the order of the difference between the metric and the British unit. For purposes of conversion, the precise factors in Appendix I, page 8, should be used whenever conversion tables are not available. An alternative to the approximate decimal equivalents given above will be found in Appendix III, page 10. Rules for rounding-off figures when conversions are made appear in Appendix II, page 9.

MEASUREMENT CONVENTIONS

14. In changing to the metric system it seems desirable to adopt at the same time measurement conventions which are in general use in countries already using the metric system. This involves abandoning British conventions such as quarter girth and volumes in hoppus measure, and the acceptance of the following conventions, some of which require little or no change.

Diameters

15. All tree and log thicknesses will be expressed as DIAMETERS even when measured with a girthing tape. Girthing tapes are generally more convenient for small trees, while rules or calipers may be preferable for large standing trees and felled timber of all sizes. Diameters will be rounded down to the nearest whole centimetre.

16. Although the British Standards Institution has recommended that units of length should normally be expressed in either metres or millimetres, it has been decided to use centimetres for diameter measurement, because either millimetres or metres would involve the use of unnecessary digits. Both the B.S.I. and the Ministry of Technology have accepted the use of the centimetre for this purpose. Sawn timber should, however, be described in metres and millimetres exclusively.

Breast Height

17. The conventional height at which the diameter of standing trees is measured will be 1.30m which is almost exactly equivalent to the present limit of 4 ft. 3 in.

Volume Measurement Limit

18. The minimum diameter limit for volume measurement will be 7 centimetres (2.76 inches) over bark which is slightly less than the present limit of 3 inches.

INSTRUMENTS AND MATERIALS

19. Some instruments such as measuring tapes, scale rules and other items of survey equipment are already available in metric units. Girthing tapes calibrated in centimetres diameter will, however, have to be manufactured to special order.

20. Weight scales, liquid containers and most materials will eventually become available as the demand for metric specifications increases. In most instances the influence of forestry on the general demand will be negligible except possibly for items such as wire netting and hand tools where the forestry industry is an important consumer.

21. The Ordnance Survey has announced its intention to produce maps to a 1:10 000 scale to replace the present six-inches-to-one-mile (1:10 560) scale, but it is expected to be about 1985 before the conversion is completed. Thus, for a period of 15 years several types of map will be in use:—

- (a) the existing 1:10 560 County Series, Provisional and Regular Editions.
- (b) Metric 1:10 000 maps with metric contours and spot heights.

This means that two types of scale rule and area grid will be used for many years, and problems may arise when some sheets within a forest area are metric and others not.

LEGISLATION

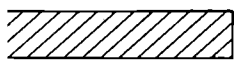
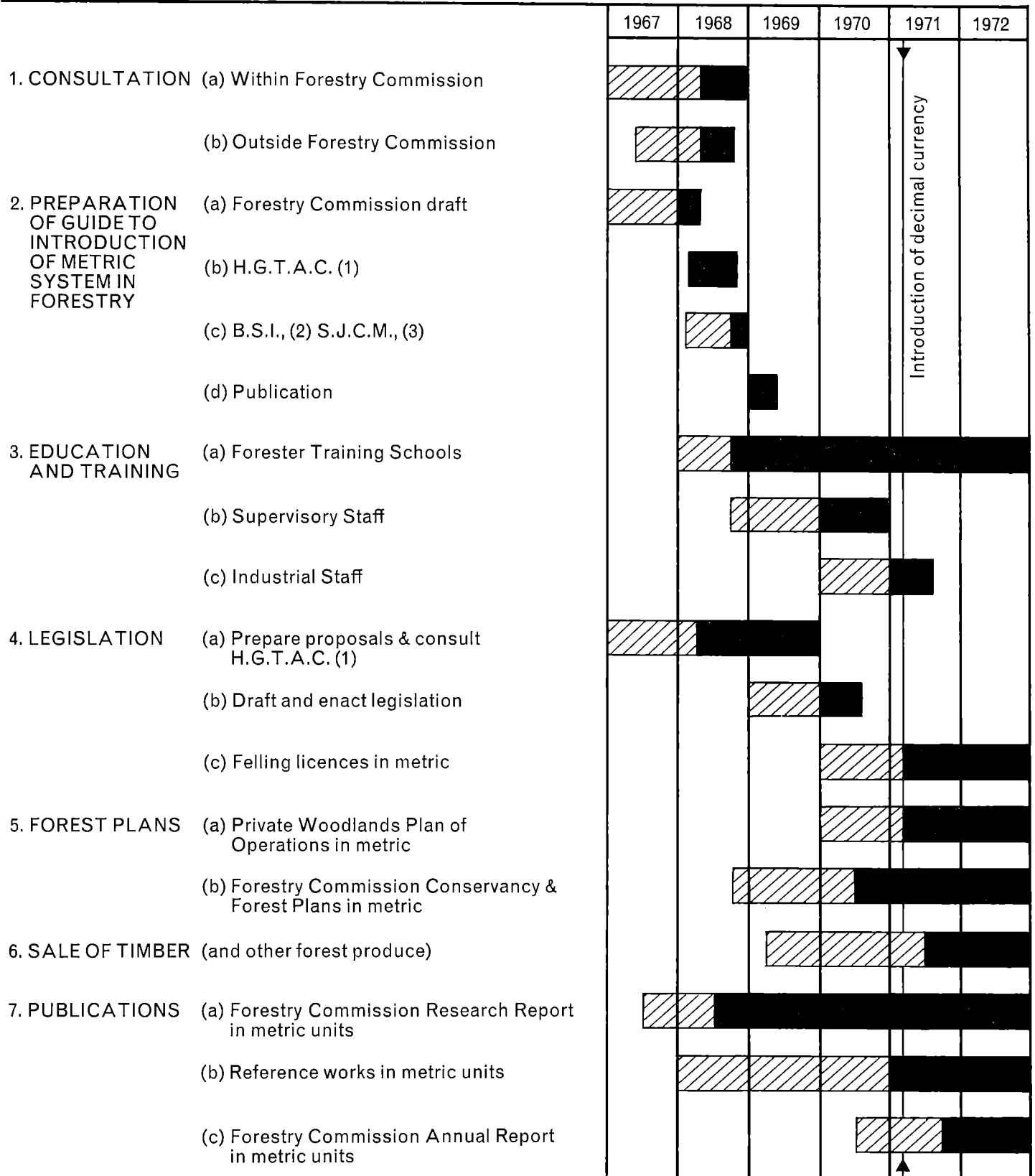
22. Enabling legislation will be introduced to make it possible for changes to be made where necessary by regulations sponsored by the Departments concerned. Most of the proposals outlined in this guide can be implemented without the necessity for further legislation. Measurement units quoted in the existing forestry legislation refer mainly to felling licensing and these references will require amendment before the change to metric measurement can be implemented in this particular field.

MANAGEMENT SERVICES DIVISION
FORESTRY COMMISSION
25 SAVILE ROW
LONDON, W.1.
1st January, 1969.

TABLE 3

SUMMARY TIMETABLE

FOR THE CHANGE TO METRIC MEASUREMENT IN FORESTRY



Preparatory work



Implementation

) H.G.T.A.C.

Home Grown Timber Advisory Committee (Forestry Commission)

) B.S.I.

British Standards Institution

) S.J.C.M.

Standing Joint Committee on Metrication (Ministry of Technology)

APPENDIX I
TABLE OF PRECISE CONVERSION FACTORS

Acre	0.404 686 4 046.86	hectares square metres
Centimetre	0.393 701	inches
Centimetre diameter	0.309 212	inches quarter girth
Chain (66 feet)	20.116 8	metres (exactly)
Cord (128 stacked cubic feet)	3.624 56	stacked cubic metres (stères)
Cubic metre	27.736 1	hoppus feet
	35.314 7	cubic feet
	1.307 95	cubic yards
Cubic metre per hectare	11.224 4	hoppus feet per acre
Cubic yards	0.764 555	cubic metres
Foot	0.304 8	metres (exactly)
Gallon	4.546 09	litres (cubic decimetres)
Hectare	2.471 05	acres
Hoppus foot	0.036 054 0	cubic metres
Hoppus foot per acre	0.089 052 0	cubic metres per hectare
Hoppus foot per ton	0.035 485	cubic metres per tonne
Hundredweight	0.050 802 3	tonnes
Hundredweight per acre	125.535	kilogrammes per hectare
Inch	0.025 4	metres (exactly)
Inch quarter girth	3.234 03	centimetres diameter
Kilogramme	2.204 62	pounds
Kilometre	0.621 371	miles
Litre (cubic decimetre)	0.219 969 1.759 76	gallons pints
Metre	1.093 61 3.280 84	yards feet
Mile (statute)	1.609 34	kilometres
Pint	0.568 261	litres (cubic decimetres)
Pound	0.453 592	kilogrammes
Pound per acre	1.120 85	kilogrammes per hectare
Pound per cubic foot	16.018 5	kilogrammes per cubic metre
Square chain	404.686	square metres
Square foot	0.092 903 0	square metres
Square metre	1.195 99	square yards
Square yard	0.836 127	square metres
Ton (United Kingdom)	1.016 05	tonnes
Tonne	0.984 207	tons (United Kingdom)
Yard	0.914 4	metres (exactly)

NOTE. The above conversion factors are provided for reference purposes. In practice, most conversions will be made by reference to special conversion tables which will usually incorporate the appropriate rounding-off conventions. The above factors may, however, be useful for conversions using a calculating machine. Where it is not possible to give exact conversions, the above factors are expressed to six significant figures.

APPENDIX II

CONVERSION AND ROUNDING OFF

When converting existing measurements into metric values it is important to retain the same level of accuracy implied in the original measurement. To achieve this objective the conversion factor used must be accurate enough to enable the converted value to be rounded off to retain the original accuracy.

Conversion very often involves a number of values of widely differing magnitude all expressed in terms of the same unit e.g. to the nearest acre. To assist in dealing with this type of conversion the following standard conversion rules are recommended:

RULES FOR ROUNDING OFF

Original Values expressed to the nearest:—	Should be converted to the nearest:—	Expressed as a % of the British unit:—
¼ inch quarter girth	cm diameter	124%
Inch diameter	cm diameter	39%
Foot	0.1 metre	33%
Yard	metre	109%
Chain	20 metres	99%
Square foot	0.1 square metre	108%
Square yard	square metre	120%
Square chain	1 000 square metres	247%
0.01 acre	0.01 hectare	247%
0.1 acre	0.1 hectare	247%
Acre	hectare	247%
Hoppus foot	0.1 cubic metre	277%
Thousand hoppus feet	0.1 thousand m ³	277%
Million hoppus feet	0.1 million m ³	277%

It will be noted that hectares and tenths of cubic metres are much coarser units of measure than acres and hoppus feet and there will be a reduction in the number of digits required to express a given quantity. If, however, the original degree of accuracy has to be retained exactly, this will mean using more digits to express a given value. For example, areas less than 10 ha can conveniently be rounded to the nearest 0.5 ha if it is not intended to re-survey the area in terms of the new unit.

APPENDIX III

TABLE OF APPROXIMATE CONVERSIONS

Length	Kilometres	$\times 6/10$	= miles	
	Miles	$\times 10/6$	= kilometres	
	Metres	$\times 1/20$	= chains	
	„	$\times 1$	= yards	
	„	$\times 10/3$	= feet	
	Feet	$\times 3/10$	= metres	
	Chains	$\times 20$	= metres	
	Centimetre	$\times 4/10$	= inches	
	Inches	$\times 10/4$	= centimetres	
	Girth/Diameter	Centimetres diameter	$\times 3/10$	= inches quarter girth
Inches quarter girth		$\times 10/3$	= centimetres diameter	
Area	Hectares	$\times 10/4$	= acres	
	Acres	$\times 4/10$	= hectares	
	Square metres	$\times 1/400$	= square chains	
	„ „	$\times 6/5$	= square yards	
	„ „	$\times 11$	= square feet	
	Square chains	$\times 400$	= square metres	
	„ yards	$\times 5/6$	= „ „	
	„ feet	$\times 1/11$	= „ „	
	Weight	Tonnes	$\times 1$	= tons
		Kilogrammes	$\times 11/5$	= pounds
Pounds		$\times 5/11$	= kilogrammes	
Volume	Cubic metres	$\times 7 \times 4$	= hoppus feet	
	Hoppus feet	$\frac{\times 9 \times 4}{1000}$	= cubic metres	
Volume/Area	Cubic metres/hectare	$\times 11$	= hoppus feet/acre	
	Hoppus feet/acre	$\times 1/11$	= cubic metres/hectare	
Volume/Weight	Cubic metres/tonne	$\times 7 \times 4$	= hoppus feet/ton	
	Hoppus feet/ton	$\frac{\times 9 \times 4}{1000}$	= cubic metres/tonne	
Weight/Area	Kilogrammes/hectare	$\times 8/1000$	= hundredweights/acre	
	Hundredweights/acre	$\times 1000/8$	= kilogrammes/hectare	

NOTE. The above multipliers are over-simplified to make mental arithmetic easier in the introductory stage, until the industry has become accustomed to “thinking metric”. They should not be used to convert measurements or records for which the precise factors or conversion tables are more appropriate.

APPENDIX IV

METRIC SIZES FOR SAWN SOFTWOOD

Cross-Sections

The table below gives the cross-section sizes for sawn softwoods which will probably be adopted by the Timber Trade Federation and by the major exporting countries. This information will probably be published as a British Standard Specification "Metric Dimensions for Softwood". The sizes are related to, but not identical with, some which have been in use for many years in imperial measure. The relationship is usually close enough to avoid the need to redesign.

BASIC SIZES FOR SAWN SOFTWOODS

Thickness in millimetres	Width in millimetres									
	75	100	115	125	150	175	200	225	250	300
16	×	×		×	×					
19	×	×		×	×					
22	×	×		×	×					
25	×	×		×	×	×	×	×	×	×
32	×	×	×	×	×	×	×	×	×	×
38	×	×	×	×	×	×	×	×	×	×
44	×	×	×	×	×	×	×	×	×	×
50	×	×	×	×	×	×	×	×	×	×
63		×		×	×	×	×	×		
75		×		×	×	×	×	×	×	×
100		×			×		×		×	×
150					×		×			×
200							×			
250									×	
300										×

NOTE. In accordance with the convention agreed by the construction and engineering industries, millimetres rather than centimetres will be used for all widths and thicknesses.

Lengths

The agreed lengths begin at 1.80 metres and rise by increments of 0.30 metres to give a series:—

1.80; 2.10; 2.40; 2.70; 3.00; 3.30; 3.60;
3.90; 4.20; 4.50; 4.80; 5.10; 5.40; 5.70;
6.00; 6.30;

It is understood that the softwood shippers will be producing these metric sizes for the 1970 shipping season, and that the building industry will be ordering in metric sizes also in that year.

It should be noted that no agreement had been reached by the hardwood importers by the end of October 1968.

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