BMN Building Metrication News

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This section appears in the second and fourth issues of 'Building' each month, and gives current news and information on metrication, as well as providing a forum in which the ramifications of the change to metric can be freely discussed. It is published in association with the Modular Society.

CONTENTS

The BMN monthly check list

As we have now entered the practising stage of the metric change, a good deal of information is being released that the designer needs to have at his fingertips. To provide him with a handy and up-to-date reference, we provide, below, a summary of all relevant publications, news and decisions that have been published in BMN since the beginning of the year. Subsequently, we shall be covering such items in the second issue of BMN in each month.

Guide to SI units: Publication of second edition of PD6031 by BSI: a revised guide to the metric system showing the units that are to be used under the SI system, which the UK is adopting. ('Building,' 24 January, p. 119.)

Dimensional co-ordination: The second of MPBW's Going Metric series provides a guide to the principles and applications of dimensional co-ordination. ('Building,' 24 January, p. 119.)

Flat glass: Plans to complete metrication of flat glass supplied to the UK construction industry by 1 October 1970 have been announced by Pilkington. ('Building,' 14 February, p. 132.)

Electrical engineering: In formulating their metric programme, the industry expects the main period of change for accessories and components to be between 1971 and 1974 and for industrial electric and electronic equipment between mid-1971 and mid-1975. ('Building,' 14 February, p. 132.)

Softwood sizes: The final range of softwood metric sizes agreed with the major producing countries has been announced by the Timber Trade Federation. A schedule was issued last June—published in 'Building,' 28 June, p. 120—and some modifications have now been made in the final schedule. ('Building,' 14 February, p. 132.)

Guidance for contractors: RIBA Practice Note No. 14 offers advice to contractors who may find that components and materials referred to in metric in the contract document are only available in imperial measure. ('Building,' 14 February, p. 144.)

Concrete pipe sizes: A metric range of standard concrete pipe diameters has been recommended by the Concrete Pipe Association for adoption by BSI. ('Building,' 28 February, p. 106.)

Concrete design charts: New tables and charts for the design of beams and slabs and of columns to be used in conjunction with CP 114 'The structural use of reinforced concrete in buildings, part 2: 1969: Metric units' has been published by the Cement and Concrete Association. ('Building,' 28 February, p. 106.)

Metric housing—what it means: An NBA publication based on one of the talks given at the series of NBA metric seminars held for local authorities last year. It is designed in booklet form for members of the design team ('Building,' 28 February, p. 106.)

Spaces for doors: In commenting on the BSI Draft for Basic spaces for Functional Group Panel 2 (External envelope), The British Woodwork Manufacturers' Association has recommended an additional width of 1 000 mm for non housing purposes to accommodate a door width of 926 mm. ('Building,' 14 March, p. 150.)

Proposals for timber units: BWMA proposals, issued as general guidance for architects, for metric sizes for doors, windows, kitchen units, etc. This is intended as an interim document until BSI announce, probably later this year, metric sizes for individual components. ('Building,' 28 March, p. 125.)

Concrete blocks: Manufacturers will be making available blocks measuring 200 mm × 400, 450, 500 and 600 mm long during 1969. ('Building,' 28 March, p. 125.)

Concrete bricks: A metrically co-ordinated concrete brick size (200 × 100 × 75 mm) is proposed besides other metric sizes. ('Building,' 28 March, p. 125.)

Span charts for beams: A set of charts for solid timber beams, prepared by Trada, combine metric and imperial units. ('Building,' 11 April, p. 136.)

Design of timber components using SI

Codes of practice for the main structural materials are now undergoing revision to metric units, while many structural designers have, for some time, been familiarising themselves with the new units by means of direct conversions from existing data. The aim of the following notes and calculations, by G. McDonnell, CEng, AMIStructE, lecturer in Theory of Structures and Structural Design at Mid-Essex Technical College and School of Art, Chelmsford, is to give some guidance to students and others who may be called on only occasionally to carry out designs for timber components using the SI units.

The starting point for design problems in such cases will be to arrive at an estimate of the loadings to be carried. To conform to the SI system of units it is necessary to have densities of the materials in units of kilograms per cubic metre (kg/m^3) in order to arrive at the amount of mass loading. Live loading for various types of occupancies are available in SI units and these can be found in CP3. Chapter V: Loading, the units used being kilo newtons per square metre (KN/m^2). Before adding together the mass loading and live loading both must be brought to the same units. To do this kilograms are multiplied by 9·806 (9·81 approximate) to give newtons.
The appropriate code of practice for design of timber components is CP112. The Structural Use of Timber. In the current edition of that code, permissible stresses are still in imperial units so that conversion to SI units is necessary if one is to design in the latter.
The examples of beam design chosen for illustration in this article apply to a typical domestic floor with a large stairwell opening, necessitating the use of a fairly heavy trimmer beam. The stresses used are direct conversions from those given in CP 112 and Grade 50 dry softwood (Group 2 species) has been used throughout. The approach to the beam design, in accordance with usual practice, follows the sequence:

(a) Compute the loading
(b) Design for bending
(c) Design for deflexion
(d) Design for shear
(e) Design for bearing

In many cases the experienced designer will omit calculations for the obvious safe conditions but for the purpose of this article calculations are executed in full.
Permissible loads for timber columns are included in table form for a range of sizes commonly used in practice and for different effective lengths. The final example shows how the permissible loads are calculated.

SI Conversions for Densities of Materials

The available mass densities of materials given in pounds per cubic foot, lb/ft^3, may be converted to kilograms per cubic metre, kg/m^3, by multiplying by 16·018.
e.g. Average mass density of S2 softwood = 35 lb/ft^3

$35 \times 16{\cdot}018 = 560$ kg/m^3

The mass of materials per metre run can now be calculated for the various sections.
e.g. For 50 mm × 100 mm section

$1 \times 0{\cdot}05 \times 0{\cdot}1 \times 560 = 2{\cdot}8$ kg per metre run.

The mass per metre run for the various preferred sections are given in Table 2.
Other materials encountered in routine design include:
Brickwork at 112 lb/ft^3 = $112 \times 16{\cdot}018$ kg/m^3 = 1794 kg/m^3
Concrete at 150 lb/ft^3 = $150 \times 16{\cdot}018$ kg/m^3 = 2402 kg/m^3
It is sometimes necessary to convert lb/ft^2 to kg/m^2 for certain thicknesses of materials such as plaster and boarding. This is done by multiplying by 4·882.

e.g. Plaster of a given thickness having a mass of 12 lb/ft^2

$= 12 \times 4{\cdot}882$ kg/m^2
$= 58{\cdot}58$ kg/m^2

Boarding of a given thickness having a mass of 4 lb/ft^2

$= 4 \times 4{\cdot}882$ kg/m^2
$= 19{\cdot}528$ kg/m^2

In each case when the full mass loading is computed in kg this is converted to units of force (newtons) by multiplying by 9·81 as shown in the design example.

SI Conversions for Stress

Once permissible stresses in SI units are clearly established, appreciation of their magnitude is not difficult. For instance, taking mega newtons per square metre (MN/m^2) as the unit of stress, this can be readily converted to pounds force per square inch (lbf/in^2) for comparison, simply by multiplying by 145.
e.g. 6·2 MN/m^2 = $6{\cdot}2 \times 145$ lbf/in^2 = 900 lbf/in^2
Similarly conversions from imperial to SI units can be made by dividing by 145.

$$\text{e.g. } 1\,200\ \text{lbf/in}^2 = \frac{1\,200}{145}\ \text{MN/m}^2 = 8{\cdot}28\ \text{MN/m}^2 = 8{\cdot}28\ \text{N/mm}^2$$

Note that numerically MN/m^2 = N/mm^2 because $\text{MN} = \dfrac{\text{N}}{10^6}$ and $\text{m}^2 = \dfrac{\text{mm}^2}{10^6}$

On this basis the permissible stresses for Grade 50, S2 softwood (dry timber) given at present in CP 112 can be converted to give the following table.

TABLE I

GRADE STRESSES FOR DRY TIMBER Species group S2, Grade 50	MN/m^2	lbf/in^2
Bending and tension parallel to the grain	6·2	900
Compression parallel to the grain	4·83	700
Compression perpendicular to the grain	1·51	220
Shear parallel to the grain	0,76	110
Modulus of elasticity—mean (E) —minimum	$8{\cdot}29 \times 10^3$ $4{\cdot}50 \times 10^3$	$1{\cdot}2 \times 10^6$ $0{\cdot}65 \times 10^6$

Sizes of Sawn Sections and their Geometrical Properties

Standard sawn sections have been recommended by the BSI, the dimensions being given in millimetre units. The geometrical properties of these sections can be calculated by using the normal mathematical formulae. It will be found that the results give relatively large numbers. These are best expressed in powers of ten as it makes for simplicity in the design calculations.
e.g. Adopting the 50 mm × 100 mm section for illustration

$$\text{Area} = 50 \times 100 = 50 \times 10^2\ \text{mm}^2$$

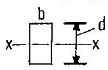
$$\text{2nd Moment of Area} = \frac{bd^3}{12} = \frac{50 \times 100^3}{12} = 4{\cdot}16 \times 10^6\ \text{mm}^4$$

$$\text{Section Modulus} = \frac{bd^2}{6} = \frac{50 \times 100^2}{6} = 83{\cdot}3 \times 10^3\ \text{mm}^3$$

The values given in Table 2 have been calculated in this way.

TABLE 2

Sawn size

b x d 

Properties of timber sections

Imperial in. × in.	S.I. mm × mm	Kg per metre (S2 softwood)	Area mm^2	Ixx mm^4	Zxx mm^3	Moment of resistance Nm (f 6·2 MN m^2)
2 × 4	50 × 100	2·80	50×10^2	$4{\cdot}16 \times 10^6$	$83{\cdot}3 \times 10^3$	516·46
2 × 5	50 × 125	3·50	$62{\cdot}5 \times 10^2$	$8{\cdot}136 \times 10^6$	$130{\cdot}2 \times 10^3$	807·24
2 × 6	50 × 150	4·20	75×10^2	$14{\cdot}06 \times 10^6$	$187{\cdot}5 \times 10^3$	1162·50
2 × 7	50 × 175	4·90	$87{\cdot}5 \times 10^2$	$22{\cdot}33 \times 10^6$	$255{\cdot}2 \times 10^3$	1582·24
2 × 8	50 × 200	5·60	100×10^2	$33{\cdot}33 \times 10^6$	$333{\cdot}3 \times 10^3$	2066·30
3 × 4	75 × 100	4·20	75×10^2	$6{\cdot}248 \times 10^6$	125×10^3	775·00
3 × 5	75 × 125	5·25	$93{\cdot}75 \times 10^2$	$12{\cdot}20 \times 10^6$	$195{\cdot}3 \times 10^3$	1210·86
3 × 6	75 × 150	6·30	$112{\cdot}5 \times 10^2$	$21{\cdot}09 \times 10^6$	$281{\cdot}3 \times 10^3$	1744·06
3 × 7	75 × 175	7·35	$131{\cdot}3 \times 10^2$	$33{\cdot}49 \times 10^6$	$382{\cdot}7 \times 10^3$	2372·72
3 × 8	75 × 200	8·40	150×10^2	$50{\cdot}00 \times 10^6$	500×10^3	3100·00
3 × 9	75 × 225	9·45	$168{\cdot}8 \times 10^2$	$71{\cdot}19 \times 10^6$	$632{\cdot}8 \times 10^3$	3923·36
4 × 4	100 × 100	5·60	100×10^2	$8{\cdot}33 \times 10^6$	$166{\cdot}6 \times 10^3$	1032·00
4 × 6	100 × 150	8·40	150×10^2	$28{\cdot}13 \times 10^6$	375×10^3	2326·86
4 × 8	100 × 200	11·20	200×10^2	$66{\cdot}66 \times 10^6$	$666{\cdot}6 \times 10^3$	4132·92
4 × 10	100 × 250	14·00	250×10^2	$130{\cdot}19 \times 10^6$	1042×10^3	6460·00
4 × 12	100 × 300	16·80	300×10^2	$225{\cdot}00 \times 10^6$	1500×10^3	9300·00
6 × 6	150 × 150	12·60	225×10^2	$42{\cdot}19 \times 10^6$	$562{\cdot}5 \times 10^3$	3490·00
6 × 8	150 × 200	16·80	300×10^2	$99{\cdot}99 \times 10^6$	$999{\cdot}9 \times 10^3$	6199·38
6 × 12	150 × 300	25·20	450×10^2	$337{\cdot}50 \times 10^6$	2250×10^3	13950·00
8 × 8	200 × 200	22·40	400×10^2	$133{\cdot}30 \times 10^6$	1333×10^3	8280·00
10 × 10	250 × 250	35·00	625×10^2	$325{\cdot}47 \times 10^6$	2604×10^3	16200·00
12 × 12	300 × 300	50·40	900×10^2	$675{\cdot}00 \times 10^6$	4500×10^3	27900·00
(Approx.)	(Actual)	(Mass)				

Design Example

Consider a domestic timber floor with stairwell and joist arrangement as shown in Fig. 1.

Loading

Floor boards	15 kg/m^2
Ceiling	30 kg/m^2
Joists	9 kg/m^2
	54 kg/m^2

$$\frac{54 \times 9{\cdot}81}{10^3} = 0{\cdot}53\ KN/m^2$$

Live load $= 1{\cdot}50\ KN/m^2$

Total $= 2{\cdot}03\ KN/m^2$

Design of joists (Mark A)

Loading on each joist $= 2{\cdot}03 \times$ spacing

$= 2{\cdot}03 \times 0{\cdot}445$

$= 0{\cdot}903$ KN/m

$$B.M. = \frac{0{\cdot}903 \times 3{\cdot}3^2}{8}$$

$= 1{\cdot}23$ KNm

Permissible stress for S2 Grade 50 dry timber $= 6{\cdot}2\ MN/m^2$

Modification factor for load sharing $= 1{\cdot}1$

$$Z \text{ required} = \frac{BM}{f} = \frac{1{\cdot}23 \times 10^3 \times 10^3}{6{\cdot}2 \times 1{\cdot}1}$$

$= 180{\cdot}3 \times 10^3\ mm^3$

From table number 2 choose 50 × 175

$Z = 255{\cdot}2 \times 10^3)$

$E = 8{\cdot}28 \times 10^3$

$I = 22{\cdot}33 \times 10^6$

$$\text{Deflexion} = \frac{5\ WL^3}{384\ EI}$$

$$= \frac{5 \times 0{\cdot}903 \times 10^3 \times 3{\cdot}3 \times 3{\cdot}3^3 \times 10^9}{384 \times 8{\cdot}28 \times 10^3 \times 22{\cdot}33 \times 10^6}$$

$= 7{\cdot}5$ mm—Satisfactory.

$$\text{Shear stress} = \frac{0{\cdot}903 \times 10^3 \times 3{\cdot}3 \times 1{\cdot}5}{2 \times 50 \times 175}$$

$= 0{\cdot}255\ MN/m^2$

$$\text{Minimum bearing length required} = \frac{0{\cdot}903 \times 10^3 \times 3{\cdot}3}{2 \times 50 \times 1{\cdot}51}$$

$= 19{\cdot}75$ mm

Design of Beam B

$$\text{Loading} = \frac{2{\cdot}03 \times 3{\cdot}3}{2} \qquad Z\text{ required} = \frac{2{\cdot}072 \times 10^3 \times 10^3}{6{\cdot}2}$$

$= 3{\cdot}35$ KN/m $\qquad = 334 \times 10^3\ mm^3$

$$B.M. = \frac{3{\cdot}35 \times 2{\cdot}225 \times 2{\cdot}225}{8}$$

$= 2{\cdot}072$ KNm

To satisfy the code maximum permitted deflexion $= 0{\cdot}003 \times 2{\cdot}225 \times 10^3$

$= 6{\cdot}675$ mm

For practical reasons limit the deflexion to 5·5 mm

$$\text{then } 5{\cdot}5 = \frac{5\ WL^3}{384\ EI}$$

$$\text{therefore I} = \frac{5 \times (3{\cdot}35 \times 2{\cdot}225 \times 10^3) \times (2{\cdot}225^3 \times 10^9)}{384 \times 4{\cdot}5 \times 10^3 \times 5{\cdot}5}$$

$I = 43{\cdot}19 \times 10^6\ mm^4$

Note: As beam B is a principal member the minimum value for E has been used.

Use two 50 × 175 (bolted side by side)

$I = 44{\cdot}66 \times 10^6\ mm^4$

$Z = 510{\cdot}4 \times 10^3\ mm^3$

$$\text{Maximum shear force} = \frac{3{\cdot}35 \times 2{\cdot}225}{2}$$

$= 3{\cdot}725$ KN

$$\text{Horizontal shearing stress} = \frac{1{\cdot}5 \times 3{\cdot}725 \times 10^3}{2 \times 50 \times 175}$$

$= 0{\cdot}319\ N/mm^2$

$= 0{\cdot}319\ MN/m^2$

$$\text{Minimum bearing length required} = \frac{3{\cdot}725 \times 10^3}{2 \times 50 \times 1{\cdot}51}$$

$= 24{\cdot}67$ mm

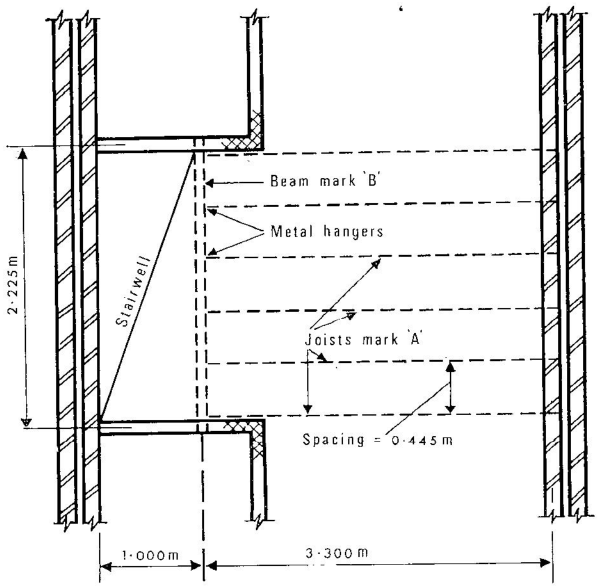


FIG. 1. Stairwell and joist arrangement.

Strength of Timber Columns

When designing timber columns in accordance with CP 112 one must take into account the effects of slenderness on the load carrying capacity of the section. Thus a modification factor is applied to the grade stress in compression parallel to the grain according to the slenderness ratio of the column.

Table 15 of CP 112 gives the appropriate modification factor (K_{18}) for the various grades of softwood and it may be used without conversion when working in SI units. It will be noted that the coefficient varies according to the three types of loading, long term, short term and medium term. This modification factor is found by calculating the values L/b and L/r and obtaining the appropriate corresponding value of K_{18} from the table as illustrated by the example.

Design of Timber Columns to CP 112

To calculate the safe load on a 150 × 150 timber column 2·900 m high in S2 grade 50 softwood.

Assume ends hinged.

$$\text{Radius of gyration of the section} = \sqrt{\frac{Ixx}{Area}}$$

$$= \sqrt{\frac{42{\cdot}19 \times 10^6}{225 \times 10^2}}$$

$= 0{\cdot}1858 \times 10^4$

$= 43{\cdot}3$ mm

$$L/r = \frac{2{\cdot}9 \times 10^3}{43} = 67{\cdot}5$$

$$L/b = \frac{2{\cdot}9 \times 10^3}{150} = 19{\cdot}3$$

Referring to table 15, CP 112, for long term loads modification factor

K_{18} for L/r of 60	$= 0{\cdot}83$
70	$= 0{\cdot}77$
difference	$= 0{\cdot}06$ for 10
therefore	$= 0{\cdot}045$ for 7·5
K_{18} for 67·5	$= 0{\cdot}83 - 0{\cdot}045$
	$= 0{\cdot}785$
Permissible load on column (stress × area × K_{18})	$= 4{\cdot}83 \times 225 \times 10^2 \times 0{\cdot}785$
	$= 85\ 000$ N
	$= 85$ KN

TABLE 3

Permissible loads in kN for timber columns of S2 grade 50 softwood (long term loads)

Size mm		Effective length in metres 2·500	2·750	3·000	3·250	3·500	Geometrical properties Iyy	least r	Area
75	100	15·00	13·40	11·23	9·78	8·69	$3{\cdot}51 \times 10^6$	21·6	75×10^2
75	125	18·75	16·75	14·04	12·23	10·87	$4{\cdot}394 \times 10^6$	21·6	$93{\cdot}75 \times 10^2$
75	150	22·50	20·10	16·85	14·67	13·04	$5{\cdot}273 \times 10^6$	21·6	$112{\cdot}5 \times 10^2$
75	175	26·25	23·46	19·66	17·12	15·22	$6{\cdot}152 \times 10^6$	21·6	$131{\cdot}3 \times 10^2$
75	200	29·99	26·80	22·46	19·56	17·39	$7{\cdot}031 \times 10^6$	21·6	$150{\cdot}0 \times 10^2$
75	225	33·75	30·17	25·27	22·01	19·57	$7{\cdot}909 \times 10^6$	21·6	$168{\cdot}8 \times 10^2$
100	100	30·91	27·53	24·34	21·73	18·83	$8{\cdot}33 \times 10^6$	28·9	100×10^2
150	150	91·29	88·03	83·68	79·33	74·99	$42{\cdot}19 \times 10^6$	43·3	225×10^2
200	200	173·30	170·02	166·15	163·25	159·42	$133{\cdot}30 \times 10^6$	57·7	400×10^2
250	250	280·74	277·72	272·89	268·67	265·65	$325{\cdot}47 \times 10^6$	72·2	625×10^2
300	300	408·62	404·27	402·53	399·05	395·58	$675{\cdot}00 \times 10^6$	86·6	900×10^2
Size		Permissible load kN					Properties		

News from the industry

Ready mixed plans

Provided the necessary legislation has been passed, the British Ready Mixed Concrete Association has resolved that all its members should change over simultaneously to the metric system of units and to decimal currency for deliveries of ready mixed concrete after 31 December 1970.
Before 1 January 1971 orders will be delivered only in imperial units (ie cubic yards). Where any customer orders in metric units for delivery before 1 January 1971, the order may be converted to the nearest ¼ cubic yard above, and invoiced as though it had been placed in imperial units.
After 31 December 1970, orders will be delivered only in metric units (ie cubic metres) and invoices will be made out in decimal currency. Where any customer orders in imperial units for delivery after 31 December 1970, the order can be converted to the nearest 0.1 cubic metre above, subject to legislation permitting metric deliveries, and invoiced as though it had been placed in metric units.
Such an arrangement will ensure that the supply of concrete from all sources is maintained in one system of units to minimise confusion and mistakes. Conversion tables will shortly be made available.

Additional block dimension

To the metric dimensions given for concrete blocks to be available later this year ('Building,' 28 March, p. 125), a further length—450 mm—should be added. The full range of metric blocks to be supplied by manufacturers will now be 200 mm × 400, 450, 500 and 600 mm long. Thicknesses will include 100 mm and others to meet performance requirements.

Concrete units in metric

The production of dimensionally co-ordinated concrete units from 1 September, in conjunction with imperial sizes, is announced by Durox Building Units Ltd. The company manufacture the largest range of autoclaved aerated concrete components in the country, including roof and floor slabs, horizontal and vertical wall units, partition panels, lintels and building blocks. The new sizes are based on the module 1M (100 mm) with first preferences for controlling dimensions in 3M or in multiples of 3M.
The width of individual reinforced units will be 2 × 3M (600 mm) with lengths for effective span up to 18 × 3M (17ft. 8⅝in.).
Two types of blocks will be produced, both with nominal lengths of 6M (600 mm).
For Durox Thin Joint Block Construction, requiring only thin coat finishes, or for a combination with bricks of a coarse height of 1M (100 mm), the block will have a nominal height of 2M (200 mm) including the 3 mm (⅛in.) joint in Durox, own mortar/plaster named Durofine.
For blockwork with traditional mortars with a joint thickness of 10 mm (⅜in.), or for a combination with 4 brick courses in 3M (300 mm), the block will have a nominal height of 225 mm. Durox standard lintels will be increased to a nominal height of 3M (300 mm) and produced in standard lengths up to 36M (11ft. 9⅝in.).
A leaflet, containing the basic information covering the new metric standard for the whole range of Durox units, with the equivalent imperial data, is available on request, from the company at Northumberland-avenue, Linford, Essex. The range of units includes roof and floor slabs, horizontal and vertical wall units, partition panels, lintels and building blocks.

Metrication in plastics

The British Plastics Federation has established a Metric Policy Committee to represent all aspects of plastics. Its duties embrace advising members of the Federation on matters of policy and detail in metrication; ensuring that the Federation is represented in all activities concerned with metrication; and maintaining a record of the progress of metrication by members of the Federation for the information of authorities and customers.
As well as ensuring that the appropriate metric (SI) units are used throughout the plastics industry, the committee will co-ordinate the work involved in the metrication of existing, revised and new standards. The main task of the committee will be to ensure that the metric conversion programmes of consumer industries are met by the suppliers, to which end a programme for the changeover in the plastics industry will be prepared so that metric components are available as and when required. Progress has already been made in ensuring the smooth transition of the supply of plastics materials from imperial to SI units, and a Metric Information Register has been started.
The Chairman of the Committee is Mr. D. A. Lever of BP Chemicals (UK) Ltd., who is chairman of the Technical Committee of the Building Group of the Federation.

Taking away the option

During the period of change-over from imperial to metric dimensions, suppliers of building materials should not have the option, without prior agreement with the buyer, of supplying substitute components which differ in size and system of measurement from those ordered. This resolution by Glasgow Junior Chamber of Commerce follows the announcement by BSI last August, that suppliers of steel bar re-inforcement will have the option of supplying 'substitute' sizes of bars for the period March to December this year. Suppliers are also allowed to deliver bars the cross section of which could vary from +35% to −20% of that ordered.
The Junior Chamber claim there is the possibility of either lack of physical space to accommodate the reinforcement or insufficient reinforcement to satisfy the design strength.
'An unfortunate precedent will have been established if suppliers of other materials or components have this option,' states the Junior Chamber. 'A contract to supply certain goods will have been altered at the supplier's will in that a different size of material will have been delivered without the prior knowledge of the customer.'

Decimal currency guide

A decimal currency guide for the professions and businesmen, 'Preparing for decimalisation, has been published by the National Cash Register Co. Ltd. This is a companion volume to 'Getting Ready for Decimal Currency'—a booklet for retailers published by NCR last year—70 000 copies of which have already been distributed.
'Preparing for decimalisation' provides guidance on pre-1971 planning, and suggests several ways in which decimalisation can be an aid to improved efficiency. The booklet includes advice on the redesign of stationery, on contracts and agreements, staff training, accounting records, conversion of balances, payroll, and machine conversion and replacement.
An important section deals with Round Pound Accounting and Decimal Pound Accounting: two procedures which enable internal records to be decimalised now, thus eliminating the need for conversion in February 1971.
Single copies of the guide are available from Decimalisation Information, NCR, 206 Marylebone-road, NW1.

School design

At a meeting of the Modular Society in Glasgow, E. Aldred of the Glasgow Corporation, described the recent work of the City Architect's Research and Development Group in the design of schools. He showed a number of examples of layout, assembly, component range and component detail drawings produced by the group on the modular method and made the following points:
1) It had been decided to use modular co-ordination as a design discipline for the development of a series of interchangeable methods of construction with a rapid sequence of building. The drawings illustrated the first in this series. For the moment, nothing more than batch production of components is envisaged.
2) The 4in. module has been adopted with the intention of 'scaling down' to 100 mm module on a 1:1 basis on changing to metric, i.e., an overall length of say 100ft. or 300 M will change

on going metric to 30 000 mm (98.425ft.). The present sizes are sufficiently generous to allow for this transposition.
3) Using the 4in. basic module grid, metric/DC standard components can be incorporated as they come along since their basic sizes will be less than their modular spaces.
4) Component ranges and details have been developed comprehensively with the object of allowing architects to select from a wide range of possible sizes. Reduction of variety is advocated on individual projects.
5) Assembly details are standard and have been drawn to be used in combination.
6) Two prototype primary schools are scheduled to start on site this year, which have been cost planned to SED cost limits.

Cheshire's metric day

Building contractors who undertake work for Cheshire County Council were invited by the County Architect, E. Taberner, to a Metric Study Day at Alsager College of Education on 10 April. The day was attended by 90 members of contracting firms.
This is the first such course held in the region. As well as presenting an up-to-date picture of the national progress towards metrication, the problems encountered in the design of the County Council's first pilot metric project—an ambulance station—were outlined.
Two other pilot metric projects, a health centre and a police station, will be introduced in Cheshire before the beginning of 1971, when all schemes will be designed in metric.

Rhodesia to go metric

Rhodesia is to switch to the metric system of measurements. The Commerce and Industry Minister, Jack Mussett, said an advisory council would soon be appointed to report on how the changeover could be made with minimum inconvenience and cost.

Letters

Metric in advertisements

Sir,—I can give your correspondents one explanation for the absence of metric information in advertisements: many manufacturers of building materials simply aren't sure enough yet of the effect of metric co-ordination on their products. As an instance I would quote my own firm which manufactures a non-combustible panel used for internal partitions, ducts, etc.; standard thicknesses range from $\frac{1}{4}$in. to $1\frac{3}{16}$in.—in metric terms 6.3 mm to 30.2 mm—and if veneers are required, we must add .8 mm or 1.6 mm per side. These figures can hardly be described as modular, but the industry does not appear to be disposed to round off to the nearest millimetre, on the grounds that functional performance is the deciding factor on thickness; I am sure this is the correct attitude, but in years to come when imperial measurements are forgotten, will we still be manufacturing boards of 15.9 mm or 19.1 mm thickness?
In the meantime it seems that we must continue to quote the rather ridiculous decimal metric figures, the only alternative being to use a sensible rounded-off dimension (which may involve producing a board which exceeds the required functional performance) and possibly lose competitive advantage.

MARGARET BOTTRILL,
Marketing Official,
Marinite Ltd.,
Watford, Herts.

Celsius or Kelvin?

Sir,—Gillian Stoba advises, in your edition of 10 January, that the temperature will in the future be measured in degrees Celsius. I have been under the impression that it will in future be measured in degrees Kelvin.
Could you please correct me if I am wrong and inform me what the Kelvin scale of measurement will in the future be used for?

P. G. CHALLINOR,
116 Oxford-road,
Reading, Berks.

(Although the intervals on the kelvin and Celsius scales are identical, a temperature expressed in degrees Celsius is equal to the temperature expressed in kelvins less 273.15. In other words the kelvin, which is used in certain fields of pure science, starts from a different base line to the freezing point of water, which is meaningless to sciences requiring an absolute temperature. For the construction industry, however, the practical unit for temperature is the degree Celsius—the preferred name for Centigrade.)

Metric expression

Sir,—There seems to have been little official guidance on the subject of metric expression in surveying which makes A. S. Whyte's letter in your issue of 28 March particularly welcome.
As our conclusions are similar, I attach a copy of the relevant paragraph* from our office guidance notes on the change to metric. The importance of consistency of expression throughout the industry can be experienced at first hand when metric surveys are attempted without first establishing a standard method of expression!

MICHAEL CARDEN [ARIBA, AADipl],
26a High-street,
Andover, Hampshire.

***5.7 METRIC SURVEYS**
All surveys in metric will be recorded in *metres*; drawings can then be prepared in metres or millimetres as necessary.
TAPE: read off exactly as markings, adding the word 'point' after the red metre number and giving numbers to the sub-divisions. The word 'point' must always occur in every reading. Do not add any unnecessary 'O's'.
e.g.

Tape	Voice	Record
210	Two point one 'O'	2·10
315	Three point one five	3·15
319	Three point one nine	3·19
1033	Ten point three three	10·33
2M	Two point 'O'	2·0

Sub-divisions below 10 must be preceded by the word 'O', e.g.

Ten point 'O' three	10·03
One point 'O' nine	1·09

and the dimensions below the first metre marking will be read as follows:

Point one 'O'	·10
Point four five	·45
Point 'O' nine	·09

Always round off to the next division up and take RUNNING dimensions.
FOLDING RULE: On normal survey work observe the same procedure and ignore the mm sub-divisions. The only difference is that the ten mm sub-divisions are sometimes numbered where they are not on the tape.
Always take an OVERALL dimension in addition to a series.
SCALE: When measuring joinery or other small items, any metric scale (or the folding rule) can be used and the record kept in mm.

PD6031 recommends writing metres to 3 places of decimals. However the RICS Guide adopts as a convention the booking of building dimensions to two places of decimals due to the Standard Method requirement to measure to the nearest 10 mm. If this is adopted for booking surveying dimensions, a constant two places of decimals should be maintained—e.g. 2.00 not 2.0 as in the above guide. Where values less than unity occur PD6031 is emphatic—write O before the decimal point. The examples in the above notes should, therefore, read: 0.10, 0.45 and 0.09.—Ed.)

Coming Events

MONDAY, 28 APRIL

Construction goes metric: A seminar organised by the MPBW at Salisbury, Wilts. Speakers will be M. F. Chaplin of the MPBW Directorate of Building Development; I. C. Walden of Gilbert-Ash and T. Sibthorpe, consultant to the metric panel of the National Council of Building Material Producers. There will be a 20 minute question and answer session after each talk. Conference fee is £2. Tickets issued by the Building Industries Officer, MPBW, The Pithay, Bristol, BSI 2NQ. Delegates meet at White Hart Hotel. 9.45 a.m.

THURSDAY, 1 MAY

Metrication and the architect: A one-day seminar organised by the RIBA for metrication advisers in practices. Case studies of metric projects in both the public and private sector will be given and problems relating to contract, supply, regulations, comprehension and drawing discussed. Speakers will include John Robinson BArch, ARIBA, of the GLC, and Dennis Marshall, DipArch, ARIBA, of James Cubitt Fello Atkinson & Partners.
The seminar will be held at the RIBA and will be limited to 40. Tickets will be available at £2 10s each. Application forms can be obtained from Professional Services Department, RIBA, 66 Portland-place, London, WIN 4AD.

TUESDAY, 6 MAY

Change to Metric: Boston, Lincs. Speaker D. T. Simmonds of Mitchell Construction Kinnear Moodie Group Ltd. at Boston College of Further Education, Rowley-road. 7.15.
Change to metric: Lecture organised by the London and Home Counties Branch, IAAS, at the Eccleston Hotel, London, SW1. 6.30 for 7 pm.

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Metrication the computer and SI

This series of conversion tables, compiled by R. M. E. Diamant and B. A. L. Hart, appears in this section periodically. They are to be used like logarithmic tables, using a ruler to ensure clear distinction of the horizontal lines. The tables have been set with the help of the English Electric KD9F computer at the University of Salford.

Table 14
Refrigeration
1 kilowatt = 0.2843454 tons of refrigeration
Note: diff signifies single units so that the reading for any number required is taken at the intersection of the horizontal 10 unit line and the vertical single unit column.

diff / kW	0	1	2	3	4	5	6	7	8	9
	tons of refrigeration									
0		0.28	0.57	0.85	1.14	1.42	1.71	1.99	2.27	2.56
10	2.84	3.13	3.41	3.70	3.98	4.27	4.55	4.83	5.12	5.40
20	5.69	5.97	6.26	6.54	6.82	7.11	7.39	7.68	7.96	8.25
30	8.53	8.81	9.10	9.38	9.67	9.95	10.24	10.52	10.81	11.09
40	11.37	11.66	11.94	12.23	12.51	12.80	13.08	13.36	13.65	13.93
50	14.22	14.50	14.79	15.07	15.35	15.64	15.92	16.21	16.49	16.78
60	17.06	17.35	17.63	17.91	18.20	18.48	18.77	19.05	19.34	19.62
70	19.90	20.19	20.47	20.76	21.04	21.33	21.61	21.89	22.18	22.46
80	22.75	23.03	23.32	23.60	23.89	24.17	24.45	24.74	25.02	25.31
90	25.59	25.88	26.16	26.44	26.73	27.01	27.30	27.58	27.87	28.15
100	28.43	28.72	29.00	29.29	29.57	29.86	30.14	30.42	30.71	30.99
110	31.28	31.56	31.85	32.13	32.42	32.70	32.98	33.27	33.55	33.84
120	34.12	34.41	34.69	34.97	35.26	35.54	35.83	36.11	36.40	36.68
130	36.96	37.25	37.53	37.82	38.10	38.39	38.67	38.96	39.24	39.52
140	39.81	40.09	40.38	40.66	40.95	41.23	41.51	41.80	42.08	42.37
150	42.65	42.94	43.22	43.50	43.79	44.07	44.36	44.64	44.93	45.21
160	45.50	45.78	46.06	46.35	46.63	46.92	47.20	47.49	47.77	48.05
170	48.34	48.62	48.91	49.19	49.48	49.76	50.04	50.33	50.61	50.90
180	51.18	51.47	51.75	52.04	52.32	52.60	52.89	53.17	53.46	53.74
190	54.03	54.31	54.59	54.88	55.16	55.45	55.73	56.02	56.30	56.58
200	56.87	57.15	57.44	57.72	58.01	58.29	58.58	58.86	59.14	59.43
210	59.71	60.00	60.28	60.57	60.85	61.13	61.42	61.70	61.99	62.27
220	62.56	62.84	63.12	63.41	63.69	63.98	64.26	64.55	64.83	65.12
230	65.40	65.68	65.97	66.25	66.54	66.82	67.11	67.39	67.67	67.96
240	68.24	68.53	68.81	69.10	69.38	69.66	69.95	70.23	70.52	70.80
250	71.09	71.37	71.66	71.94	72.22	72.51	72.79	73.08	73.36	73.65
260	73.93	74.21	74.50	74.78	75.07	75.35	75.64	75.92	76.20	76.49
270	76.77	77.06	77.34	77.63	77.91	78.19	78.48	78.76	79.05	79.33
280	79.62	79.90	80.19	80.47	80.75	81.04	81.32	81.61	81.89	82.18
290	82.46	82.74	83.03	83.31	83.60	83.88	84.17	84.45	84.73	85.02
300	85.30	85.59	85.87	86.16	86.44	86.73	87.01	87.29	87.58	87.86
310	88.15	88.43	88.72	89.00	89.28	89.57	89.85	90.14	90.42	90.71
320	90.99	91.27	91.56	91.84	92.13	92.41	92.70	92.98	93.27	93.55
330	93.83	94.12	94.40	94.69	94.97	95.26	95.54	95.82	96.11	96.39
340	96.68	96.96	97.25	97.53	97.81	98.10	98.38	98.67	98.95	99.24
350	99.52	99.81	100.09	100.37	100.66	100.94	101.23	101.51	101.80	102.08
360	102.36	102.65	102.93	103.22	103.50	103.79	104.07	104.35	104.64	104.92
370	105.21	105.49	105.78	106.06	106.35	106.63	106.91	107.20	107.48	107.77
380	108.05	108.34	108.62	108.90	109.19	109.47	109.76	110.04	110.33	110.61
390	110.89	111.18	111.46	111.75	112.03	112.32	112.60	112.89	113.17	113.45
400	113.74	114.02	114.31	114.59	114.88	115.16	115.44	115.73	116.01	116.30
410	116.58	116.87	117.15	117.43	117.72	118.00	118.29	118.57	118.86	119.14
420	119.43	119.71	119.99	120.28	120.56	120.85	121.13	121.42	121.70	121.98
430	122.27	122.55	122.84	123.12	123.41	123.69	123.97	124.26	124.54	124.83
440	125.11	125.40	125.68	125.96	126.25	126.53	126.82	127.10	127.39	127.67
450	127.96	128.24	128.52	128.81	129.09	129.38	129.66	129.95	130.23	130.51
460	130.80	131.08	131.37	131.65	131.94	132.22	132.50	132.79	133.07	133.36
470	133.64	133.93	134.21	134.50	134.78	135.06	135.35	135.63	135.92	136.20
480	136.49	136.77	137.05	137.34	137.62	137.91	138.19	138.48	138.76	139.04
490	139.33	139.61	139.90	140.18	140.47	140.75	141.04	141.32	141.60	141.89
500	142.17	142.46	142.74	143.03	143.31	143.59	143.88	144.16	144.45	144.73

Table 14
Kilowatts to tons of refrigeration. To be used for air conditioning calculations.