BMN
Building Metrication News

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This section appears in the fourth issue 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

METRIC MONTH

When will it be available?

Already architects and contractors are asking when products are going to be available in metric or metric modular sizes. Not unnaturally the answer is likely to be somewhat vague. This is not the fault of the manufacturer. If the fault lies anywhere it lies with the person asking the question. BSI's programme lays down a timetable for manufacturers to change to metric over a period of time up to the end of 1972. No manufacturer who has been following the programme closely will have yet produced metric components. What then is happening? First, BSI have published BS 4330 : Controlling Dimensions. This provides initial guidance to designers who need to make a start on the sketch plans for large long-term projects on or shortly after the beginning of next year. This Standard also gives basic advice for BSI's own committees. Second, BSI are shortly to publish lists of component categories. These result from the work of the functional group panels. The categories are as follows:

Category A: Components for which dimensional co-ordination is essential and for which further recommendations will be made by BSI.

Category B: Components which are dependent on Category A for their co-ordinated sizes and for which further recommendations will be made by BSI.

Category C: Components which require to be co-ordinated but for which the recommendations of BS 4011 provide sufficient guidance.

Category D: Components only required to have 'sensible' metric sizes.

BSI's Technical Committee are all ready to produce new metric Standards for components in categories C and D. When these Standards are published, or immediately the lists are published if no Standard is applicable, manufacturers can finalise the sizes of their metric components. But further recommendations need to be prepared for components in categories A and B. Draft British Standards for these recommendations will be published by the BSI during next year. The first of these, for Functional Groups structure, external envelope and internal sub-division, will be published early on in the year. These will be followed later in the year by Functional Groups services and drainage, and fixtures, furniture and equipment. Drafts of all these Standards will be published in Building Metrication News. When comments have been received the Standards will be published. But in the meantime technical committees at BSI will start work on Standards for individual components. Again where no Standard for a component is applicable, manufacturers will be free to finalise metric sizes directly the Standards produced by the functional group panels have been published.

At the beginning of next year, therefore, the first new metric components to conform to BSI's programme and recommendations will begin to come on to the market. Initially these will be restricted to components in categories C and D. Later these will be joined by components in categories A and B. In due course there should be something of a deluge, each week new metric and metric modular components appearing.

How will you know when a manufacturer has started production of a metric component? How will you know that it conforms to BSI's recommendations? After all, only recently a plastics firm has circulated architects with a questionnaire asking which module they prefer! The Building Centre has agreed to maintain an authoratitive list of building products designed to metric sizes. This job of work is being undertaken in collaboration with BSI who will check that each product conforms to published recommendations. This authoratitive list will be published at regular intervals in Building Metrication News so that you can keep abreast of the situation.

In order to assist the Building Centre in compiling the list, manufacturers are asked to send details of metric products to: The Administrative Director, The Building Centre, 26 Store-street, London, WC1. Information can be accepted for components in categories C and D directly BSI publish the lists of component categories. But information on components in categories A and B cannot be included in the authoratitive list until recommendations have been published. It should be noted that the list will not include the metric equivalent sizes of what are imperial sized products.

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Metric Warehouse Project

FIRST BOVIS METRIC CONTRACT

The project comprises a four-storey reinforced concrete warehouse incorporating continental mechanical handling equipment, together with underground car park and external works.
The client, Roche Products Ltd, requested the use of metric measurement due to the need to accommodate continental equipment. Some of the problems met with are outlined by the project manager, P. E. Hasling, and project surveyor, R. E. Evans.

Observations by Manager

Metric equipment had to be specially purchased for this contract, consisting mainly of theodolite, staffs, tapes, rods and rules. The metric theodolite has an azimuth circle of 400 divisions, i.e. a right angle is 100 metric degrees instead of the 90 deg. we normally use. Metric staffs are graduated in either 5 or 10 mm. For normal use this equipment is quite satisfactory but on this contract we are working down to a tolerance of plus or minus 2 mm and it is necessary to use a telescopic level and a staff graduated to 1 mm. For the operations, 1 m rules and 3 m metal tapes are used. 100 ft. tapes are replaced by 30 m tapes and the surveyors use 2 m rods. For office use we have 1:25, 1:50 and 1:100 scale rules.

For conversions from imperial to metric conversion tables issued by the BSI to BS350 are used and also dimension conversion tables issued by the RIBA technical section.

The first principle is to get everybody 'metric minded' as quickly as possible, and to further this end it is best to simplify dimensioning as much as possible. On this contract we have done this by working to millimetres and not using deci- or centimetres. Grid line centres are 6 m and 8 m and these are expressed as 6,000 and 8,000. A dimension of, say, 305 on a drawing is automatically known as being 1 ft. For general purposes the mental conversion of 1 in. to 25 mm is acceptable (the analysis equivalent being 25.4). Although this method is a useful guide, care must be taken when dealing with larger dimensions. For instance, the analogous metric size for 40 ft. is 12,000 and the exact equivalent is 12,192, a difference of 192 or $7\frac{1}{2}$ in.

With regard to the basic components for the contract we have three situations. The specialised mechanical handling equipment is Swiss made and is manufactured and detailed wholly in metric. Purpose-made items are being made to metric dimensions, and for items where there is, as yet, no metric equivalent we are converting the feet and inches dimensions to metric and ordering in this manner. The manufacturer or supplier is then converting back for the purpose of supply but is invoicing in metric. The BSI programme does not require manufacturers to produce metric dimensionally co-ordinated products until 1970. In general, therefore, we have found that manufacturers are reluctant to move towards the metric system until the Modular Society and the BSI have produced their findings.

To sum up, the transitional period presents problems for the industry as a whole and will affect every individual in our company to some degree. The problems, however, should not be over-exaggerated and if one concerns oneself, initially anyway, with the conversion of the units that one uses in day-to-day operations, the effect upon production during the transition period should be minimal.

Surveying Methods

According to the project surveyor, R. E. Evans, the use of the metric system does not involve any major departures from normal quantity surveying methods. One point, however, does call for increased vigilance due to dimensions on drawings being shown in millimetres. To 'square' or 'cube' all dimensions in millimetres would involve rather lengthy sums. Therefore, in 'taking off,' these dimensions are converted to metres, the number of decimal places depending upon the degree of accuracy required. For example an area size 2,402 mm x 5,298 mm to be painted would be rounded off to 2.4 m x 5.3 m.

He goes on:—

Obviously the placing of the decimal point by the 'taker off' creates an additional error factor in a task not normally subject to check. Quantities are 'billed' in metres, square, cube and lineal; weight in kilogrammes.

Centimetres are used only in describing the superficial area of glazing panes or similar purposes. Girths are described in millimetres.

The size of materials or articles mentioned in description are 'rounded off' to the nearest whole millimetre without decimal places, i.e. 1 in. diameter mild steel reinforcement converts to 25.4001 mm. and is billed as 25 mm. This will obviously continue until all materials are manufactured to a decimal module.

As it is a reinforced concrete job, we were presented by the engineers with a huge pile of bending schedules which required weighting the steel in kilogrammes. We wanted to do this in a proper manner and searched everywhere for a table giving weights of British rods in kilos per lineal metre. We could not find one so we enlisted the assistance of our comptometer operator who converted pounds per foot run to pounds per lineal metre, this result then being converted to kilos per lineal metre. She discovered during this process a handy conversion factor whereby pounds per foot run multiplied by 1.488 gives a result of kilos per lineal metre.

We soon realised during early negotiations with subcontractors that their quotations would require careful checking to ensure that estimating errors had not occurred in conversion. It is usual for all pricing to be calculated on imperial constants and the rates converted to metric.

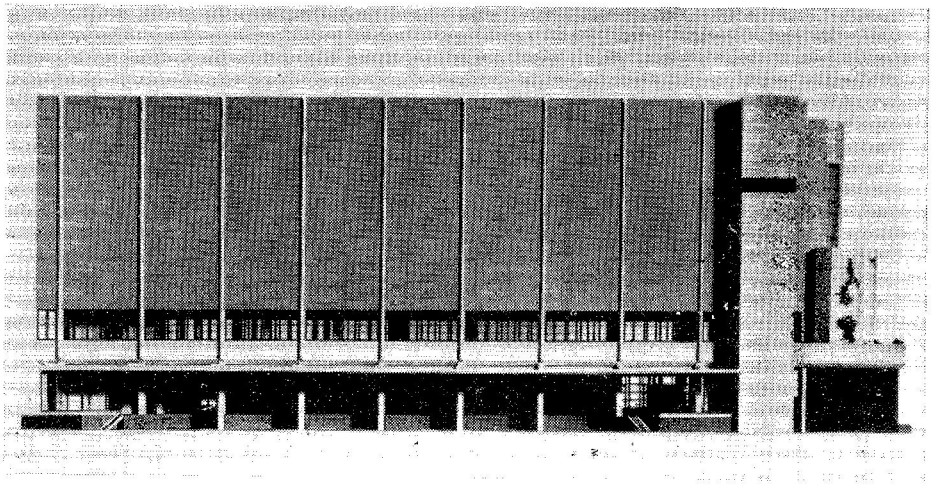
All materials are required to be delivered in metric quantities and this has involved slight extra costs where suppliers using a computerised invoicing system geared to British measurement have had to resort to handwritten invoices in metric.

All surveying instruments used on site are metric. The metric measuring rod is 2 m long with divisions at tenths of a metre and centimetres only.

The most difficult aspect of metric conversion is really that of familiarity. One 'has a picture in the mind's eye' when the size of any object or unit of measurement of building is mentioned. This has been gained over years of usage with British measurement, and to absorb and gain the same familiarity with metric measurement may take some considerable time.

(For permission to publish this article we are indebted to Bovis News.)

Model of the Roche metric warehouse project built by Bovis



METRIC CONSULTANT

At the moment most eyes are focused on January 1969, the date when architects will start designing in metric. The real trial, however, in terms of a successful metric changeover, is likely to come later, in 1970, when buildings are put on the ground. By how much will costs rise? How easily will site operatives cope? What metric components will be available?

One man who is acutely aware of these problems is A. W. Rickard, NFBTE's metrication consultant. 'It is very hard to be precise about this period,' says Rickard. 'It is possible, for instance, that the difficulties that site operatives will face may have been exaggerated. He uses the analogy of the holiday visitor to the Continent who quickly gets used to driving on the right-hand side of the road and to thinking in terms of kilometres and francs. 'So it is conceivable that metric measurement could be picked up fairly rapidly after an initial period of adjustment. Of course, things can't be left to chance. Proper training at the right time (too soon and the operative can forget the application, too late and he is unprepared) has long been advocated by the NFBTE.'

Another imponderable is the problems that managament and administrative staff will have to face. For some time after the change there will be a good deal of intermixing of imperial and metric. Many firms, says Rickard, will have a proportion of their contracts in metric and a proportion in imperial. They may be working in metric units invoiced in imperial. Suppliers too will find some customers demanding metric products, some imperial. To get through this situation adequately will call for increased administrative ability. The earlier the problems are assessed and planned for the easier the transition will be and, in fact, it is one of the recommendations of the NFBTE's guide for building contractors on the metric change (which Rickard played a large part in drawing up) that each firm should appoint a senior person to keep up-to-date on metric matters and advise when specific action needs to be taken. This is broadly Rickard's mandate at the NFBTE. He lectures to local associations (averaging about two a month), sits on BSI and other liaison committees, advises on retraining, and alerts the Federation's metric sub-committee on any significant event that may require action.

On a company, as opposed to a national, level he also does a similar job for John Laing, for whom he has worked, mainly in the research and development division, since 1951, after reading civil engineering at the University College, Southampton.

On the long term benefits of going metric, Rickard is optimistic. 'Dimensional co-ordination, once under way, should mean progress for the whole industry. But it won't be dropped in our laps. Some very positive efforts have to be made and current BSI work on jointing and tolerances is particularly important. We must know what tolerances can be achieved in practice and we must establish jointing conventions to really get anywhere.'

Talking about costs in the initial stage of change, Rickard goes along with the general view. They will rise. Some additional costs, such as retraining staff, purchasing new equipment and reorganising office procedure may be calculable. Others, such as loss through errors and slower operation because of unfamiliarity with the metric measure, are difficult to forecast. Eventually this increase in costs should be more than compensated by the benefits of dimensional co-ordination. That, says Rickard, is the goal. If it isn't reached, the consequences for both the industry and the national economy are serious.

NEWS FROM THE INDUSTRY

Timing the Switch

The MPBW's intention to make known the amount of public sector work being designed in metric was reiterated by Robert Mellish, the Minister, at a Building Material Producers seminar on metrication in London this month. This will help producers in deciding when to switch to metric sizes. 'You want to be sure that long term metric sizes have been firmly agreed for your products and that a reasonable volume of metric work is in the pipeline,' said Mr. Mellish. 'The RIBA are planning to do the same for the private sector, so that the (building) industry will be able to find out how quickly metric measurements are taking root among designers.'

'The building material producers,' said Mr. Mellish, 'were in the front line of the change to metric. Their cycle from the date they decide to launch a product until the date it comes off the production line is necessarily long. Yet metric components must be available if the full metrication of design and assembly is to be realised.'

The Minister added that he realised he was asking a lot and that for earlier metric schemes the rules have to be bent to enable existing components to do the job. But nobody wanted to carry on with the double standard longer than necessary.

Artist's impression of MeTra housing

Metric Designed House

A new house type for local authorities by Selleck Nicholls Williams (ECC) Ltd. combines metric dimensions with traditional construction. Known as MeTra, it is estimated to be 5% cheaper than the same company's present rationalised traditional built house.

The new dwellings can be built in high density layouts. They are planned on a 300mm. grid and incorporate the vertical metric control line dimensions recommended for domestic building. In 1969, the pre-transition period to building in metric, the MeTra plans will be available for building in equivalent imperial units.

Warley's Two Schemes

More metric housing on traditional lines is to be built by the local council at Warley, Worcs. The first scheme, in which the National Building Agency will act as architects and surveyors, will be built on a site in Smethwick. According to present plans it is likely to be started on the ground in September 1969. A second scheme in metric is likely to start a month or two afterwards and will probably be built at Cradley Heath. Work on this will be carried out by Warley Borough Architect's Department.

Speaking in the US

H. A. R. Binney, director-general of BSI, and Col. J. S. Vickers, chief engineer, Planning, who has prepared the BSI programme for the British engineering industry's change to the metric system, are to go to the United States to speak to America's National Standards Organisation on the subject on 11 December.

Although no official announcement has been given about the attitude in the United States to the world swing to the système internationale—a standard metric system—there is evidence of increasing interest in that country. The four-day conference is the latest example.

Course for Building Designers

Twenty-four senior architects, engineers and quantity surveyors working on building design took part in a course on 'Change to metric and dimensional co-ordination' arranged by the Education Group of the MPBW. The course, at the College of Architecture and Advanced Building Technology of the Polytechnic, Regent-street, was held in October.

A feature of the course was a half-day exercise in which the use of controlling and preferred metric dimensions for planning grids, structure, cladding, jointing and costing was practised. Three short exercises following the specialist lectures were also included.

METRICATION INDEX

An index of references to metrication published in 'Building' since Building Metrication News last appeared.

Satisfactory progress is being made in producing a metric system of industrialised building for education projects, it was reported at the third a.g.m. of Metropolitan Architectural Consortium for Education. (1 November, p. 122.)

Scotland's change to metric will give architects of local authority housing greater freedom for matching plans to varying family needs, said Mr. Ross, Secretary of State for Scotland, in a written reply to the House of Commons on the question of what progress is being made in preparing for the metrication of housing in Scotland. (1 November, p. 104.)

Speaking at the Modular Society's annual lunch, Lord Beeching said it was impractical to insist on a particular date for the change to metric. (1 November, p. 99.)

A bibliography on metrication literature has been published by the CADIG Liaison Centre. (8 November, p. 187.)

COMING EVENTS

TUESDAY, 3 DECEMBER

Change to Metric: a two-day course for architects, quantity surveyors and engineers to bring them up-to-date with current metric proposals. Organised by the Institute of Advanced Architectural Studies at the King's Manor, Exhibition-square, York. Fee, 11 gns.

MONDAY, 9 DECEMBER

The Decimal system in Britain: by C. Borrett. Organised by East Midlands Branch Institution of Plant Engineers at the Midland Design and Building Centre, Mansfield-rd., Nottingham. Starting at 7 p.m.

WEDNESDAY, 11 DECEMBER

Metrication: a four-day course for architects and members of the building design team to provide a thorough study of the change to metric and dimensional coordination. Organised by Building Performance Research Unit, Strathclyde University, Glasgow, C1. Fee £21.

TUESDAY, 4 FEBRUARY

Metrication: A series of four weekly evening lectures for quantity surveyors. Organised by the College of Estate Management, St. Alban's-grove, London, W8. Fee 6 gns.

Fluorescent Lamps and Lighting Fittings

Because of the need for clarifying the affect of dimensional co-ordination on the sizes of tubular fluorescent lamps and associated lighting fittings, a statement has been issued by the Electric Light Fittings Association Ltd. and the Electric Lamp Industry Council Ltd. It points out that tubular fluorescent lamps have been nationally and internationally standardised for many years in metric units. The length dimensions are nominally based on integral multiples of 1ft., inclusive of thin lampholders. Most of these dimensions originated in the United States and have been accepted internationally, particularly in countries which have used the metric system, for many years. There are, therefore, only few cases where existing tubular fluorescent lamps in fittings comply with a preferred dimension in the system of dimensional co-ordination; one is the recently introduced 85W. 6ft. lamp, which is approximately 2in. shorter than the nominal length; the 8ft. lamp is also shorter than the nominal length, though not by the same amount. Even so these lamps come very near the limits of the modular dimensional spaces.

Tubular fluorescent lamps are one of the few building elements which are expendable and are regularly replaced. The number of lamps used per year for replacement purposes in fact greatly exceeds the number installed in new fittings. It is therefore impossible to discontinue production of the present sizes of lamps, and the cost of underloaded new machinery for additional lamp sizes together with multiple stocking would considerably increase lamp selling prices. Costs would also be increased in stock planning and handling for the existing users and distributors as well as the manufacturer. This higher cost would seriously affect the UK lamp industry export potential as it is likely to be several years before other countries formally accept dimensional co-ordination and provide a wider market for any hypothetical new lamps. There would also be the likelihood of errors due to the wrong lamps being specified. It is therefore the opinion of ELFA/ELIC that there is not sufficient reason for introducing new tubular fluorescent lamp types.

The question arises, how far can dimensional co-ordination of fittings be met with existing lamps?

Recessed fittings: these can be designed to one of two possible concepts.

a) Where the fitting size at the ceiling surface and above the ceiling is contained within the modular dimensions. This would generally require the use of an existing lamp of shorter length than would be desirable to achieve an optimum economic lighting design (eg, 40W. 4ft. lamps in a 5 x 300mm. fitting).

b) Where the fitting size on the ceiling surface is contained within the modular dimensions but above the ceiling is not so contained, i.e., there is freedom for encroachment outside the basic space. The choice of lamp could then be extended and made on the normal basis of good lighting design and economics as in present practice. Unfortunately this may prevent the end to end abutment of more than two fittings.

Modular surface and suspended fittings: dimensionally co-ordinated fittings can only be designed to accept lamps which are within the modular dimensions and therefore are subject to the limitations applying in recessed fittings (a).

Non-modular surface and suspended fittings: these fittings could be designed having dimensions in accordance with BS4011 based on existing lamps to give optimum efficiency, appearance and economics as in present practice. Second or third preference modules in BS4011 would have to be adopted in most cases. The dimensioning of ceiling elements, including lighting, is often determined by partition spacing, which is in turn mainly dependent on the basic column spacing at the window line. ELFA/ELIC suggest that it would be an advantage to have increased standardisation of this key dimension in multiples of 2 x 300mm., and a first preference for the controlling lines on the axial lines of loadbearing walls and columns.

It is probable that the preferred lengths for industrial lighting trunking will be 3,000mm. or 4,500mm. This will enable a modular co-ordinated suspension system to be used in association with non-modular surface and suspended lighting fittings.

Commercial lighting trunking may be shorter than 4,500mm. or 3,000mm., but based on multiples of 300mm., with preference for 2 x 300mm. multiples.

LENGTH DIMENSIONS OF METRIC MODULE RECESSED TROFFER FITTINGS (dimensions in mm)

Nominal lamp length	8ft.	6ft.	5ft.	4ft.	3ft.	2ft.
Overall length from end of opposite pins (max.)	2389	1780	1514	1214	909	604
Add: 3mm each end of lamp for minimum lampholder thickness	2395	1786	1520	1220	915	610
Add: 9mm min. for removal of lampholder at one end of lamp	2404	1795	1529	1229	924	619
or Add: 18mm max. for removal of both lampholders	2413	1804	1538	1238	933	628
Add: Thickness of metal ends of fitting, paint (3mm) and manufacturing tolerances on metal work (2–5mm), i.e. 5mm or 8mm	2409 ≈ 2421	1800 1812	1534 1546	1234 1246	929 941	624 636
Nearest 300mm module	2400	1800	1500	1200	90	

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Metrication, the Computer and SI

This is the second of a series of conversion tables compiled by R. M. E. Diamant and B. A. L. Hart, which will be appearing in this section each month. 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 KDF 9 computer at the University of Salford.

Table 3

Meganewtons per m² to ton per inch²

IMN/m² = 0.0647488 ton per in²

Note: DIFF signifies units of ten so that the reading for any number required is taken at the intersection of the appropriate horizontal 100 unit line and the vertical ten unit column.

DIFF	0	10	20	30	40	50	60	70	80	90
MN/m²					ton per in²					
0		0.65	1.29	1.94	2.59	3.24	3.88	4.53	5.18	5.83
100	6.47	7.12	7.77	8.42	9.06	9.71	10.36	11.01	11.65	12.30
200	12.95	13.60	14.24	14.89	15.54	16.19	16.83	17.48	18.13	18.78
300	19.42	20.07	20.72	21.37	22.01	22.66	23.31	23.96	24.60	25.25
400	25.90	26.55	27.19	27.84	28.49	29.14	29.78	30.43	31.08	31.73
500	32.37	33.02	33.67	34.32	34.96	35.61	36.26	36.91	37.55	38.20
600	38.85	39.50	40.14	40.79	41.44	42.09	42.73	43.38	44.03	44.68
700	45.32	45.97	46.62	47.27	47.91	48.56	49.21	49.86	50.50	51.15
800	51.80	52.45	53.09	53.74	54.39	55.04	55.68	56.33	56.98	57.63
900	58.27	58.92	59.57	60.22	60.86	61.51	62.16	62.81	63.45	64.10
1000	64.75	65.40	66.04	66.69	67.34	67.99	68.63	69.28	69.93	70.58
1100	71.22	71.87	72.52	73.17	73.81	74.46	75.11	75.76	76.40	77.05
1200	77.70	78.35	78.99	79.64	80.29	80.94	81.58	82.23	82.88	83.53
1300	84.17	84.82	85.47	86.12	86.76	87.41	88.06	88.71	89.35	90.00
1400	90.65	91.30	91.94	92.59	93.24	93.89	94.53	95.18	95.83	96.48
1500	97.12	97.77	98.42	99.07	99.71	100.36	101.01	101.66	102.30	102.95
1600	103.60	104.25	104.89	105.54	106.19	106.84	107.48	108.13	108.78	109.43
1700	110.07	110.72	111.37	112.02	112.66	113.31	113.96	114.61	115.25	115.90
1800	116.55	117.20	117.84	118.49	119.14	119.79	120.43	121.08	121.73	122.38
1900	123.02	123.67	124.32	124.97	125.61	126.26	126.91	127.56	128.20	128.85
2000	129.50	130.15	130.79	131.44	132.09	132.74	133.38	134.03	134.68	135.33
2100	135.97	136.62	137.27	137.91	138.56	139.21	139.86	140.50	141.15	141.80
2200	142.45	143.09	143.74	144.39	145.04	145.68	146.33	146.98	147.63	148.27
2300	148.92	149.57	150.22	150.86	151.51	152.16	152.81	153.45	154.10	154.75
2400	155.40	156.04	156.69	157.34	157.99	158.63	159.28	159.93	160.58	161.22
2500	161.87	162.52	163.17	163.81	164.46	165.11	165.76	166.40	167.05	167.70
2600	168.35	168.99	169.64	170.29	170.94	171.58	172.23	172.88	173.53	174.17
2700	174.82	175.47	176.12	176.76	177.41	178.06	178.71	179.35	180.00	180.65
2800	181.30	181.94	182.59	183.24	183.89	184.53	185.18	185.83	186.48	187.12
2900	187.77	188.42	189.07	189.71	190.36	191.01	191.66	192.30	192.95	193.60
3000	194.25	194.89	195.54	196.19	196.84	197.48	198.13	198.78	199.43	200.07
3100	200.72	201.37	202.02	202.66	203.31	203.96	204.61	205.25	205.90	206.55
3200	207.20	207.84	208.49	209.14	209.79	210.43	211.08	211.73	212.38	213.02
3300	213.67	214.32	214.97	215.61	216.26	216.91	217.56	218.20	218.85	219.50
3400	220.15	220.79	221.44	222.09	222.74	223.38	224.03	224.68	225.33	225.97
3500	226.62	227.27	227.92	228.56	229.21	229.86	230.51	231.15	231.80	232.45
3600	233.10	233.74	234.39	235.04	235.69	236.33	236.98	237.63	238.28	238.92
3700	239.57	240.22	240.87	241.51	242.16	242.81	243.46	244.10	244.75	245.40
3800	246.05	246.69	247.34	247.99	248.64	249.28	249.93	250.58	251.23	251.87
3900	252.52	253.17	253.82	254.46	255.11	255.76	256.41	257.05	257.70	258.35
4000	259.00	259.64	260.29	260.94	261.59	262.23	262.88	263.53	264.18	264.82
4100	265.47	266.12	266.77	267.41	268.06	268.71	269.36	270.00	270.65	271.30
4200	271.94	272.59	273.24	273.89	274.53	275.18	275.83	276.48	277.12	277.77
4300	278.42	279.07	279.71	280.36	281.01	281.66	282.30	282.95	283.60	284.25
4400	284.89	285.54	286.19	286.84	287.48	288.13	288.78	289.43	290.07	290.72
4500	291.37	292.02	292.66	293.31	293.96	294.61	295.25	295.90	296.55	297.20
4600	297.84	298.49	299.14	299.79	300.43	301.08	301.73	302.38	303.02	303.67
4700	304.32	304.97	305.61	306.26	306.91	307.56	308.20	308.85	309.50	310.15
4800	310.79	311.44	312.09	312.74	313.38	314.03	314.68	315.33	315.97	316.62
4900	317.27	317.92	318.56	319.21	319.86	320.51	321.15	321.80	322.45	323.10

Table 3—Meganewtons per m² to ton per in².
This table is to be used for such purposes as dealing with stresses in prestressing and post-tensioning cables, high point loads on concrete frames and Young's modulus.

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METRICATION, THE COMPUTER AND SI

In the foreword to last month's tables some important prefixes were given of which two were incorrect. To avoid possible confusion the correct list is given below:

micro	μ	$\times 10^{-6}$
milli	m	$\times 10^{-3}$
kilo	k	$\times 10^{3}$
mega	M	$\times 10^{6}$
giga	G	$\times 10^{9}$
tera	T	$\times 10^{12}$

Table 4

Kilogrammes per cubic metre to pounds per cubic foot

$1 kg/m^3 = 0.0624278$ lb/ft³

Note: DIFF signifies units of ten so that the reading for any number required is taken at the intersection of the appropriate horizontal 100 unit line and the vertical ten unit column

DIFF	0	10	20	30	40	50	60	70	80	90
kg/m³					lb/ft³					
0		0.62	1.25	1.87	2.50	3.12	3.75	4.37	4.99	5.62
100	6.24	6.87	7.49	8.12	8.74	9.36	9.99	10.61	11.24	11.86
200	12.49	13.11	13.73	14.36	14.98	15.61	16.23	16.86	17.48	18.10
300	18.73	19.35	19.98	20.60	21.23	21.85	22.47	23.10	23.72	24.35
400	24.97	25.60	26.22	26.84	27.47	28.09	28.72	29.34	29.97	30.59
500	31.21	31.84	32.46	33.09	33.71	34.34	34.96	35.58	36.21	36.83
600	37.46	38.08	38.71	39.33	39.95	40.58	41.20	41.83	42.45	43.08
700	43.70	44.32	44.95	45.57	46.20	46.82	47.45	48.07	48.69	49.32
800	49.94	50.57	51.19	51.82	52.44	53.06	53.69	54.31	54.94	55.56
900	56.19	56.81	57.43	58.06	58.68	59.31	59.93	60.55	61.18	61.80
1000	62.43	63.05	63.68	64.30	64.92	65.55	66.17	66.80	67.42	68.05
1100	68.67	69.29	69.92	70.54	71.17	71.79	72.42	73.04	73.66	74.29
1200	74.91	75.54	76.16	76.79	77.41	78.03	78.66	79.28	79.91	80.53
1300	81.16	81.78	82.40	83.03	83.65	84.28	84.90	85.53	86.15	86.77
1400	87.40	88.02	88.65	89.27	89.90	90.52	91.14	91.77	92.39	93.02
1500	93.64	94.27	94.89	95.51	96.14	96.76	97.39	98.01	98.64	99.26
1600	99.88	100.51	101.13	101.76	102.38	103.01	103.63	104.25	104.88	105.50
1700	106.13	106.75	107.38	108.00	108.62	109.25	109.87	110.50	111.12	111.75
1800	112.37	112.99	113.62	114.24	114.87	115.49	116.12	116.74	117.36	117.99
1900	118.61	119.24	119.86	120.49	121.11	121.73	122.36	122.98	123.61	124.23
2000	124.86	125.48	126.10	126.73	127.35	127.98	128.60	129.23	129.85	130.47
2100	131.10	131.72	132.35	132.97	133.60	134.22	134.84	135.47	136.09	136.72
2200	137.34	137.97	138.59	139.21	139.84	140.46	141.09	141.71	142.34	142.96
2300	143.58	144.21	144.83	145.46	146.08	146.71	147.33	147.95	148.58	149.20
2400	149.83	150.45	151.08	151.70	152.32	152.95	153.57	154.20	154.82	155.45
2500	156.07	156.69	157.32	157.94	158.57	159.19	159.82	160.44	161.06	161.69
2600	162.31	162.94	163.56	164.19	164.81	165.43	166.06	166.68	167.31	167.93
2700	168.56	169.18	169.80	170.43	171.05	171.68	172.30	172.93	173.55	174.17
2800	174.80	175.42	176.05	176.67	177.30	177.92	178.54	179.17	179.79	180.42
2900	181.04	181.66	182.29	182.91	183.54	184.16	184.79	185.41	186.03	186.66
3000	187.28	187.91	188.53	189.16	189.78	190.40	191.03	191.65	192.28	192.90
3100	193.53	194.15	194.77	195.40	196.02	196.65	197.27	197.90	198.52	199.14
3200	199.77	200.39	201.02	201.64	202.27	202.89	203.51	204.14	204.76	205.39
3300	206.01	206.64	207.26	207.88	208.51	209.13	209.76	210.38	211.01	211.63
3400	212.25	212.88	213.50	214.13	214.75	215.38	216.00	216.62	217.25	217.87
3500	218.50	219.12	219.75	220.37	220.99	221.62	222.24	222.87	223.49	224.12
3600	224.74	225.36	225.99	226.61	227.24	227.86	228.49	229.11	229.73	230.36
3700	230.98	231.61	232.23	232.86	233.48	234.10	234.73	235.35	235.98	236.60
3800	237.23	237.85	238.47	239.10	239.72	240.35	240.97	241.60	242.22	242.84
3900	243.47	244.09	244.72	245.34	245.97	246.59	247.21	247.84	248.46	249.09
4000	249.71	250.34	250.96	251.58	252.21	252.83	253.46	254.08	254.71	255.33
4100	255.95	256.58	257.20	257.83	258.45	259.08	259.70	260.32	260.95	261.57
4200	262.20	262.82	263.45	264.07	264.69	265.32	265.94	266.57	267.19	267.82
4300	268.44	269.06	269.69	270.31	270.94	271.56	272.19	272.81	273.43	274.06
4400	274.68	275.31	275.93	276.56	277.18	277.80	278.43	279.05	279.68	280.30
4500	280.93	281.55	282.17	282.80	283.42	284.05	284.67	285.30	285.92	286.54
4600	287.17	287.79	288.42	289.04	289.67	290.29	290.91	291.54	292.16	292.79
4700	293.41	294.04	294.66	295.28	295.91	296.53	297.16	297.78	298.40	299.03
4800	299.65	300.28	300.90	301.53	302.15	302.77	303.40	304.02	304.65	305.27
4900	305.90	306.52	307.14	307.77	308.39	309.02	309.64	310.27	310.89	311.51

Table 4—Kilogrammes per cu. m. to lb. per cu. ft.
This table is to be used for densities of all kinds of building materials from expanded plastics upwards. The relationship between the value of kg/m³, which is an SI value, and normal metric specific gravity is to divide this value by 1,000, i.e. 1,000 kg/m³ = specific gravity 1,000.