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

What is happening in the schools?

To what extent are metric measurement and dimensional co-ordination being practised in schools of architecture? Speaking at the Building Centre recently Bruce Martin expressed some concern. The occasion was the award of the Pilkington Prize for modular design, a competition organised by the Modular Society. The number of entries was disappointing and the standard did not warrant the award of a first prize, although for the second year running, second year students of the Regent-street Polytechnic collected joint prize money for extremely competent work. What appeared to be lacking in the drawing on display was the integration of modular thinking and standardisation of components in the designs. The dimensional framework was mostly applied rigidly but without real understanding. Only six schools submitted entries and obviously many others could have submitted work but for some reason did not. Perhaps the competition idea is not acceptable to students in this day and age. This is something that the Modular Society will need to look at again.

Nevertheless, the doubt exists as to whether the schools are abreast of the metric change programme and as to whether those students who qualify later this year will have to be re-trained when they join their first office. Probably they will be conversant with SI units, but what about dimensional co-ordination, which is an essential part of the change as far as the construction industry is concerned. Is there a sufficient number of staff capable of teaching the subject? For that matter is the need to teach the subject sufficiently appreciated?

In BMN we should like to report on work going on in the schools and have already been approached by one or two. We would be glad to hear from a lot more and to be in a position to publish case studies and to explore methods of teaching.

Metric Parkinson

No one is likely to envy Lord Ritchie Calder his post of chairman of the Metrication Board, but we should at least like to wish him success. He comes on the scene when most industries have already prepared their programmes or, as with industries such as construction and pharmaceutics, the programme is already well under way. He will obviously need time to collect together his board members and staff and by that time these industries will have progressed still further. It is to be hoped that they will in no way be held up while the tricky problems of co-ordination between industries are resolved.

In particular the Metrication Board needs to show that the country as a whole is going metric. It knows that it is to adopt decimal currency and indeed it has no alternative. But a great deal of publicity will be needed to convince shopkeepers and housewives that the inch and the ounce are on the way out.

Perhaps this would be a good moment for the construction industry to review the number of committees already concerned with metric change. At present it is quite possible to spend the week moving from one committee to another discussing the same agenda, apparently with the same people wearing different hats. One plea to Lord Calder, do please appoint members for the construction industry who know what is happening and who are already involved. It will take time enough for the Metrication Board to become effective without having to explain to board members what it is all about.

Learning basic metric sizes

In the second of his two articles on learning metric, L. J. F. Stone, MPBW's Metrication Officer, discusses the more complex metric units. There is no simple method of learning these, such as the metre-yard relationship, and it is suggested that a basic range of equivalents must be stored in the mind to provide suitable checkpoints.

Metric equivalents of other imperial functional dimensions

So far this paper has dealt with the problem of appreciating the size of common objects in terms of metric units but this is not the only problem with which the designer and those involved with him in the construction of buildings or installations are concerned. The other major problem is learning the basic metric sizes of components and fittings, the dimensions of which have a functional derivation, without constantly converting the imperial dimensions into metric units. Typical examples of these basic dimensions are: (a) the height of a sink unit; (b) the treads and risers of stairs; and (c) the height of the seat of a chair.

To solve this problem, an entirely different technique from that necessary for appreciating the size of common objects is required. Initially the imperial dimension has to be converted into its metric equivalent which must then be memorised. This involves a positive mental process of committing basic metric data to memory and although this can be achieved by the repeated use of the metric sizes in day-to-day work, those not constantly designing in the new units will need to embark upon a separate exercise of learning the new basic data. If this is not done the designer will find himself thinking of the imperial size and converting it to metric units on almost every occasion.

A convenient way of learning is to write down all basic data in metric terms only and commit them to memory as a child learns mathematical tables.

Metric equivalents of imperial units and data

Up to this point, reference has been solely to dimensions, but the technique of learning the basic metric dimensions of objects which have a functional derivation applies equally to all other data at present expressed in terms of cost per imperial unit of length, area or volume. Price or cost data in terms of pounds, shillings or pence per foot or yard must be converted into terms of pounds and decimals per metre before it can be memorised but once converted it is essential that at least a representative selection of data is committed to memory so that the user of the data can think and talk intelligently in the new units. This applies particularly to quantity surveyors who having memorised for example the cost of the most significant items in each trade in decimal pounds per square metre can arrive at other prices in similar terms by relativity. Here again the starting point of the exercise is the listing of the basic data in metric terms and this includes the conversion of a representative selection of elemental cost analyses.

All of the techniques previously mentioned have been related to data based on the SI unit for length and its derivatives. The SI system, however, includes a number of basic and derived units which are of much greater complexity than the linear units and will have a significant effect upon the work of the civil, structural and mechanical engineers.

Whereas in the case of the unit of length and its derivatives the greatest difficulty is the dissimilarity of the size of the imperial and metric units, the units for force, heat flow, heat conductance (U value), etc. are in terms which involve calculations based on a combination of a number of new units.

There is, therefore, no simple method of learning the new units which will also serve as a method of learning the solutions to basic design problems using these units. For example, an understanding of the derivation of the Newton will not in itself indicate the metric equivalent of a cube strength of concrete of 4 000 lbf per sq.in. which is 27.6 MN/m². Neither will there be any obvious relativity between a U value expressed in imperial terms as 1.0 BTU/hr./sq.ft./deg. F and in terms of SI units as 5.7 W/m²/deg. C.

This being so, no results of calculations involving the new units will look wrong or even absurd until the designer has stored in his mind a basic range of equivalents which can act as checkpoints in a series of solutions to the design problem or in other words until he has established a series of key recognition factors. If, for example, the structural engineer memorises the facts that concrete stresses of 20.7 *MN/m² and 27.6 MN/m² are the equivalents of 3 000 lbf/sq.in. and 4 000 lbf/sq.in. respectively he will be able to recognise an error of any significant magnitude throughout the whole range of relativity. Similarly the mechanical engineer can use a boiler output of 30 kW which is the approximate equivalent of 100 000 BTU/hr. as the mnemonic for the whole range.

The following items are suggested as examples of such key recognition factors

Civil engineers

DESIGN FACTOR	METRIC			IMPERIAL	
IMPOSED LOADS	Value as new Codes of Practice	Unit symbol	Unit	Equivalent value	Unit
Office floors					
General use	2·50	kN/m²	kilonewton/square metre	50	lbf/ft²
Data processing equipment	3·50	kN/m²	kilonewton/square metre	70	lbf/ft²
Factory floor	5·00	kN/m²	kilonewton/square metre	100	lbf/ft²
SAFE BEARING CAPACITY OF SOIL	107·25*	kN/m²		1	tonf/ft²
	214·50*	kN/m²		2	tonf/ft²
	429·00*	kN/m²		4	tonf/ft²
REINFORCED CONCRETE					
28-day cube strength	21·00	MN/m²	meganewton/square metre	3 000	lbf/in²
	41·00	MN/m²	meganewton/square metre	6 000	lbf/in²
Permissible comp. stress in bending	7·00	MN/m²	meganewton/square metre	1 000	lbf/in²
	8·50	MN/m²	meganewton/square metre	1 250	lbf/in²
	10·00	MN/m²	meganewton/square metre	1 500	lbf/in²
Shear	0·70	MN/m²	meganewton/square metre	100	lbf/in²
	0·90	MN/m²	meganewton/square metre	130	lbf/in²
Reinforcement M.S.	140·00	MN/m²	meganewton/square metre	20 000	lbf/in²

* Direct equivalents not yet covered by C.P.

Mechanical engineers

UNIT OR DESIGN FACTOR	METRIC			IMPERIAL	
	Approximate value	Unit symbol	Unit	Equivalent value	Unit symbol
Gallon per minute	7·5	litre/s	litre per second	100	g.p.m.
British Thermal Unit	105·0	kJ	kilojoule	100	B.T.U.
Therm	0·1	GJ	gigajoule	1·0	10^6 BTU
Refrigerant ton	3·5	kW	kilowatt	1·0	12 000 BTU/hr.
Horse power	7·5	kW	kilowatt	10	h.p.
Boiler capacity	15·0	kW	kilowatt	50 000	BTU/hr.
	30·0	kW	kilowatt	100 000	
Pound force per square inch	689 500	N/m²	newton/square metre	100	lbf/in²
	689·5	kN/m²	kilonewton/square metre		
'U' values	5·7	W/m²/deg.C	watt/square metre/degree celsuis	1·0	BTU/hr/ft²/deg.F
	2·7	W/m²/deg.C	watt/square metre/degree celsuis	0·47	
	1·7	W/m²/deg.C	watt/square metre/degree celsuis	0·3	
	1·1	W/m²/deg.C	watt/square metre/degree celsuis	0·2	
Radiator emission	650	W/m²/60 deg.C	watt/square metre	185	BTU/hr/ft²/100 deg.F
Illumination	10·76	lx	lux	1·0	foot candle lm/ft²

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Quantity surveyors	Approx. value in decimal £'s
Excavate surface trench not exceeding 1·50 metres deep	1·78 m³
Portland cement concrete (1:3:6)—¾in. in trenches over 300 millimetres thick	6·57 m³
½in. (13 mm) diameter steel rod reinforcement to BS 785 hooked and bent and fixing in floors	0·10 kg.
Formwork to horizontal soffites of floors and roofs	1·84 m²
One brick wall in flettons in cement lime mortar (1:2:9)	3·50 m²
4 × 2in. (102 × 51mm.) Softwood floor joists	0·22 m.
1in. (25 mm.) (nominal) Straight edge softwood flooring and nailing to joists	1·08 m²
1¾in. (44 mm.) (finished) External pattern ply-faced flush door size 2ft. 6in. × 6ft. 6in. (762 × 19 812 mm.)	4·54 each
Rolled steel joists	0·11 kg.
¾in. (19 mm.) Copper pipe to BS 659 with capi llary couplings	0·70 m.
Render and set in cement lime sand (1:1:6) and set in gypsum on walls	0·60 m²
26oz. (737 g.) and glazing to wood with putty in panes over 0·10 but not exceeding 0·50 square metres	1·44 m²
Knot, prime, stop and paint two undercoats and one finishing coat on general surfaces of woodwork internally	0·72 m²

Cost of Building

A building of the type now costing about:	will now be expressed as about:
50/– sq.ft.	£27 m²
100/– sq.ft.	£54 m²
150/– sq.ft.	£81 m²
200/– sq.ft.	£108 m²

i.e. 20/– sq.ft. is approximately £11 m² (actually £10·764).

It is essential that engineers and quantity surveyors should set up their own checkpoints to enable them to develop an instinct of error in metric terms similar to that which they now have in imperial terms.

In this paper an attempt has been made to suggest guide lines for the learning and appreciation of metric units of measurement.

Except as an initial process for determining the metric equivalents of imperial functional dimensions and for setting up key recognition factors, conversion of imperial dimensions to metric equivalents must not be adopted as a method of learning if we are to be able to think metric. The technique must be to relate metric sizes and units directly to recognisable lengths, shapes and terms of performance and use the resultant images as the basis of appreciation in metric terms.

The method adopted when the decision was made to change the scale of air temperature from fahrenheit to centigrade is a good example of the wrong technique. When air temperatures were given in fahrenheit and centigrade, only the fahrenheit registered with us as we developed a habit of associating air temperatures in terms of fahrenheit with degrees of personal comfort. Had the air temperatures been given in terms of centigrade only we would have been forced to relate them to degrees of comfort if only to determine what type of clothing to wear. As it is, air temperature expressed in centigrade has little significance to most of us and this will be the same with other metric units unless we adopt the correct method of learning them.

Readers will no doubt be able to adapt the ideas which have been put forward and improve upon them but, if this paper results only in an awareness of the need to make a conscious and determined effort to learn the new system rather than hope that it will be learned gradually by conversion of imperial units and use, it will have achieved its purpose.

*CP 114 quotes 21·0 N/mm². This is equivalent to 21.0 MN/m² which will be the accepted expression.

Coming events

TUESDAY, 18 FEBRUARY
Lecture on metrication: the problems of applying controlling dimensions economically to design. College of Estate Management, St. Alban's-grove, Kensington, London, W8, at 6.30.

TUESDAY, 25 FEBRUARY
Lecture on metrication: an examination of a pilot project being undertaken by the MPBW for the design of a building in SI units and controlling dimensions. College of Estate Management, St. Alban's-grove, Kensington, London, W8 at 6.30.

THURSDAY, 27 FEBRUARY
Metrication in the building industry: papers by O. H. Lawn, asistant secretary, MHLG; L. J. F. Stone, metricaton officer, MPBW; and Rosemary Part, CITB. Organised by the Building and Estates Group, The Royal Society of Health, at Eccleston Hotel, Eccleston-square, London, SW1. 2.15.

WEDNESDAY, 19 MARCH
Trend 69: a conference on metrication in the building industry chaired by Peter Cocke, chairman of the RIBA Metric Advisory Group and arranged by Dibben Builders' Merchants Ltd. Held at the company's headquarters at Antelope House, Bursledon-road, Thornhill, Southampton at 5.30. Applications for tickets (10s.) should be made to the Conference Secretary, c/o Dibben Builders' Merchants.

MONDAY, 31 MARCH
Metrication and modular co-ordination: a three-day mid-career course for architects in preparation for the change to metric and an introduction to modular co-ordination will be held in the School of Architecture, Department of Environmental Design, Manchester College of Art and Design, All Saints, Manchester 15. (31 March-2 April).
The fee for the course, which is non-residential, is £12. Accommodation is limited and those wishing to attend the course should make application by 28 February to the Secretary, School of Architecture, at the above address.

MPBW lectures

The following lectures on the change to metric have been arranged by MPBW's Directorate of Research and Information.

Tuesday, 18 February
Newton St. Boswells, Scotland. Speakers: P. Shaw (Muirhead Muir & Webster) and M. F. Brake, of Scottish Development Department, at St. Boswells Public Hall, 7.30.

Wednesday, 19 February
Cardiff. Speaker: A. M. Harrison of L. C. Wakeman & Partners (quantity surveyors), Birmingham, at the Reardon Smith Lecture Theatre, Cathays Park, 7.30.
Lincoln: Speaker: I. H. Seeley of Nottingham Regional College of Technology, at the Technical College, Cathedral-street, 7.15.

Thursday, 20 February
Glasgow. Speakers: P. Shaw of Muirhead & Webster, and M. F. Brake of Scottish Development Department, at Room 449, Strathclyde University, 7.30.
Worthing. Speaker: P. Hughes, deputy borough architect of Worthing, at Worthing College of Further Education, Broadwater-road, 7.15.

Thursday, 27 February
Preston. Speaker: To be appointed, at the Bull and Royal Hotel, Church-street, 7.15. (In association with the Building Centre).

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News from the Industry

Building glass metrication plans

In co-operation with the Flat Glass Association, Pilkington has announced plans to complete metrication of flat glass supplied to the UK construction industry by 1 October 1970. This date was chosen to coincide as far as possible with the conversion to decimal currency in February 1971 and allows for a short running-in period. From October 1970, all Pilkington invoices will quote metric sizes and be calculated in decimal currency, but until decimalisation day, totals will also be shown in £ s. d.
Since 1 January 1969, all flat glass has been made in metric thicknesses. Small changes have been made in some glass thicknesses to bring them into line with internationally agreed standards, the intention of which is to set the nominal thicknesses at exact millimetres. Linear measurement of glass will continue to be in imperial units until October 1970. The industry also say that some changes in stock sizes are inevitable in converting imperial sizes to the nearest metric equivalent.
A metric catalogue will be available by spring 1969, but the current imperial catalogue will be kept in print during the changeover period. A new tariff quoting decimal prices and metric sizes will be published, for information only, by mid-1970.
All dimensions of glass supplied in the UK will be expressed in millimetres, thus avoiding use of the decimal point, but the unit of area will be the square metre.

Lag in metric literature

More than 95% of the makers of building materials who replied to a survey by the Materials Information Group of the GLC Department of Architecture are still not using metric conversions in their trade literature. The Group—in their latest bulletin (No. 19)—say that of the 1 400 asked to send their latest details, a thousand replied and of these less than 5% included metric units.
According to BSI's programme, manufacturers should have been providing technical information in metric terms by last December.

Site problems

Referring to problems on site during the metric changeover, E. Thompson, Technical Information Officer NFBTE, in a talk last month to the London Construction Safety Group, said in the first stages of conversion the contractor would have on site some imperial-size components and some metric. This could come about fairly soon with reinforcing rods, and after 30 June, 1970, no imperial rods will be manufactured as standard. This will mean extra cost for the contractor, as he will need to have separate stacks on site.
What has the contractor to do? asked Mr. Thompson. First, he must recognise that the change is now with us. Second, the implications must be understood by contractors and this, he suggested, required the appointment of one man in each company to look after things and say what training programmes are needed. In this connection, Mr Thompson said training should be linked to a fairly immediate prospect of working in metric. If training were done too early and the time between it and the actual commencement of working in metric was overlong, much of it might be forgotten.

More industries go metric

Two more major sectors of industry—shipbuilding and electrical engineering—announced their programmes for changing to metric last month.
The electrical industry expects the main period of change for accessories and components to be between 1971 and mid-1974. Industrial electric and electronic equipment should mainly change between mid-1971 and mid-1975, but power generation and transmission equipment will take longer, with up to three-quarters of the change completed by the end of 1976.
In introducing the two documents, George Beeby, chairman of BSI, said that the membership of the Metrication Board, for which Lord Ritchie Calder has been chosen as chairman, was known to be under active consideration. Once it was announced the great metrication movement would really be on the move. Doubtless the movement would have to counter inertia and the resistance to change which seems to be built into mankind. 'There are those who think that this is the wrong time for such a major change. I take the view that this is precisely the right time, with the great surge of technological advance going on all round us here and now—and as for the cost, which will undeniably be considerable though widely distributed, can we really afford not to adopt a system that is already used so widely abroad.

Softwood metric 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 (see 'Building,' 28 June, p. 120) in order to give specifiers and users an indication of the metric sizes softwood shippers will be producing for the 1970 shipping season. It is expected that metric softwood will be arriving in the UK in reasonable quantities early next year.
The modifications incorporated in the final schedule are that 38 mm replaces 40 mm, and 44 mm replaces 45 mm in the thicknesses. The length range now commences two 'steps' down—at 1.8 m instead of 2.4 m.

Metric seminars for designers

A series of one-day metric seminars is being organised by the National Building Agency for private architects and for the design staffs of builders and manufacturers. These follow the series of forty-two metric seminars that the NBA organised for local authority staffs last year.
They are being held as follows: Manchester, Tuesday 18 March; Newcastle, Tuesday 25 March; London (1), Thursday 27 March; Birmingham, Wednesday 2 April; Bristol, Tuesday 15 April and London (2), Thursday 17 April.
The seminars have been designed to explain preparations for the change to metric, the dimensional framework for housing, the development of metric components, and house planning and detailing in metric dimensions.
Five talks will be given during the day. A £10 fee covers attendance, morning coffee, lunch and afternoon tea and a set of relevant government, BSI and NBA publications. The seminars are approved by the Construction Industry Training Board and qualify for grant. Application forms can be obtained from the Seminar Secretary at NBA House, Arundel Street, London WC2.

Metric aid

CIRIA, the Construction Industry Research and Information Association, have introduced a desk-top edition of their widely-used metric conversion factors. Printed both sides of an A4 card for quick reference, and laminated for cleanliness, the new format gives conversion guidance to nearly 200 British units.
The factors cost 20s. for ten, £8 for 100 and £65 for 1 000 (reduced rates to CIRIA members) and are available from Buckland Press Ltd., Dover, Kent. Specimen copies cost 3s. 6d. each.
CIRIA's pocket-book edition, available from Harvey Pictorial Services, 4 Alfred-square, Deal, Kent, have sold 15 000 copies in four months of publication.

Conversion guide

A booklet of conversions to metric measurements, intended as a practical aid for specifiers and users of fibre building boards, has been published by FIDOR (Fibre Building Board Development Organisation Ltd.). The FIDOR Metric Conversion Guide is an A4-size loose leaf folder with plastic lip binder. It lists the metric equivalents for all common sheet and tile sizes and thicknesses. A table gives conversion factors for the units of measurement relevant to the use of sheet materials (length, area, mass, density, mass per unit area, thermal conductivity and pressure/stress). For rapid reference purposes, a pull-out fold shows nine graphs of common conversions. Further notes in the guide relate to the presentation of numerical values, examples of rules of use, scales, etc.
Copies of the guide are available free of charge from: FIDOR, Buckingham House, 6-7 Buckingham-street, London, WC2.

Metric office building

A Crown Office in Penrith has been designed by the Directorate-General of Research and Development of the Ministry of Public Building and Works. Below is a preliminary report, by Eric Corker, Dip.Arch, ARIBA, on this first project for MPBW in the UK to be designed in metric units to conform with BS 4330.

Client
INLAND REVENUE, Department of Health and Social Security and the Department of Employment and Productivity

Project manager
LEN LEWIS

Job architect
TIM HOBBS

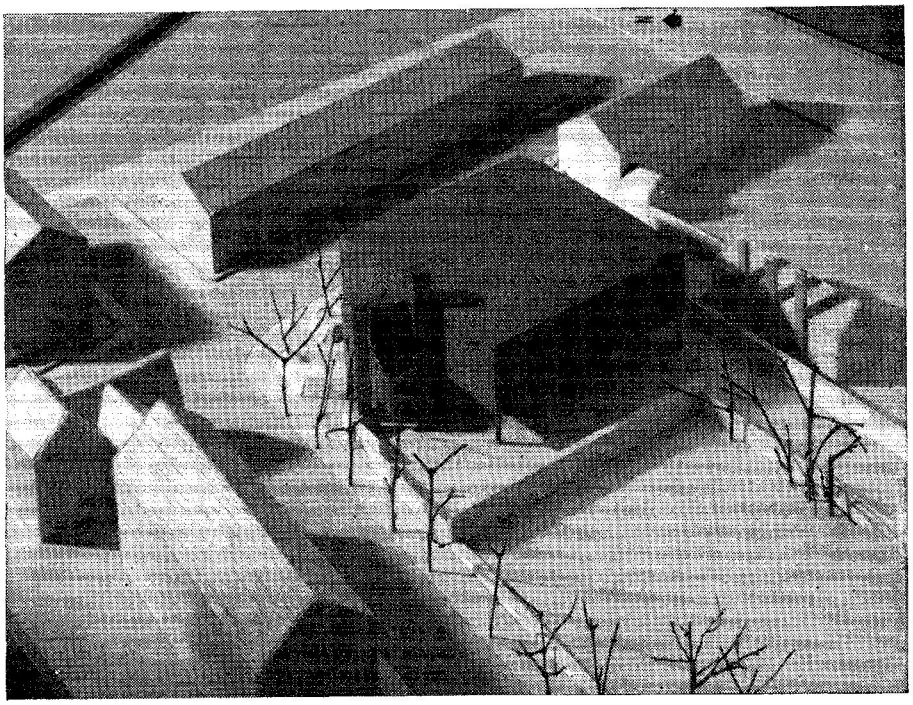
Assistant architect
PAUL RICHOLD

Quantity surveyor
JOHN AYRIS

Structural engineer
DEREK TOMLIN

Mechanical & electrical engineer
GEORGE GRAHAM

The policy of the Ministry of Public Building and Works is that all new projects entering the design stage after 1 January 1969 shall be designed in metric, applying co-ordinated dimensions to BS 4330. It was decided that this project was a suitable one to be used for a pilot study ahead of the metric building programme to try to find out what problems arose in practice in metric units. The project is typical of Crown Office buildings and has been designed to keep within current cost limits. It was commissioned in June 1968 and covers a net area of 1 070 m^2. This project was originally conceived in imperial terms and the brief had to be converted to metric but from now on, all new projects for the Ministry will be based on a metric brief. The design has received client approval and town planning assent, and contract drawings/schedules and bills of quantities are now being prepared; it is anticipated that tenders will be invited in May.
Experience during the design stages of the project has been recorded and this is the first of a series of three articles, which together will comprise a preliminary account of some of the main lessons that have emerged so far. A more detailed case history is being made for the Ministry as a reference for future projects.



Model of the Crown Office building at Penrith, Cumberland

Experience in using metric

No unexpected difficulties were reported by any of the designers in the process of becoming familiar with metric units of measure. Two or three weeks experience is all that seems to be needed to get the 'feel' of the metric system and the numerous aids and conversion tables which are now available to help change values from imperial measure to metric seem to have proved perfectly adequate; no one found any difficulty with arithmetical calculations in metric units.
Everyone, however, did find that at certain points in their work there was a need to convert back from metric to imperial measure and that aids for this purpose were not available, except by using either the existing tables backwards, the BSI Conversion Slide or by calculation using either of the conversion factors. For example, having produced a scheme completely in metric dimensions and areas, the architects suddenly found that they had to do some quick calculation in front of their clients to explain what the figures meant in imperial terms; the quantity surveyor frequently found that he needed re-conversion tables to check that the various values for cost estimates he had produced in metric were in fact sensible; similarly, the structural engineer and the mechanical and services engineer both found that they needed to re-convert to check that their calculations were within acceptable limits. It was generally felt that in the course of time, people would soon retain certain figures as points of reference and become as accustomed to metric measurements as they had to imperial. But until metric thinking had become habitual, it was thought likely that people would continue to have reservations about their confidence in whether their metric calculated figures were sensible; it would therefore be very useful if all re-conversion tables were available for quick checking purposes.

At this present time, there are as yet only a very few metric components readily available and for this project, in fact, only door sets can be obtained 'off-the-shelf.' For some components such as windows and concrete cladding panels, it has been possible to design them in sensible metric sizes because there are sufficient of them for batch production facilities to be used and still remain economical. Other components are to be made in situ, particularly the structural components (rc columns and plate floors and staircases). For the rest, the components used will be imperial sized standard components which will have to be adapted to suit the metric dimensions of the project. The application of the Ministry's policy on dimensional co-ordination caused no undue difficulties and the framework of the grid reference was employed and found to be a useful drafting aid in the working out of the details of the design and construction.

Sequence of work

But the discipline of dimensional co-ordination does affect the sequence of the various stages in which design evolves and due regard must be paid to this aspect.
In the past it has been usual in the Ministry for this type of project to proceed in a 'traditional' sequence of work, designing and working-up the scheme to a scale usually no larger than $\frac{1}{4}$ in = 1 ft. Client approval, local authority consents, cost checks, preliminary structural and services design, and schedules of materials are all carried out largely on the basis of drawings to this scale. Thereafter, much larger scale working drawings are produced, bills of quantities prepared and competitive tenders invited.
This procedure has worked well up to the present time because it was linked to traditional methods of construction

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Texts for to-day

In October last year, metrication learning texts, covering a wide spectrum of the building industry, were issued by the Construction Industry Training Board. Each of the eight texts was carefully plotted on a guide sheet—who they were for, what they covered, the approximate time needed for completion, at what period of the metric change they should be used, where the texts could be studied, i.e., in the office, at home or on the site, and what would be needed as a follow up. This intelligent and meticulous treatment gave clarity to what, in essence, was a fairly complex exercise.

Its compiler, the Head of CITB's metrication section, Miss Rosemary Part, has this facility for extracting the essence of a subject and reducing it to very simple terms. Changing to metric she sees for most people as largely a psychological problem; the more one is conditioned, the more difficult it will be to break out of the imperial barrier. She quotes a joinery manufacturer in a factory making parts for aircraft: 'he found that experienced joinery craftsmen had a much harder task in working to metric than did housewives who had only recently joined the firm.'

In the building industry she feels that the greatest problems will lie with those who need to have a visual understanding. 'Storekeepers, for instance, where they can now look at a delivery lorry and estimate X yards^3 will have to do the visual calculation in X metres^3.'

Designers, such as architects and structural engineers, will have the biggest headaches—'it could take them months to years to gain the expertise of looking at things in metric. There may be little we can do to help—it is more likely to be learned by bitter experience.'

It is in the main area where the transition is not so traumatic that the CITB learning texts are principally aimed: for managers of small firms, technical staff, clerical staff and site operatives where the new system can be learnt on a teach-yourself basis. Where learning texts are not appropriate as a teaching method, course material is available, either as a syllabus for use by experienced training officers or 'fully scripted' for 'ad hoc' tutors.

Background in industry

Miss Part's knowledge stems from nearly seven years in the building industry and a deep involvement in education. Her original intention to become a hospital almoner was frustrated by the war, when she served in the air force in radar. Afterwards she spent nine years as organising secretary for the Crosby Hall Endowment Fund, International Hall of Residence for Women, an organisation that helped to get women placed at university, then later switched occupations to become company secretary to a hosiery manufacturer.

Her connection with the construction industry was made in 1962 when, 'fascinated by the possibilities' she joined the London region of the NFBTE (then the LMBA) to become responsible for educational training. She looks back on this as a most rewarding experience. 'During my four years there I placed about 700 youngsters in building firms.' Besides the satisfaction derived from helping young people get on, she got to know a lot about the industry.

In 1966 Miss Part moved to the CITB which 'seemed an interesting place to go. It covered the whole country and the whole field of construction.' Being an early member of the training division (external section) 'was very exciting.' Courses held outside, i.e., run by colleges and private organisations, were vetted to see that the right people were directed to the right course. 'Since a lot of money was paid out in grants we had to take particular care and I did a lot of sitting in on courses.'

She moved on to the metrication section in February 1967, on the same day that BSI published PD 6030. Contact was made with BSI and some 35 professional institutions, employers' and trade associations and trade unions to establish training requirements. It soon became clear that special training would be unnecessary for new young entrants taking City & Guilds, etc., as the Council of Technical Examining Bodies were already planning for examinations to be set in metric. The CITB was therefore able to concentrate on the retraining of those already in the industry. In July and August 1967, investigations were carried out with a number of firms of different size to establish retraining needs. It was decided, because of the wide dispersal of these firms and the high proportion of small units among them (50 000 firms with 19 men downwards) it would be necessary to use every available means of retraining in a crash programme. The training aids introduced for this purpose have been a spectacular success—'we can't distribute them fast enough, by the end of the year about 8 000 had been sent out.'

The CITB have also briefed one man in each of their sectors to advise on metric. Regular meetings are held for feed back and visits are paid to companies to discuss problems involved in going metric. In all, this involves 18 people, of whom only Rosemary Part and Denny Dennis (who joined the metrication section last July) are full time members.

How smooth will the changeover be? 'It depends on the attitude of mind from management to labour,' says Miss Part. 'If people say it is going to be difficult they will make it so. If approached with an alert and clear mind, the transition need not be painful!' She thinks that firms cannot afford not to give staff time off in order to study. But it was necessary to start training at the right time. If too early, the trainee could lose the feel for metric and have to begin again. This was one thing the learning texts, with their specific indications on timing, could help to avoid. Apart from designers, are there any other difficult areas?

'Supervisors who are in charge of large sites and could lose their companies a lot of money if they weren't adequately trained. Also management if they were not aware of the implications as far as their firms are concerned. But I hope, and think, that by 1972 all will be plain sailing and we may wonder what all fuss was about.'

METRIC OFFICE BUILDING

(continued from page 135)

which predominantly used on-site craftsmanship and which affords the facility of modification of details up to quite a late stage, even after the construction work may have begun. Such craftsmanship is increasingly in short supply, however, and in recent decades, there has been a rapidly increasing need to use ever more off-site fabrication and standard components. Such a method of construction needs a good deal more programming and planning which automatically limits the possibility of late adjustments or modifications to the design and construction—and this tendency to fixing decisions stretches right back into the design phase. An essential pre-requisite for the proper employment of standard components is a single dimensional discipline which encompasses both design and construction needs and this is one reason why the Ministry has devoted so much attention to dimensional co-ordination in recent years.

In practice, one of the first effects on the design process of applying the dimensional control of BS 4330 is that at the sketch design stage it is essential that certain details of some components and their assembly must be fixed. The case of the Penrith offices was no exception and such details included the size and location of columns, sizes of external cladding, the junctions between columns, cladding and partition and the thickness of the floor zone.

The solutions to these problems as they were worked out in the Penrith offices project will be described in subsequent issues of Building Metrication News.

BMN Building Metrication News

Key components

Blocks: lightweight

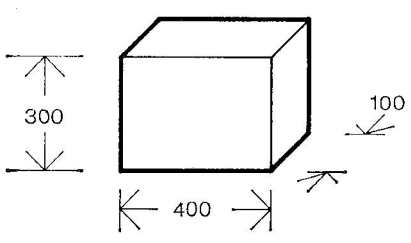
This is the 2nd of a series of data sheets prepared by The Modular Society under the editorship of Brian Jolly, ARIBA, to be published monthly in BMN.

The purpose of this second data sheet is to present the proposals of the Modular Society for the Key block which should be included in any manufacturer's range of these components, to justify its choice as a Key Component and to demonstrate its use in current building practice. These proposals are put forward as a basis for discussion —see introductory article in 'Building,' 10 January 1969. Comments will be welcomed. The Society wish to thank correspondents who have already submitted their views on the first data sheet.

Building blocks are walling units which are used in construction with similar techniques to those for brickwork. This data sheet deals with low density or perforated blocks where the block weight does not exceed 18 kg. The most common materials used for block-making are concrete, covered by BS 2028, 1364: Precast Concrete Blocks, and fired clay, covered by BS 3921: Bricks and Blocks of Fired Brickearth, Clay or Shale. A single Key block size is advocated since, for many applications, the use of cut blocks is sufficient to provide the additional sizes necessary to ensure correct bonding at openings and corner junctions in the blockwork. Special consideration should be given to fairfaced work where precision is important. The use of 'specials' may be preferable to the appearance of cut blocks, unless a precise cut can be achieved.

Key block

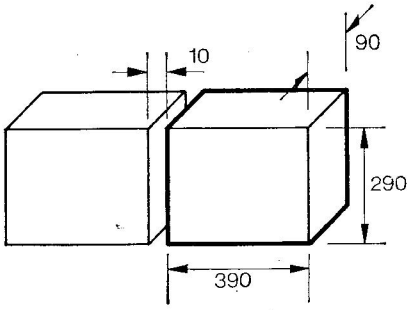
A lightweight walling block. The Key block may be of solid, hollow, perforated, cellular or aerated type where appropriate to the block material—see BS 2028, BS 3921.



Key block sizes

The block height of 300 mm is a BS 4011 first preference metric size. The block length of 400 mm and thickness of 100 mm are BS 4011 second preference metric sizes. All three sizes are simple multiples of the International basic module of 100 mm.

The manufacturing size of the Key block is 390 mm by 90 mm by 290 mm. This allows for an average joint width of 10 mm (or $\frac{3}{8}$in.), in accordance with BS 2028 and BS 3921.



Where only the Key block is used it may need to be cut into either two equal halves of 200 mm in length, or into one 100 mm length and one 300 mm length. These sizes also conform to both BS 4011 first or second preference sizes and the international basic module size.

The Key block size is within the limits of current block manufacturing sizes listed in BS 2028 and BS 3921. Current lengths range from 295 mm ($11\frac{5}{8}$ in.) to 600 mm ($23\frac{5}{8}$in.); thicknesses from 51 mm (2in.) to 219 mm ($8\frac{5}{8}$in.); heights from 92 mm ($3\frac{3}{8}$in.) to 295 mm ($11\frac{5}{8}$in.).

The weight of the Key block is limited to a maximum of 18 kg for handling considerations. This corresponds to a maximum block density of 1832 kg/m^3, whether the blocks are solid, hollow or cellular (see BS 2028). Where the actual material density exceeds this block density, the Key block may be restricted to a hollow or cellular form.

Blockwork heights

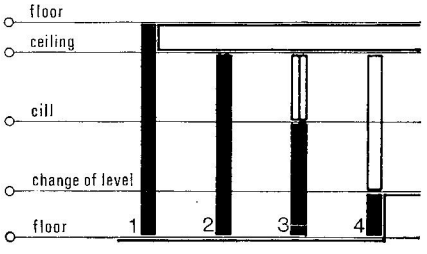
The block height of 300 mm corresponds to the single blockwork course height of 300 mm. Heights of walls constructed with this course height will be first preference sizes to BS 4011. These wall heights conform with the requirements of BS 4330 for:

1: storey height walls: from 2 700 mm

2: floor to ceiling partitions: 1 500 mm, 1 800 mm, 2 100 mm, 2 400 mm, 2 700 mm, 3 000 mm and above.

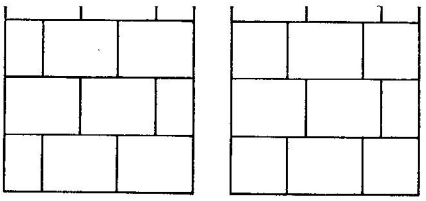
3: under cill walls: all first preference heights

4: walls at changes of level: in increments of 300 mm and 600 mm.

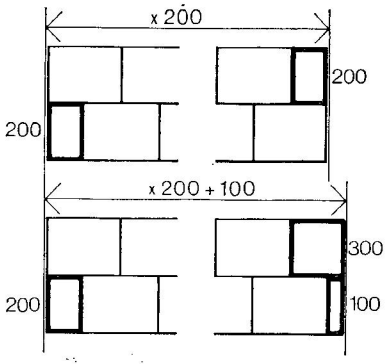


Blockwork lengths

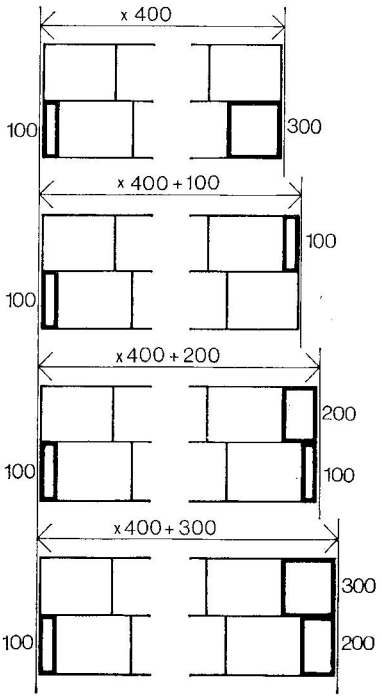
Blockwork of any 100 mm increment of length may be achieved with the use of the Key block size and its three cut lengths of 100 mm, 200 mm and 300 mm. This accords with both first and second preferences to BS 4011 and the requirements of BS 4330. Two bond arrangements are possible, half lap, and quarter lap.



Examples of half lap bond



Examples of quarter lap bond



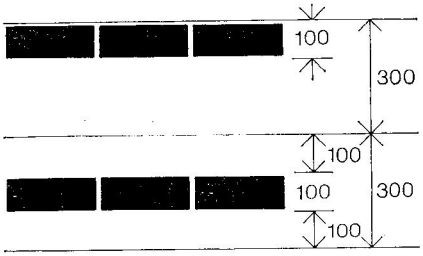
Blockwork thickness

The single thickness of 100 mm for blockwork is both a second preference size to BS 4011 and a recommended loadbearing wall zone width to BS 4330. Since the Key blockwork thickness of 100 mm is equal to its increment of length, no additional block sizes are required at corners and intersections.

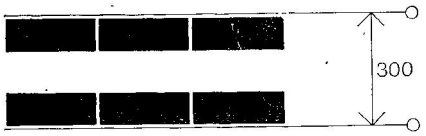
Planning with key blocks

Blockwork may be used in loadbearing and non-loadbearing walling. Loadbearing blockwork is shown below related to the appropriate zone widths to BS 4330. Non-loadbearing blockwork is shown related, for convenience, to a grid of 300 mm.

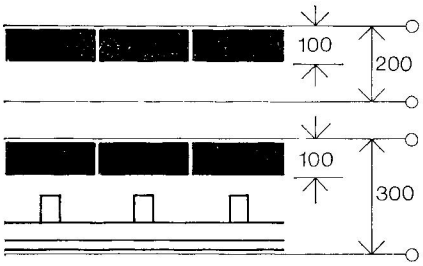
100 mm loadbearing wall in a 100 mm zone.



100 mm non-loadbearing partitions in a 300 mm grid space, shown centrally placed, and also placed with one face on a grid line.

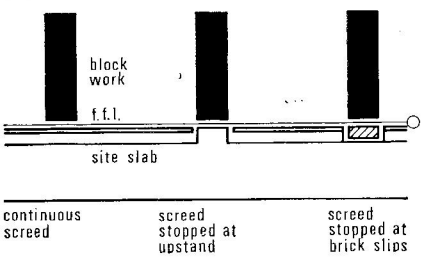


300 mm loadbearing cavity wall in a 300 mm zone.



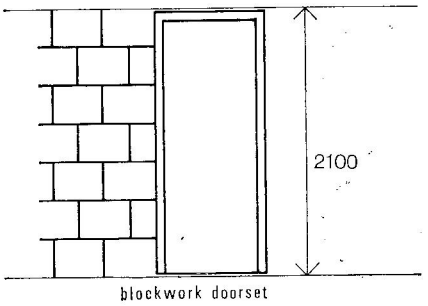
100 mm loadbearing inner leaves in 200 mm and 300 mm external wall zones.

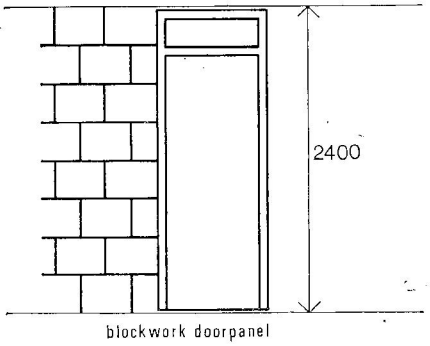
Ideally blockwork should be located so that vertical controlling lines coincide with joints between the blockwork courses. At floor level, the lowest course should be placed immediately above the finished floor level, not on the structural floor level.

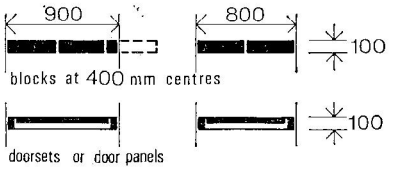


Co-ordination with other key components

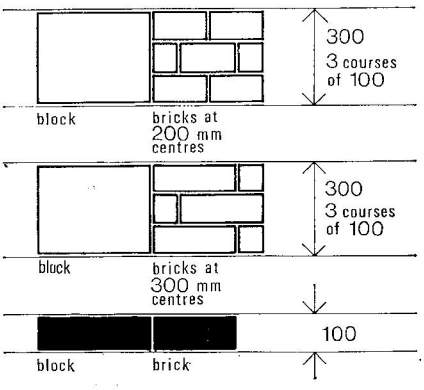
Doorsets and door panels

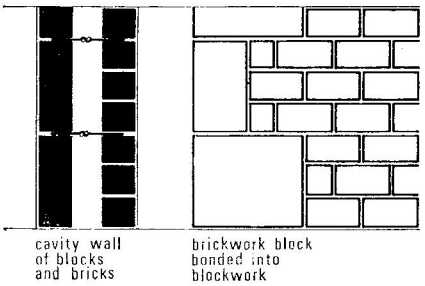




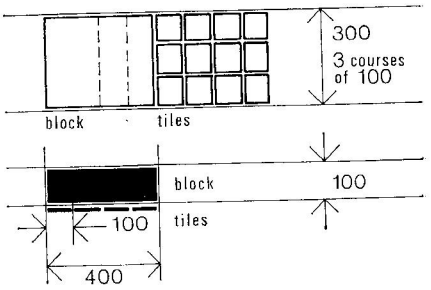


Bricks

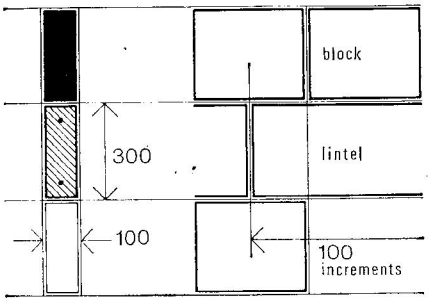




Wall tiles

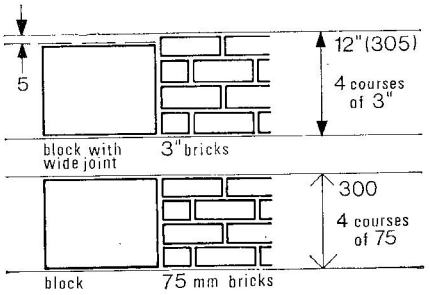


Lintels

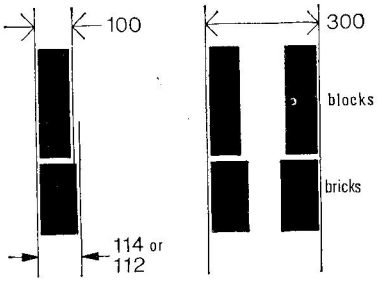


Co-ordination with imperial sized bricks

Key blocks will be required for blockwork in 12 in courses to bond with existing brickwork of four courses to the foot. This requires the use of a wide joint 5 mm larger than its standard metric joint width. Bonding with brickwork at four courses to 300 mm is also a requirement.



The different thicknesses of blockwork and imperial brickwork do not permit both faces of a composite wall to line through. In cavity wall construction, this difference may be taken up in the cavity.



BMN Building Metrication News

Letters

Key components

Sir,—Might I offer the following observations on the Key Components Data Sheet—Internal Door Sets and Door Panels published in Building Metrication News of 10 January 1969.

1. Only one method of forming door panels is proposed based on the use of a fixed transom with fanlight panel over. Two possible alternative methods warrant consideration on grounds of cost and appearance, first a 2 340 mm door leaf height, second a 2 040 mm door leaf height with a matching panel of 300 mm with or without rebated edge.
2. Whilst the Data Sheet is not concerned with assembly details I should like to draw attention to the standard door sets, at present in imperial measure, included in the Ministry of Health Compendium of Hospital Building Assemblies. The Compendium range is incidentally based on a 6ft. 10in. door leaf height; it also includes a standard detail for door panels used in a partition separating two rooms of differing ceiling height.

J. M. E. POTTER [ARIBA],
Williamson, Faulkner Brown & Ptnrs.,
Northumbrian-way, Killingsworth,
Newcastle upon Tyne.

Sir,—Since the publication of Design Bulletin No. 8 by MHLG, the British Woodwork Manufacturers' Association has undertaken considerable work on metric sizes for door sets and other components. The outcome of these studies has been well publicised and, as you will know, resulted in the BWMA proposals being submitted to ISO, having first been adopted by the organisations representing European door manufacturers.

The first of your series of key components data sheets, prepared by the Modular Society and published in your issue of 10 January, concerns internal door sets and panels. Since the proposals outlined here omit some of the detailed results of our own studies we would like to make the following comments, which have been invited by you.

We feel that the terminology employed could cause confusion. The terms 'door height set' and 'floor to ceiling height set' are those which are used and are to be preferred.

The data sheet refers only to 800 and 900 mm widths × 2 100 and 2 400 mm heights. The range of internal door sets will be based on the Functional Group Panel's Matrix which has not yet been finalised. As the organisation representing the door manufacturing industry, we shall be pressing for a range based on our proposals which have already been made known and are currently displayed at the London Building Centre. No reference is made to BS 4176:1967 or the Government decision to require the 2 600 mm floor-to-floor height in the public sector of housing.

The data sheet suggests that the door leaf thickness will be 46 mm whereas this is almost certain to be 40 mm. The latter dimension is, of course, greater than the current 1⅜in. which is commonly used.

If by clear opening the writer meant the available unobstructed width for passage through the door set when the door was opened at right angles, then the clear opening would be, in the case of the 900 mm unit, a rebate width of 830 mm less, one rebate of 12 mm, = 818 mm less one 40 mm door thickness = 778 mm less the 2 mm clearance = a clear opening of 776 mm, and in the case of the 800 mm unit this would become 676 mm. The same error occurs in the reference to the current 2ft. 6in. width door leaf where the clear opening with the door at right angles is reduced to 2ft. 4in. (710 mm).

In connection with the thickness of the framing the BWMA proposals offer a practical and economic method of dealing with a variety of partition thicknesses. There would seem to be doubts as to whether a partition thickness of 100 mm is likely to be the most commonly used.

DOUGLAS E. HALL,
Secretary,
The British Woodwork
Manufacturers' Association,
130 Regent-street, W1.

Designers start here

Sir,—I should like to point out that rule No. 3 of your guide to architects in the 10 January issue conflicts with your first BMN edited technical information sheets, published in the same edition.

It states that architects should on no account design to metric dimensions jobs which are to go on the ground prior to 1 January 1970. Presumably, however, you agree with the statement in the technical information sheets, since you edited them, that the use of components and elements, metrically dimensioned in accordance with the recommendations of the BS 4011 : 1966, helps the process of metric familiarisation during the period that the construction industry is co-ordinating its efforts for the change to the metric system.

The information sheets illustrate four A.75 metric projects which have been completed, or are under construction. Other similar projects are starting on the ground prior to 1 January 1970. This is not considered in any way to conflict with, let alone challenge, the BSI programme, since metric dimensions only apply to the components for the shell of the buildings, and in this case are entirely controlled by my company. Architects who have carried out these projects have welcomed the simplicity and ease with which metric dimensioning can be employed; manufacturers have preferred such dimensioning; and even the smallest of the builders concerned have found no problems in employing a metric tape.

May I suggest, therefore, that rule No. 3 in your leader should have read as follows:

'Make your decision on when to change on the basis of when your first job will go on the ground. This should not be before 1 January 1970, unless you are employing a complete range of components designed and produced to metric dimensions in accordance with BS 4011, and certainly not after December 1972.'

A. H. ANDERSON,
Managing Director,
A. H. Anderson Ltd,
235 Vauxhall Bridge-road,
London, SW1.

[Mr. Anderson points out that there is an exception to every rule. Who could deny this? The rule was intended to give firm guidance without hedging it round with ifs and buts. The rule conforms to the BSI programme, but if we had our time again we would omit the offending words 'on no account.'—ED.]

Publications

GOING METRIC IN THE CONSTRUCTION INDUSTRY. 2 DIMENSIONAL CO-ORDINATION. London HMSO 1968 7s. 6d.

This is the second bulletin in the series prepared by the Ministry of Public Building and Works, the first having been concerned with the change to the metric system.

The purpose of this Bulletin is to describe the general theory of dimensional co-ordination and its application in design, manufacture and construction. Following the Introduction, the bulletin is divided into six sections covering the basis of dimensional co-ordination, designation of zones, location of components, application of sizes to plans and components, requirements for assembly and sample drawings.

All concerned: the Ministry, BSI, the authors and printers are to be heartily congratulated on a first-class presentation in every sense. All 47 pages are laid out with the utmost clarity, each paragraph being both defined and illustrated. The drawings, which are used in parallel with the text, have a second colour superimposed with precision and placed in such a way as to highlight the points under discussion. The method is effective and extraordinarily successful.

The content shows the same meticulous attention to detail, precise use of words, co-ordination of subject-matter and a thorough comprehension of the subject-field that can only be the result of long analyses and studies and, I suspect, much discussion and considerable hard work. The results justify every bit of the effort.

It must be clear that I consider the bulletin is essential reading for all who are engaged in going metric. Even for those who feel they know the subject, it is worth reading as a refreshing refresher. It will remove a lot of the confusion that has inevitably grown up during the transition years and it sets out clearly up-to-date metric practice for the drawing office, the factory and the site which should ensure that going

metric will be the success it should be. The bulletin itself, while referring to PD 6031, BS 4330 and BS 1192, is fully in accord with current recommendations and standard practice and is therefore a valuable handbook simply to have around in preparation for the next stages in the changeover. We must look forward to Bulletin No. 3 in due course.

BRUCE MARTIN

QUESTIONS AND ANSWERS IN ELEMENTARY SURVEYING (METRIC STANDARD). By H. J. Brend, FRICS, MInstRA. (London: Maclaren & Sons.) Price 20s.

The book consists of 73 surveying problems with worked answers. A further 30 problems with answers only are also included. The problems are, in the main, practical surveying calculations that a student on an elementary surveying course should be capable of dealing with. The questions cover very adequately the main aspects of elementary surveying. They are mainly mathematical in content and require a reasonable proficiency in simple algebra and trigonometry. The writer suggests that the book might be used in a similar fashion to a programmed text. With the exception of a few of the simpler questions it is doubtful if many students would suceed initially in answering the questions without some assistance from a lecturer. The writer himself suggests that reference to a text book on surveying should be made and this in conjunction with the worked problems would be most useful to a student.

The answers themselves are clearly laid out although the answer to the first question has an ambiguity in the written section. The placing of the decimal point in the printing too is not in accordance with the SI recommendations. Some of the problems tend to be a little theoretical in their approach. For example, the measurement of the third place of decimals (a millimetre) on a levelling or stadia staff. Perhaps too the problems involving incorrect tapes, staffs and instruments would be better presented as calculations to find the resulting errors rather than calculations that seem to condone the use of incorrect instruments.

The foregoing is, however, a minor and personal criticism and does not detract from the usefulness of the book as a source of surveying problems.

D. F. REEVES

BRITISH STANDARD CODE OF PRACTICE CP 114: THE STRUCTURAL USE OF REINFORCED CONCRETE IN BUILDINGS PART 2, 1969, METRIC UNITS. BSI Sales Branch at 101-103 Pentonville-road, London, N1. Price 30s. each (postage 2s. extra to non-subscribers).

This part of the code gives the detailed recommendations contained in CP 114 : 1957 in terms of SI units. The values have been rounded to convenient numbers and presented in a separate document for the convenience of designers. The technical content is essentially unchanged, and it is intended that this part will remain in circulation until it is superseded by the new unified structural concrete code, now in preparation.

The code is in seven sections. The opening general information is followed by a section on materials, appliances and components and a third section on design considerations. The latter has subsections giving the general aspects of design, details for beams and slabs, columns, flat slab construction, walls, bases, stairs, reinforced lightweight concrete, fire resistance and chemical resistance. The remaining sections are on work off site, workmanship, testing and inspection, and maintenance.

Recommendations on fire resistance of reinforced concrete and on high alumina cement concrete are given in appendices.

DESIGNING FOR OLD PEOPLE

The Ministry of Housing and Local Government have issued metric editions of their first two Design Bulletins, both originally published in 1962. Both are published by HMSO, No. 1 at 3s. and No. 2 at 7s. 6d.

Design Bulletin No. 1—'Some Aspects of Designing for Old People' contains advice on interior design and equipment for old people, with anthropometric diagrams in which metric equivalents have been substituted for the original imperial dimensions. It is noted that measures are given to the nearest 5 mm which may result in a slight but unimportant degree of mathematical inaccuracy between values shown and the addition of standard deviations.

The essential content of the bulletin remains unchanged, covering such vital elements of consideration as heating, lighting, window design, sound insulation, floors, stairs and doors; and, most important of all for old people living alone, equipment and fittings for kitchens, bathrooms and wc's. It is thought that many old people will have had little experience of the latest domestic machinery, and on moving into new homes, 'they may need advice on how to use it.' This is true enough, as it is also true that 'there are clearly limits to what the designer can do.' But already seven years have passed since this bulletin was first compiled. Old people have short lives and new homes have much longer ones, and people moving into old-age groups are becoming progressively more familiar with modern equipment all the time. Designers of old people's dwellings have to think of the future aged as well as the present.

The bulletin is a valuable guide on such details as shelf heights, cupboard design, worktops, and on the placing of all equipment which involves facility in stretch and reach. Much of the advice could be applied with advantage over a wider range of domestic planning than homes intended purely for old people. Most homes have old or disabled people living in them some of the time.

Design Bulletin No. 2—'Grouped Flatlets for Old People,' has also been revised into metric, and to include the 1961 census figures. This is a sociological study containing information collected from the first six local authority schemes built in England and Wales, on how old people used the facilities provided for them, and what they thought of them in use. It is a well written and very readable account which should make valuable material for any student of sociology. As one would expect in this kind of survey, the findings are as variable as the people. The reporting is faithfully done, indicating reactions to neighbours, views, equipment and facilities generally. The bulletin includes layout plans of the six groups.

In designing homes for old people, designers have to remember that the great preponderance of residents will be women. As a concept of accommodation for old people in general, this bulletin shows that grouped flatlets with a warden in attendance are an undoubted success. Old people like to feel self-contained within their own flatlet, yet at the same time they derive a sense of security from knowing that they can ring for help. Finding the right kind of people for wardens, which might have been thought a difficulty, does not in fact prove to be so. The local authorities in the survey had no difficulty at all in filling the post, and in each case the wardens seem to have entered into their work with vocational zeal.

One of the more interesting observations in the report, which designers might take special note of, is the social function of corridors and circulation space generally. These spaces prove better social centres than common rooms, where old people tend to stay fixed in one position, or else the television takes over. But in corridors—'especially where it is a pleasant and warm area'—neighbours meet and chat who normally do not use the common room. It should not prove a difficult condition for designers to meet—making circulation spaces pleasant and warm.

MARY HADDOCK

RIBA PRACTICE NOTE

Practice Note 14, Changeover to metric, issued by the RIBA's Joint Tribunal on the Standard Form of Building Contract, offers advice to the contractor who, in the early stages of the changeover, may find when carrying out work that components and materials referred to in one measure in the contract documents are not, in fact, available in the measure or size. When this happens it is suggested that he should seek instructions from the architect. Any substitution of a different measure or size could have design implications which the architect would obviously need to consider.

SANITARY APPLIANCES

Latest edition of BS 3402, Quality of vitreous china sanitary appliances, has specifications in 'sensibly rounded metric sizes' instead of the former inch sizes. Otherwise there are no technical differences between the current and the previous edition. Copies available from BSI Sales Branch, price 8s.