another. It is the spiritual truth, living and continuing, which this sound artistic tradition is intended to set forth.

So in Mr. Brangwyn's panels it is a British working-man who helps to place the body in the tomb. Workmen lift the body from the Cross, and, by contrast, a capped workman joins in the imprecations as the weary Christ, staggering under the load of His Cross, toils onward to Calvary.

And when overcome by His burden Christ falls on the way a British "Tommy," in steel hat and sheepskin coat, threatens to strike Him. But behind Him, in another panel, walk two soldiers whose attitude seems that of compassion. Indeed, they are apparently helping to carry the heavy Cross. So it is all through these panels, the contrast of follower and reviler drawn from the same classes. A workman curses and workmen reverently take the body down for burial. One kisses the head of Christ as he tenterly lowers Him, freed from the cruel nails.

There is much cymbolism here; but it does not force itself on the beholder. It is quietly introduced and so naturally that it appears an integral part of the panel. Some of the women wear the clothing of nuns. Some of the men might well be monks. But the similitude is not stressed, and does not annoy. Clearly the artists means to convey here the relation between Christ and His Church.

Those who know the work of Mr. Brangwyn, also know his incurable optimism. Always in his paintings in which there is any religious or ethical motive, notably in such decorations as those at Horsham and his war-panel at Winnipeg, he introduces somewhere the note of hope, the vigorous belief in youth and life. Here too it may be seen by those who care to look for it. In the station where Christ wipes His brow while a workman threatens Him, there is a naked boy clinging to his mother's skirts. And along the way there are tufts of grass. While Christ goes to His death He also goes to give life. So Mr. Brangwyn conveys the truth by the boy, who symbolises the new life and the grass of the field which is constantly renewed.

You will find this symbolism again in the scene at the tomb. Right in the foreground, and serving the double purpose of decoration and symbolism, are some growing flowers, springing up amid the thick grass. So in a simple and natural symbol the artist suggests the Resurrection.

The composition of these panels is largely determined by their nature and by tradition, and there is no need to say much about it. The drawing is vigorous, the handling direct, and there is a rough strength which must appeal to the type of mind for which these stations were produced. Mr. Brankwyn can never be other than Mr. Brangwyn. Even in such conventional and strictly limited work as this he has stamped it with the mark of his own personality He has brought to his task a profound sympathy with the common people. His is not the "pretty-pretty" school of art. He sees men and women as they are, and his fidelity for truth is at times ruthless. But no man has done more to preach the dignity and nobility of all honest labour. And he has done it, not by making his working-men as beautiful as Greek gods and as clean and smart as new-washed statues, but by showing behind the hard-cut features and the dirty, dishevelled clothes the true greatness which these cannot hide. So in these panels he pays another tribute to labour—labour, not in the sense of a political label, but in the sense of all true work, whether of hand or brain, for the common good.

CONDITIONS OF CONTRACT.

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THE PRELIMINARY STUDY.

THE FINISHED ARTICLE.

A STATION OF THE CROSS BY FRANK BRANGWYN, R.A,

The South African Institute of Quantity Engineers.

Minutes of the Thirteenth Annual General Meeting held at the Scientific and Technical Club, 100, Fox Street, Johannesburg, on Saturday, 22nd April, 1922.

PRESENT: Messrs. T. Moore (President) in the Chair; G. E. Howgrave-Graham (Vice-President); N. T. Cowin, D. Dakers, E. B. Farrow, F. D. Hickman, D. J. Laing, W. E. Puntis, H. Rowe-Rowe, G. E. Turner, and A. Loots (Secretary).

MINUTES OF PREVIOUS GENERAL MEETING: The Minutes of the previous Annual General Meeting, held on the 30th January, 1921, were read and, on the motion of Mr. Rowe-Rowe, seconded by Mr. Howgrave-Graham, were confirmed as correct.

COUNCIL'S REPORT: The Chairman stated the report was a concise report of the year's work and had been printed and circulated to all members.

Mr. Cowin drew attention to the copy of the Balance Sheet annexed to the Report; £10 appears therein as earmarked for educational purposes, but he was under the impression that the amounts donated by him and Mr. Cowling were £10 and £5 respectively, totalling £15. The President stated that the Minute Book in use previous to the present one had been mislaid and the amount could be verified He was inclined to agree with Mr. Cowin. The Secretary was instructed to endeavour to verify this amount and to make the necessary alteration.

Mr. Hickman, in proposing the adoption of the Council's report, stated that he had been away the greater part of the year, but he was pleased to see how much work the Council had gone through; it gave him pleasure to find that the Institute had emerged from its dormant state into a real live body. He referred to the past differences which had always marked the General Meetings, but it gave him satisfaction to find that these had been forgotten and harmony appeared to be the keynote now. He wished the incoming Council success and had much pleasure in proposing that the Report be adopted in its entirety.

Capt. Turner seconded and the adoption of the Report was agreed to with unanimity.

BALANCE SHEET: The Chairman, in introducing this, stated that it gave him pleasure to announce the fact that no subscriptions were outstanding. He stated that the Instiue had had to meet heavy liabilities during the past year, but notwithstanding the drain on its resources, there was still on fixed deposit, on hand, and in the bank, a total of £169 2s. 8d. Most of the liabilities will not again occur during the present year, but, on the other hand, a levy of £2 2s. per member will have to be met in connection with the Architects' Act. Further, an assessment of approximately £15 towards the Associated Scientific and Technical Societies will require payment during the current year.

With reference to this latter assessment Mr. Cowin referred to members who were practising under the dual capacity as Quantity Surveyors and Architects.

The Chairman stated that in accordance with a resolution of a previous Council Meeting the Secretary had written to the A. S. & T. S. to the effect that the Architect Members of the Institute had elected to be assessed and to pay through the Association of Transvaal Architects.

Mr. Puntis proposed, and Mr. Hickman seconded, that it be an instruction of the incoming Council to put on fixed deposit as large a sum as possible. Agreed.

Mr. Hickman analysed the Balance Sheet and criticised its different heads. He considered that the monies expended last year were well spent. He dprecated the idea of having too much money on Deposit A/C. He would prefer to see the money spent judiciously and in the interests of Quantity Surveying and the Institute.

Major Puntis drew attention to the fact that £15, allocated to Education, included in the £150 on fixed deposit had not allocated interest. He considered interest accrued should be added.

Mr. Cowin was of opinion that the money donated for Educational Purposes should be spent on some useful project, e.g., Architectural Students' Prizes. The Chairman stated that a letter had been received from the Registrar of the A.T.A. re Students' Prizes and read the contents of the letter. It was decided to leave this matter for the incoming Council to deal with.

Mr. Turner proposed the adoption of the Balance Sheet subject to the rectification of the amount allocated to Education, and Major Puntis seconded. Agreed.

Major Puntis further proposed a vote of thanks to Mr. Hickman for auditing the Accounts, etc. Mr. Farrow seconding, the vote was agreed to.

PRESIDENTIAL ADDRESS: The Chairman stated that this had been printed and circulated to all Members. He now wished to draw the Members' attention to one head, viz., " Quantity Surveyors' Fees." Numerous letters in connection with fees had reached him during the past year and these letters had been replied to and the gist of the replies were contained in the address.

Considerable general discussion ensued with regard to Measuring Fees and it was eventually decided to leave this matter in abeyance until after the Architects' Registration Committee Meeting to be held the following Monday, the 24th April.

Mr. Laing proposed that the Presidential Address be adopted; Mr. Hickman, in seconding, eulogised the work of the President and the time he must have spent in its preparation. He drew attention to the various heads of the Address which deserved special consideration, and, inter alia, was of the opinion that the Quantity Surveyors' Fees should be printed and circulated amongst the members. Further, he was also of the opinion that the Institute should do more to advertise itself, and instead of individual members shouldering the expense, the Institute should do so.

The Chairman pointed out to Mr. Hickman that the Institute had printed pamphlets setting out the fees for Quantity Surveyors, and these were distributed to members present. With reference to the Builders' Conference to be held in Capetown, the President stated that he had written to the President of the Master Builders' Federation wishing the Congress success. He had expressed a desire to Mr. Corlett, the President, that a representative of the Institute be invited to attend and had mentioned the name of Col. Everard White. Mr. Corlett had been sympathetic and stated that he would see that a representative of the S.A.I.Q.S. be invited.

Mr. Farrow stated he had seen Mr. Corlett since and had been informed that Colonel Everard White had been invited and had attended the Meetings of the Congress.

ELECTION OF OFFICE BEARERS AND COUNCIL: The Chairman stated a letter had been circulated to all members enumerating the Council's nominations, viz.:

As President, Mr. T. Moore.

As Vice-President, Mr. G. E. Howgrave-Graham.

As Council, Messrs. N. T. Cowin, D. Dakers, E. B. Farrow, F. D. Hickman, W. E. Puntis, H. Rowe-Rowe and A. Stratton.

No further nominations had been received, he put these names before the meeting and these gentlmen were declared elected. He then thanked the meeting for electing him President for the ensuing year. Mr. Howgrave-Graham also spoke thanking the meeting for electing him Vice-President.

GENERAL BUSINESS: The Chairman stated no notice of further business other than appeared on the agenda had been received.

Mr. Rowe-Rowe here stated that in his opinion an effort should be made in future to hold the Annual General Meeting before the end of January. The Chairman explained that this had been the Council's intention, but owing to various unavoidable reasons and circumstances such had been impossible.

Mr. Puntis expressed a wish that the next Annual General Meeting be held in Pretoria, and the President replied that he hoped such would be the case.

Before closing the meeting the President proposed the Secretary's remuneration for the current year's work be inscreased from £20 to £25. Mr. Rowe-Rowe seconded and proposed a bonus of £5 be also granted for the past session, which was agreed to with unanimity.

In conclusion, Mr. Puntis proposed, and Mr. Farrow seconded, a vote of thanks to the Chairman, and this was carried unanimously.

The meeting then terminated.

Notes on the Design of Timber Beams.

By G. Bromilow.

A formula in general use for ascertaining the breaking weight (concentrated) of a given timber beam

is $W = C \times \dfrac{b \times d^2}{L}$, in which

W = Breaking Weight in cwts.
C = 4 (a constant for Baltic Pine).
b = breadth in inches.
d = depth in inches.
L = Span in feet.

In practice it is frequently necessary to design the beam to carry a given load and as it is more convenient to calculate in lbs. rather than cwts. and to consider distributed loads, the formulas following have been modified to suit this method of working.

The factor of safety adopted is 6, or $\dfrac{W}{S} = 6$

S being the safe distributed load.

The formula given above is modified as follows: Eliminate C from multiplier and introduce 1.5 to divisor to produce factor of safety (4 x 1.5 = 6); insert 2 in multiplier to convert to equivalent distributed load; insert 112 to give result in lbs. instead of cwts.

The formula then becomes $S = \dfrac{2 \times b \times d^2 \times 112}{L \times 1.5}$ (1)

Example I.

To design a beam to carry S = say 200 lbs. over a span of 4 ft. it is necessary to find the Bending moment by the formula $M = \dfrac{Wl}{8}$ (2)

in which M = Bending Moment
W = Total distributed load
l = Span in inches.

In this case $M = \dfrac{200 \times 48}{8} = 1{,}200$ inch pounds.

The next step is to obtain the Section Modulus (Z) by dividing M by f which is the extreme fibre stress per square inch allowable in the beam, 1,350 lbs. per square inch is adopted. Thus

$$Z = \frac{M}{f} = Z = \frac{1200}{1350} \therefore Z = 0.9 \text{ nearly.}$$

Appended is a table of Section Moduli for various ordinary scantlings calculated by the formula

$$Z = \frac{b \times d^3}{6d} \qquad (3)$$

On references to this table the nearest modulus to 0.9 is 1,266 corresponding in a batten $1\frac{1}{2}$ in. x $2\frac{1}{4}$ in. which will be found rather larger than is strictly necessary; but, as this is a convenient sub-division of the deal (9 in. x 3 in.) and not largely in excess of the requirements, this may be adopted as a suitable batten.

Testing this result by formula (1) we have

$$S = \frac{2 \times 1.5 \times 2.25^2 \times 112}{4 \times 1.5}$$

which by cancelling

$$= S = 5.0625 \times 56 = 283.6 \text{ lbs}$$

as compared with the actual load of 200 lbs.

If the conditions under which the batten considered in the foregoing example are such as would constitute it a continuous beam its bearing capacity would be increased by 50% and M would be $= \dfrac{Wl}{12}$

Taking the same load and span as above we find

$$M = \frac{200 \times 48}{12} = 800 \text{ inch pounds and}$$

$$Z = \frac{M}{f} = Z = \frac{800}{1350} = 0.59$$

The modules in the table nearest to 0.59 is 0.562 which is that of a batten $1\frac{1}{2}$ in. x $1\frac{1}{2}$ in. which, tested by formula (1) gives

$$S = \frac{2 \times 1.5 \times 1.5^2 \times 112}{4 \times 1.5} = S = 2.25 \times 56 = 274.5 \text{ lbs}$$

Thus, for example, a tile batten $1\frac{1}{2}$ in. x $1\frac{1}{2}$ in. would be safe for a total load of 68 lbs. per lineal foot (4 x 68 = 272).

Example II.

Required to find dimensions of a beam to carry floor joists as in cases where it is desired for decorative reasons to show the beam.

Allow say 100 lbs. per square foot as the total load on the floor including weight of material.

Span of beam = 10 ft.; beam in middle of room 16 ft. long. The total distributed load on the beam = 8 x 10 x 100 lbs. = 8,000 lbs.

$$M = \frac{8000 \times 120}{8} = 120000; \; Z = \frac{120000}{1350} = 88$$

which nearly corresponds to a 9 in. by 6 in. beam.

If 9 in. x 6 in. be used the factor of safety would, of course, be less than 6; but if it be desired to keep well on the safe side the required depth can be obtained as follows:—

$$Z = \frac{b \times d_3}{6d} = 88 = \frac{b \times d^2}{6} \text{ Now } b = 6 \text{ and}$$

and substituting 6 for b there is

$$\frac{6 \times d^2}{6} = 88$$

Eliminating 6 we have

$$d^2 = 88 \therefore d = \sqrt{88} = 9.38 \text{ inches.}$$

Thus the required depth would be say $9\frac{1}{2}$ inches.

Example III.

Having determined Z and requiring to find depth of a beam to carry load as in Example II, the breadth of the beam to be 5 inches.

$$Z = \frac{b \times d_3}{6d} = 88$$

Substituting 5 for b the statement becomes

$$\frac{5 \times d_3}{6d} = 88$$

By cancellation there appears $\frac{5d^2}{6} = 88$;

$$d = \sqrt{\frac{88 \times 6}{5}} \therefore d = 10.27 \text{ inches}$$

The required depth is therefore say $10\frac{1}{2}$ inches and a beam 5 in. x $10\frac{1}{2}$ in. will carry S = 8,232 lbs. according to formula (1).

Table of Section Moduli.

b inches	d inches	Z	b inches	d inches	Z
1	1	0.166	3	6	18.00
1	$1\frac{1}{2}$	0 374	3	$7\frac{1}{2}$	28.12
$1\frac{1}{2}$	$1\frac{1}{2}$	0.562	3	9	40.55
$1\frac{1}{2}$	$2\frac{1}{4}$	1.266	6	6	36.00
$1\frac{1}{2}$	3	2 250	6	9	81.00
$2\frac{1}{4}$	3	3,375	6	12	144 00
3	3	4.50	9	12	217.40
3	$4\frac{1}{2}$	10.12	12	12	288,00

THE ARCHITECTS' UNION REGISTRATION EXECUTIVE COMMITTEE.

67 EXPLORATION BUILDING,
COMMISSIONER STREET,
JOHANNESBURG.

The new draft bill to provide for the statutory qualification and registration of Architects and Quantity Surveyors throughout the Union has been completed in accordance with the resolutions of the Architectural Congress held in September, 1921.

A copy of this document will be posted to each known Architect and Surveyor together with an accompanying letter asking for the acknowledgment of receipt and any comments upon the Bill.

Any member of the profession failing to receive a copy should apply to the Secretary at the above address who will immediately remedy such omission.

M. K. CARPENTER,
15th September 1922. Secretary.

AD LUCEM.

By G. W. NICOLAY, F.S.Arch.

By the middle of the twelfth century the revolution which the Byzantine work commenced in the architecture of the West was complete so far as the structural changes are considered. Rome had gone to Greece and robbed that country of its art treasures. The costly columns of their public buildings were scattered over the central West of the Ancients. Their statues and household effects of the better kind were distributed among the patrician families of the Romans. The Romans went again to the East, establishing there the seat of the Empire, rather in despair than from choice and in course of time accepting the new faith had erected, as has been pointed out, the great church at Constantinople, the Byzantium of the day. As has been noted from this centre are building moved again from the East westward, but this time as a new and vigorous growth. Although it was obliged to make use of material often comparatively mean, had within it what was far more valuable than any brilliant work achieved. the ability, namely, to think and invent rather than simply carrying forward or copying the existing works. It is singular how impossible it is for any movement of this nature to become permanent. From about 1150 A.D. to 1650 this growth continued, although for some time it had been influenced by reversions to the study of the ancient Roman work which, beginning in Italy, was gradually spreading through the West.

But in the Medieval times the remains of the Roman work stood disregarded or in some cases were destroyed just as medieval buildings were destroyed to make way for the revival of the Ancient work then called for the first time " Classic."

At the time under brief notice, the middle of the Twelfth Century the Medieval method of building was completely developed, although there was some hesitation in vaulting spaces of any considerable width or height, probably on account of the expense and the time that would be occupied by the building operations.

The difference between typical examples of each manner discovered on making a comparison is definite in every part.

The ancient buildings were developed on a one-storey conception, the upper storeys being in design as well as execution significantly described as " super imposed," and usually this super-imposition was of one order above another as may be seen in such a building as the Colliseum at Rome. Each storey was an " order " and the order, as we call it, was doubtless the ancient idea of architecture. This rather narrow view of the work was avoided by the Romans when they introduced the vault, which they handled with such magnificence.

The Medievalists having no interest in the traditions of the ancients and having a new lead given by the Byzantine work, set their minds on satisfying their own wants and aspirations in their own way and with energy and speed akin to that which developed the architecture of the Greeks, produced in most complete order and beauty what people of a later day who were enamoured with ancient architecture called contemptuously " Gothic."

This great change was so complete that it affected and changed every part of the work and the artistic handling of it. The tradition of the Egyptians for large blocks of stone which the Greeks continued, though in a more moderate way, was put aside. The monolithic column was the rare exception, generally all were jointed. It is a principal characteristic of medieval work that material should be kept to moderate dimensions in order to facilitate hoisting and setting of stones and fixing timbers and generally economy of materials and labour was given the greatest attention.

The medieval builders being, as has been said, freed from the conventions of former times were able to exercise their commonsense and ingenuity in a wholehearted manner quite unknown to the ancients and therefore built naturally and without restraint.

Unlike his predecessors he conceived the buildings or parts of buildings as units, placed a cornice at the head of the wall for protection and confined himself only by the natural division of the work, such as floors, galleries and staircases. These decided the position and size of his openings for light and access and what are called conventional enrichments to be devised as the work proceeded. Again forsaking the ancient method they placed these enrichments within the face of the work while the ancients put them outside, the only exception being drip and other weather stones serving the practical purposes of protecting the wall or the enrichments. These enrichments were either plain bands or simple mouldings or mouldings enriched with carving or even figure sculpture. This freedom from restraint gave naturally and at once the appearance of free growth to the medieval buildings. This is well seen in the towers and spires which in grace and splendour of construction are scarcely approached by any other architecture.

In their more important buildings the scientific nature of their construction induced a simplicity of general arrangement which exhibits a perfect agreement between the general masses of exterior and interior, which is by the ancients only shown in their later works. The Parthenon, for instance, has internally two storeys consisting of orders one above the other and apparently having no purpose in the construction.

The medieval system in its complete form exhibited in the important Churches is one of complete balance, as indeed it appears also in S. Sophia. They employed both counterforts, the pressure of an applied mass, such as the flying buttress and the heavy load, as in the case of the abutment on the nave side in the form of the weight of the clerestory and the high vault to discharge the thrust of the isle vaulting. Sir Christopher Wren, at S. Paul's Cathedral, uses the load instead of the buttress to counteract the thrust of his nave vault, although he discharges the thrust through flying buttresses on to the aisle walls. It would not have suited his Renaissance ideas to have followed the medieval manner of showing his construction, because he was completely under the influence of the fashion of his day and desired to imitate the manner of the ancient architecture. He obtained his " order " and superimposed " order " accordingly and quite honestly, but has been accused more than once of putting up a sham by those who, although having knowledge of construction, overlooked or denied the right of every architect or other constructor to build as he deems best and most generally suitable to the work in hand and overlooked the fact when censuring him that the builders of the type of Church, to which in plan and general form he was unwillingly shackled, used the same abutment though not in the same form and position in reverse action against their aisle vaults. He was, no doubt, expected to follow the fashion of his day. He did so and followed his own inclinations at the same time. Wren was building in the manner he affected to despise and even in the construction of his dome used this same form of abutment, as he calls it, to hold up the cone on which he carries its timber and lead roof, and it will be shown later that the Renaissance architects carried this much further.

The changes which by nature are the destiny of men and their affairs come about in periods of great activity and are little observed until following changes in their inception are working their overthrow. It has been noted that in Italy the ancient architecture was never quite set aside. The Romans especially had a great reverence for it. It was the last expression of the ancient manner, the Renaissance, as it is called, was an attempt to revive it and probably to destroy the methods adopted by the medieval builders, and was not in either case very successful. The fine arts flag or revive together, they never die. Sculpture, painting and architecture once made known to man remain his possessions for all time. At one time exaulted, at another debased, they are as constant as the tides. In Egypt, in Greece, in the Roman Empire, in medieval Europe and onwards during the brilliant periods all the best times of Architecture, Sculpture and Painting move together, painting and architecture have gone hand in hand, so that at any time the one may be taken as the measure of either of the others, only painting comes a little after and is complimentary to the other two. Until the middle of the twelfth century all three were beginning to move towards perfection, all in rather crude condition, though of great vitality, more graceful in the South, more vigorous in the North, but instinct with life, comprehensive in its aim, embracing in its range of work, all natural objects, man and beast, seen or imaginary, birds, fish and reptiles, trees, flowers and fruit, all carved with the freedom and love of the work that in the brief space of a hundred years developed a system of carving and sculpture which, though it fell short of the best Greek work, reached a higher achievement, being infinitely wider in its range and giving pleasure, instruction and even amusement to the people generally through all the Western World.

NOTES and NEWS.

Mr. Edward B. Lee, President of the Pittsburg Chapter of the American Institute of Architects, has addressed the following communication to the Royal Institute of British Architects:—

" There is at present in our town a shortage of able and well trained architects, assistants, draughtsmen, and even apprentices. So far as this goes, the same thing applies, I think, to most other American cities.

" This office is in need of men to serve as draughtsmen and assistants. This is written with the idea that you might refer this letter to the proper organisation or individuals in England that might be interested.

" If such should be the case we would like to enter into details regarding wages, transportation expense, if necessary, and length of service required to obtain from England the help which we need. There are in this city a number of good men who have come from England and Scotland by their own choice. We like them, and could at this time place more.

" The idea is somewhat novel and might be difficult to work out, but we can at least make the effort."

Mr. Ernest M. Powers, F.R.I.B.A., the Editor of this Journal, left with his family for a trip to the Old Country at the beginning of this month, during his absence the conduct of this Journal will be in the capable hands of Mr. Edward H. Waugh, A.R.I.B.A., a former Editor.

At every slate quarry, huge, unsightly, and hitherto useless heaps of spoil and refuse accumulate, owing to the fact that between 75 and 90 per cent. of the product of a slate quarry is scrapped.

It is understood that the problem of disposing of this spoil is on a fair way to solution, as it has been discovered that slate ground into flour forms a valuable " filler " in the construction of a durable, economical, and dustless road surface which is strong enough to resist heavy motor traffic, is sufficiently elastic for horse-drawn traffic, and is impervious to water.

Experiments with slate flour have been carried out by road engineers and are stated to have proved highly satisfactory, the material possessing a very high cementing quality.

Many quarry owners are, therefore, making arrangements to grind the slate refuse into flour, and some have already demonstrated the commercial success of the undertaking.

Architects' Concrete.

By H. BELL-JOHN, M.C., M.S.A., F.S.I.

It will probably be asked at once what is meant by Architects' Concrete and why and in what way it differs from that used by anyone else. Yet on due consideration it must be admitted that in many cases at least, the Architect does not look for nor does he get the concrete upon which many engineers insist and on the qualities of which they base their design. In saying this it is quite contrary to my purpose to hint that Architects are slack in what they ask for or expect to get. The whole point hinges on the power of the Architect, under existing conditions to obtain a certain definite concrete upon which he can rely and based on the very strictest limits of cost. This latter is an important point. The Architect as a rule supervises his own work and only on the larger contracts is a Clerk of Works employed. Even there, in these quick changing and progressive days a Clerk of Works may easily have very fixed ideas as to the properties of concrete not borne out by the latest investigations in the laboratory.

Professor Duff Abrams, of Chicago, has conducted a very large number of experiments under laboratory conditions which have proved that broadly speaking the less water there is in concrete the stronger it is. On the other hand, we know that concrete which is allowed to dry out too quickly loses much of its strength.

On the Vaal River Barrage we are told Professor Duff Abrams' formulas and methods of mixing have been successfully adopted, but in that case there is a Resident Engineer with qualified assistants always on the site and the work is done Departmentally.

What is possible in such a case is not necessarily possible where there may not even be a Clerk of Works or where there is one there is also a contractor who quite fairly wishes to get his work done as economically and quickly as possible. In such a case one can almost say the wetter the concrete the easier to place in position. In any case if that extreme is not accepted, the wetness of a workable mix to put into trenches or reinforced floors will be considerably wetter than is theoretically necessary, and will consequently be below strength if based upon Duff Abrams results. It is realised that the present formulas are not all based on such a concrete mix as will meet these higher tests, but naturally it is desirable to obtain as high values as possible, and practicable.

The concrete used by Architects must therefore be that which is based on formulas and conditions of execution likely to be obtained under the system usually adopted for the erection of buildings, i.e., based on practical conditions.

What these practical conditions are is well known and may be summarised thus:—

1. Cement is not always uniform in quality and may on occasion be below standard.
2. Standard sand is not usually available and a wide difference in value must be allowed for.
3. Stone aggregate may contain much sand and may not be well graded.
4. Natives are employed in mixing and where this is done by hand the mix may not be well done. Where done by machine sufficient time must be given, and if it is a "rush job" this may not be done.
5. Too much water may be added, and cement be lost by the water being split or running away through ground or boarding.

The only safe practice is for a responsible person, Architect, Clerk of Works, or other to see all concrete put in. The sand, stone and cement can all be inspected before concrete mixing is begun and the actual mixing only is left in doubt.

Sand should be as near "standard" as possible, being well graded and clean.

Stone should be well graded so that the voids are reduced to a minimum. Where 2 in. stone is specified it will often be found that proportions of other small sizes will be required to complete the grading.

There are several easy tests for cement known to most people, if the machine made tensile rest is not desired. The expansion test is an important one and easily made. Concrete should be as dry as possible consistent with facility in getting it into the places it is meant for.

I have not attempted to lay down any rules, but have assumed the Engineering Standard Committee tests and standards are known.

I have merely attempted to discuss in a general way certain aspects of the use of concrete in buildings.