Heating	51
Electrics	51
Hot Water	23
Cold Water	5
Soil Pipes	9
Sanitary Fittings	15
Special Services	4
	£158/square

Hardware	12
Wall Finishes	33
Floor Finishes	41
Ceiling Finishes	14
Decorations	27
	£127/square

Clearly the economics of services design should be as well considered as that of the building structure. Architects have a fair idea of what is cheap and what is costly in floors, walls and roofs, but are much less knowledgeable and confident when it comes to services and rely too much on consultants and commercial firms. There must be an increased use of priced Bills of Quantities for specialist services. Traditional rule of thumb methods which rely on the swings and roundabout principle for the sub-contractor must be broken down, e.g., the traditional £X per point for pricing electrical work makes no allowance for the points being 2ft or 20ft apart, the simplicity or complexity of the layout and not much for differences in installation (surface mounted or concealed).

Without labouring the point, this information, this perspective on building costs, with practice, allows the architect to give the client better value for the same amount of his money.

The architect can then demonstrate this to his client when he starts comparing the cost of his new building with another. Few clients are likely to accept estimates at their face value without making some attempts to satisfy themselves that it is reasonable. If he's building a factory, he'll soon discover from friends, other firms or from whatever sources are available the costs of other factories and after making his allowances for differences in size, quality, site and so on arrive at his own conclusion—by comparison. It's the only method he has and one that we all employ all the time. When we buy a new car, we compare price, style, comfort, performance and reliability. Comparison is the means by which we judge value for money and it is only by finding out why building costs vary that value in building can be assessed and improved.

The different construction, materials, finishes, maintenance costs and frequency, and the different element costs of the wall systems used at Robb and Duval, and ultimately the differing architectural quality or appearance, can be rationally balanced and evaluated by comparison.

"An architect is not competent until he can persuade his client to spend more than he wishes" is a belief that, it is said, was held by Sir Edwin Lutyens, who had a reputation for overlooking the financial effects of his designs. This out-of-date, God the Architect attitude dies hard and undoubtedly cost planning will appear to some architects to be a rather strict and even an anti-architectural discipline. That it is a discipline is true, but one for which the architect usually determines his own limits; it is a discipline which assists him to discharge a responsibility which the client expects him to bear—to design within his own estimate!

Cost should not be regarded as an obstacle to design—it should be realistically accepted as a factor in the design in the same way as the client requirements, climate and site conditions are accepted. A good design is one in which all factors are considered and each given their proper weight according to their importance. We must avoid producing buildings which are under or over designed. If substantial under or over spending is therefore to be avoided at tender stage, we must have some method of deciding how much to spend on each element of a building and then spend just that sum.

For those architects who deal with a relatively small range of buildings for which they have evolved a pattern of planning and a convention of construction, cost planning may not be very necessary. For the architect with a wide range of work, who wishes to adopt unusual designs and building techniques, cost planning removes a major anxiety from his work and permits him to make decisions with a greater degree of confidence. I would suggest that this confidence is a major factor in the creation of fine design.

References:

1. **"Estimating and Cost Control"**—James Nisbet and others (Batsford 1961): Nisbet was one of the Quantity Surveyors who pioneered this technique in England. This article has leant heavily on the above book which is strongly recommended—it should be used as a textbook in our schools of architecture.

2. Various issues of the **Architects Journal,** London, from 1954 to 1960, particularly a series on "Cost Control in Building" during 1957.

3. **The Building Economist**—the Journal of the Institute of Quantity Surveyors (Aust.) now publishes Cost Analyses from time to time and has an article on Cost Planning in the February 1964 issue.

June 1964

Cost Control in Building

by Donald Gazzard, ARIBA, ARAIA
partner in the firm Clarke Gazzard Yeomans

There are two things for which, as a profession, we are continually being criticised. The first of these is that we are never sure what a building is going to cost and the other is that we can never ensure that it will be completed on a given date. Both are justifiable criticisms—both are made much of by package dealers with great effect.

The second problem of controlling the time of completion will not be dealt with here—suffice it to say that, like cost control, this is another field in which more scientific management techniques will have to be employed. Techniques such as Critical Path Scheduling will have to be thoroughly understood by architects and perhaps such schedules will have to be demanded with the tendered price and incorporated in the contract!

The larger reasons for our lack of cost control are not hard to see—buildings over the last two decades have become considerably more involved with newer, less predictable materials and particularly with more complex mechanical installations; inflation and rising costs have been intermittently continuous for nearly twenty years.

The problem is not a new one, however. In 1847 the present Treasury in Whitehall, London, was completed to designs by Sir Charles Barry. The final cost was £42,646/8/9, an excess on the approved estimate of £8,534/16/-. Sir Charles Trevalyan, the founder of the modern English civil service, was, at the time, savagely creating a new order in the Treasury. This outrage perpetrated on his doorstep was not to pass unnoticed—Trevalyan drafted a long letter in his own hand conveying their Lordships' displeasure and their decision that Barry's commission was to be calculated not on the actual cost as was customary, but on the approved estimate only.

The excess expenditure may not have been due to faulty estimating but the incident reflects the mood of a client who feels he has been misled. With the passage of over a century the client has become no less insistent that estimates should be reliable forecasts of his future commitments.

Upon the amount of an estimate he may decide whether or not to build. This decision is always of the highest importance. For the small building owner, perhaps building only once in a lifetime, it may be the most important financial decision of his life. For the larger building owner it may affect his investment policy. For politicians and civil servants at the head of large government departments it may affect social, educational and other types of national building programme.

To the professional advisers who prepare the estimate the task has become more difficult and the responsibility greater. Let us examine then the traditional process in which a preliminary estimate is made.

A client usually comes to an architect both with a list of requirements and some limit on his financial resources to pay for these. When sketch or design drawings are completed, a preliminary estimate of cost is required. Unless the architect happens to be building a steady succession of the same type of building and therefore has an idea of the cost, it is usual at this stage for the architect to ring up his quantity surveyor. An Alice in Wonderland dialogue then ensues in which the QS quotes, as a guide, unit rates for buildings of a similar type which he has just completed.

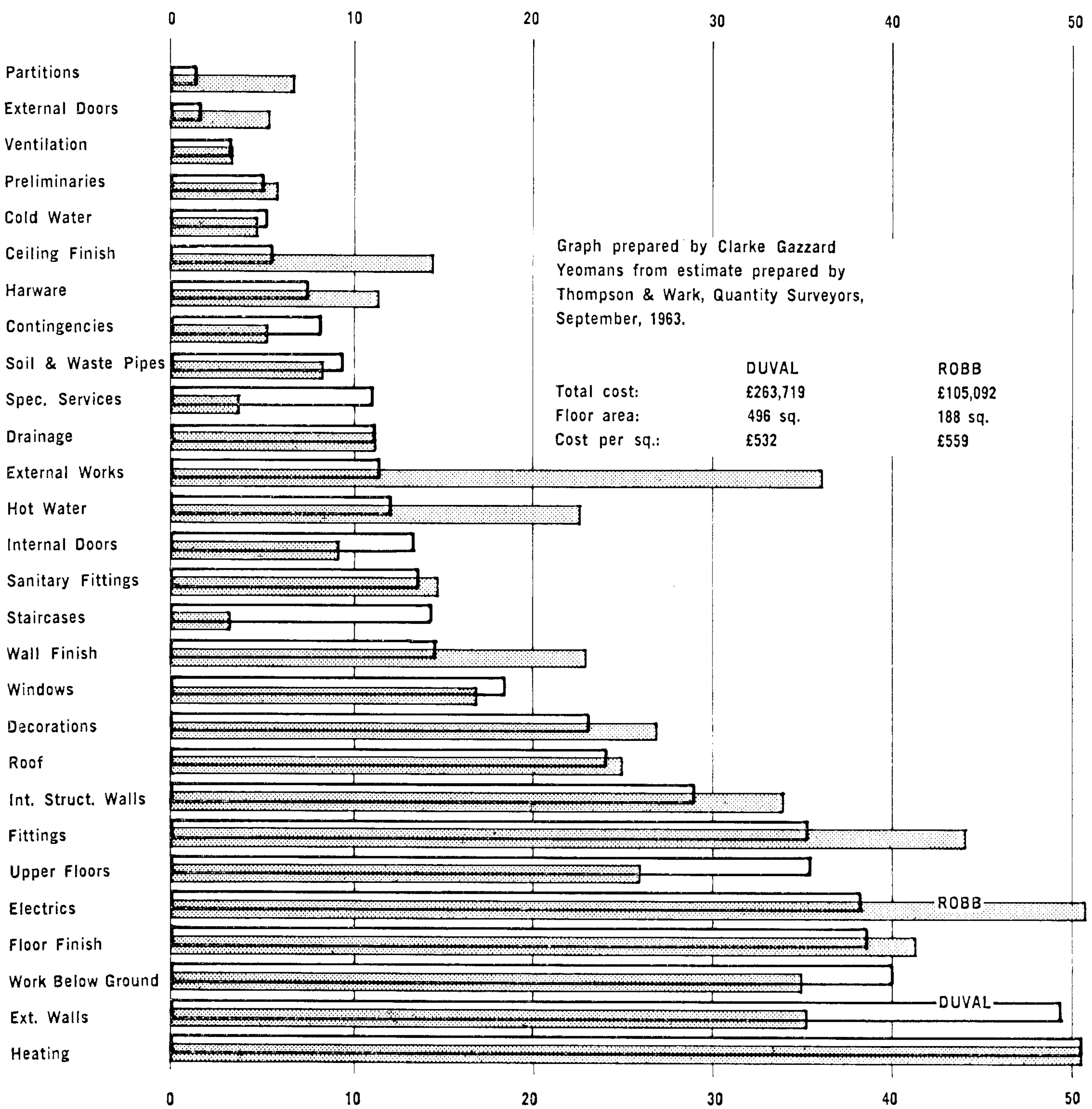
Let us assume, for instance, that our projected building is in Camperdown—a 14-storey block of access balcony flats with eight flats per floor. It has two lifts, two staircases, exposed concrete frame with brick infil. The flats are of a reasonable minimum finish and are all two-bedroom flats of about 800 sq ft. Bathrooms are internal and therefore mechanically ventilated. Test bores have not yet been made but we suspect some foundation problems from the evidence of nearby buildings.

The only block of flats the QS has recently completed, however, is in Darling Point—an eight-storey block with three flats per floor. It has one smaller lift and one staircase. The flats are three-bedroom and two-bedroom, are larger in area than those we are concerned with and are of a reasonably good standard of finish. All flats have projecting balconies which ours do not. Foundations were normal but there was a complicated drainage condition which cost nearly £3,000 to cure. The site treatment, paving, landscaping, etc., is more elaborate than ours might be but we of course have a larger site area and more cars to accommodate.

The other flat buildings the QS can quote which might be more comparable, still of course with maddening inconsistencies, were all completed over two years ago, and prices have risen considerably since then. True comparisons are rarely possible, so an amalgamated "guesstimate" is made of a unit rate that is applicable to our building. Of course we are still not sure whether

**University of New England: Duval Cost Plan.
Robb Cost Analysis.**

ELEMENT £ PER SQ. OF FLOOR AREA



made independently by the QS either from other analyses or by taking off rough quantities. In Robb, for instance, the walls were predominantly timber panels, so the elemental cost was no guide for estimating Duval where the walls were brick.

At all these stages, skill and judgment are needed.

An additional refinement, sometimes carried out in the U.K. in connection with schools, is the calculation of various quantity factors or ratios as part of the cost analysis; for example, the ratio "area of external walls to floor area" is calculated as it has been found to give a rapid indication of the relative economy of different planning solutions at early design stage. It is to be expected that more of these ratios as a guide to design economy will be developed when the cost planning technique becomes more usual.

It is normally possible to produce the main abstract of a cost analysis in less than a working day. The major part of the time spent in producing full cost analyses such as shown in the appendix is absorbed in calculating the quantity factors and preparing the specification notes—this may take up to 5 days.

If the Bill of Quantities were prepared in an "elemental" rather than a "trades" form the preparation of cost analyses would be greatly facilitated. As we all know, the trades form is largely a convention as a lot of the trades don't really exist as separate entities. Elements are the way the architect thinks when he is designing the building, not trades. Although it has been done in England, there are some minor obstacles to the introduction of elemental Bills of Quantity in this country, particularly in buildings over two or three storeys in height, related to the way builders price. These are currently being investigated. Elemental Bills may also increase the quantity surveyor's work slightly as some items which are now measured together may have to be separated. As a balance it reduces the work of cost planning and preparing the cost analysis considerably. The fee payable to the quantity surveyor for the extra work involved in the cost planning and cost analysis of these colleges (the Bill was prepared in the conventional way) was less than 1/12th of 1% of the tendered price. This fee was surely worth the resultant knowledge and control gained and would be reflected in the future in greater accuracy and control, and possibly lowered unit prices.

The cost plan and preliminary estimate are ideally prepared concurrently on the completion of sketch plans. When the working drawings and specification are started an order of work along elemental lines should be agreed with the quantity surveyor so that drawings and details of the elements in order of importance are given to the QS as work proceeds. This incidentally also provides an ideal opportunity to study the way in which drawings are prepared and to rationalise them, to eliminate repetition in drawing and to group items common to a particular element on the one sheet for greater efficiency.

The quantity surveyor checks the cost allowed for the element in the cost plan from these drawings by taking off rough quantities or by actual quotes from material suppliers, etc. This process continues at intervals as work proceeds; changes in materials or specification standards can thus be quickly evaluated against the cost plan. If changes are made, they are made consciously and the client can be kept informed. Reductions subsequently found possible in one element allow consequent upgrading of some other element to give better architectural or environmental standards within the total cost estimated.

Examination of the comparative analyses for the two colleges at Armidale immediately produces queries of why particular element costs varied so much between the two colleges.

The answering of these queries—some explicable by differences in quality and some only by some factor of design—in themselves creates a cost conscious atmosphere. Architects upon first seeing such analyses are usually staggered by the high proportion of the total cost absorbed by the "service" elements. Electrics are shown to cost more than the foundations, more than external walls, more than R.C. structural floors and are exceeded as an element cost only by heating! Yet this electrical cost is intended to be at rock bottom cost with switch drops in surface mounted conduit.

This points the way to achieving higher standards. A 10% increase in the cost target for the element "internal doors" would allow solid core doors to be used throughout. This, in a residential college, would cut down one of the most persistent user complaints, that of noise transference. Surely a significant improvement, yet it could be paid for by less than a 2% reduction in the electrical cost. We then have to study this element; surely it could be reduced 2%!

An interesting exercise is to group the elements as follows into Carcase, Services and Finishes. This dispels any doubt in which direction economies should be sought.

Internal Struct. Walls	34
External Walls	36
Upper Floors	26
Roof	25
Frame	8
	£129/square

waste and soil pipes. Stack pipes as far as gully or joint to drain at ground level. Overflows.

23. Cold Water Services includes rising main, storage tanks, pumps and distributing piping to draw-off points and boilers. Builders' work in connection should be shown separately. Number of cold draw-off points.

24. Hot Water Services includes any system for distribution of hot water, including boilers, calorifiers, instantaneous heaters, piping to draw-off points and lagging. Builders' work in connection should be shown separately. Number of cold draw-off points.

25. Heating Services includes any system for distribution and emission of heat including boilers, controls, radiators, piping and storage tanks, etc. If the system is gas or electric it should be included here. The cost of the following should be shown separately if it is possible.

(i) oil fuel tank and feed to boiler
(ii) automatic stoking equipment to boiler
(iii) gas service to boiler

Builders' work in connection should be shown separately. The heat load in Btu per hour.

26. Ventilation Services includes mechanical ventilation and air treatment plant, ducts and isolated fans. Builders' work in connection should be shown separately.

27. Gas Services includes installation from and including meter and distribution to outlets. When a gas service is primarily for heating or for hot water it should be included under the appropriate element heading. Builders' work in connection shown separately. Number of outlets.

28. Electrical Services includes installation from and including meter, switch gear, etc., and distribution to outlets and fittings. The figures should be broken down as follows:

(i) meter and switch gear
(ii) lighting installations
(iii) power installation
(iv) lighting fittings

The number of points. Services to such items as lifts, escalators, warning lights, clocks, etc., are to be shown separately if possible. The total electrical load of installation. Builders' work in connection should be shown separately.

29. Special Services includes lifts, escalators, cooking equipment, laboratory equipment, pneumatic tube message systems, sprinkler installation and fire-fighting equipment and other similar special services, and the information required is such as will indicate the extent of each service (e.g., for lifts, the number, capacity and speed of each and the number of stops should be given). Builders' work in connection should be given separately.

30. Drainage includes soil and surface water drainage from foot of stacks to and including the last collecting chamber adjacent to building.

31. External Works includes roads and paths, playgrounds and paved areas, fences and gates, outbuildings, external steps, site planting and landscape work, adjacent connections to service mains. Drains from last collecting chamber adjacent to building to main sewer, including connection of disposal plant.

Appendix B

DUVAL COLLEGE COST ANALYSIS

Element 9—EXTERNAL WALLS

a. Construction and Materials

Brick arches, timber-framed walls to stairs sheeted with natural finish horizontal boarding, brick sills, Super Grade Alcor dampcourses and flashings.

All facing bricks were clinker bricks obtained from local yards.

The external walls were load-bearing, crushing strength of bricks and the composition and mixing of mortar was fully specified. All bed joints in brickwork were thickened to give a four course rise of exactly 14½in. The timber walls to stairs were in Oregon framing of conventional construction sheeted externally with 8in x ⅞in D.A.R. Canadian Red Cedar weatherboards prepared for natural finish.

b. The Costing of the external walls was as follows:

Generally	£20
Walling	14,916
Facings	2,617
Dampcourses and flashings	1,465
Arch bars	10
Various	619
Labours	100
On completion	500
Timber-framed walls	1,210
External linings	1,218
Total Cost	£22,675
c. COST PER SQUARE	**£45.72**

Element 14—INTERNAL DOORS

a. Construction and Materials

All frames to doors were of Red Meranti of sections 5in x 3in, 5in x 2in, 5in x 1½in and 6in x 1¼in and generally were full height to underside of ceiling. A few internal doors in two leaves were of framed, ledged and sheeted construction with rebated top edges for matching panels over. These were sheeted with 4in x ½in T & G V-jointed boarding. Some single leaf framed and ledged doors were prepared for top glazing with ¼in thick drawn sheet glass. The majority of doors, however, were 6ft 8in x 2ft 8in x 1⅝in (fin.) solid core veneered both sides with Red Meranti and complete with ½in thick matching edge strips, the top edge being rebated for panel over of similar construction. The toilet doors were 2ft wide of hollow core construction. Numerous duct access panels were located throughout the building, generally of ½in thick plywood set in timber surrounds.

b. Costing of the internal doors was as follows:

Door frames and jamb linings	£2,517
Doors and panels	4,747
Access panels	264
Glazing	85
Total Cost	£7,613
c. COST PER SQUARE	**£15.35**

Element 17—FLOOR FINISHES

a. Construction and Materials

The main areas were covered with 3.2mm thick "A" quality hessian backed sheet linoleum of selected colour on unsaturated paper felt underlay. The linoleum was secured to 27/32in thick cement topping composed of three parts of finest stone screenings, one part of sand and one part of cement.

¾in square vitreous ceramic floor tiles of ochre colour were used in toilet and wash areas while 9in x 4½in x 1¼in quarry tiles were specified for arcades, roof terraces and stairwells. These quarry tiles were imported Bently Brand of selected red colour with a rough natural finish. All nosing tiles had top arris chamfered off ⅛in with a carborundum wheel before laying. Generally timber skirtings to lino floors.

b. The Costing of the external walls was as follows:

Generally	£100
Preparation	252
Cement topping	2,840
Sheet linoleum	6,928
Vitreous tiles	1,777
Quarry tiles	3,804
Topping under baths	20
On completion	513
Brass strips, etc.	169
Skirtings	1,765
Total Cost	£18,168
c. COST PER SQUARE	**£36.63**

to include the open access balconies at the same rate or what to do about part of the ground floor left open, etc.

Still, a preliminary estimate is arrived at based on the sketch design drawings and is accepted by the client. As work proceeds to prepare tender documents some slight changes are made, the foundations are perhaps slightly worse than was expected and we encounter the problem of exactly what standard of finish our estimated unit rate includes for certain items. Uncertainly we specify and detail certain items, such as quarry tile floors in the lobbies, telling ourselves that we can always change these if the tenders come in too high. When all documents are completed, sent out and tenders are being prepared, the QS prices out his own Bill of Quantities. His estimate exceeds the preliminary estimate by a reasonable amount but by then it's too late to do anything about it.

The tenders are opened to disclose a price slightly below the final QS estimate—a few amendments are made and negotiated with the lowest tenderer, the client is persuaded, with a wealth of rationalising, to accept the increased price and we breathe a sigh of relief. We are a little annoyed however, thinking it over later, that the client had remembered and attached such importance to the preliminary estimate that was given to him. There is a hidden implication that the estimate once mentioned should be instantly forgotten like some irrelevant remark, for we, perhaps subconsciously, realise on what shifting sands it is based. But it must be expected that clients will remember estimates because they make decisions on them and they will therefore expect us to meet their requirements within the figure stated.

We all make preliminary estimates like this with more or less skill, intuition and experience. Larger offices perhaps have more experience and data to draw on. But all are made fundamentally on the basis of the square rates of a "comparable" building. The uncertainty of the above approach is lessened by some in a way described to me recently by an eminent architect who had, he said, learnt his lesson a long while ago after a particular, humiliating experience. Put briefly, his advice was, greatly inflate the preliminary estimate, carry the exaggeration through into the tender and contract prices by inflating all the p.c. sums and if this is done with sufficient skill, the final cost, no matter what happens, will not exceed the preliminary estimate.

This architect has a reputation for efficiency and realism in regard to estimates and control of costs—he undoubtedly is a realist in accepting the limitations and impossibilities of preparing estimates in the normal way but this method can hardly be claimed to give the architect control over costs or over quality of building at any stage.

Another possible method of estimating sometimes used is for the quantity surveyor to take out rough or bulk quantities based on the sketch plans and some preliminary specification notes. The only defects of this method are that it is costly and that rarely has the architect taken his ideas far enough to commit himself to an outline specification with any certainty. Even the constructional system might be one of several alternatives at this stage, so the method loses much of its point.

What is needed therefore is a systematic method of comparing the actual costs of buildings irrespective of size, style, shape or construction, of relating costs to functional, physical and environmental standards, and of interpreting such data in preparing estimates for future buildings. And, as estimates lose much of their value if the actual cost does not compare reasonably with the estimate, it is also necessary to have some means by which the cost of a building can be measured and controlled while still being drawn up. The preparation of estimates is a recognised feature of professional practice but the subsequent procedure till now has been left to experience and intuition. In the future, experience and intuition will not be enough and a systematic method of planning and checking the cost against the approved estimate is required as work proceeds.

A technique of Elemental Cost Analysis and Control to meet these needs has been evolved in England over the last ten years arising out of work started at the Ministry of Education during 1950. The large number of schools to be built made urgent the task of stabilising school building costs, and in examining and analysing costs from priced Bills of Quantities to this end, it was noticed that there seemed to be certain similarities in the distribution of costs among the various elements. This then suggested that a positive use might be found for these figures during the earlier planning stages, and this has proved to be the case.

The method has now been extended to do three things:

Enable more accurate preliminary estimates to be made and allow the design to be more easily related to the funds available.

Fill in the embarrassing gap in cost control between the preliminary estimate and the tender, allowing the estimate to be checked against a "Cost Plan" as working drawings and specifications proceed, and

Provide an opportunity by comparison with other buildings for ensuring that the client is obtaining good value for his money.

The technique, in essence, consists of establishing the cost of the constituent parts or elements (which are common to most buildings) from the information available in priced bills of quantities, and of comparing these costs by means of a common yardstick, e.g., a unit of floor area. This then allows the costs of buildings to be compared regardless of size, shape, quality of finish or type of construction. Cost analysis attempts to **isolate points of difference** so that variations in construction, function and specification can be properly evaluated, not to absorb differences or limit comparison to identical buildings.

To make a cost analysis, it is necessary to re-arrange the items in a Bill of Quantities into uniform groups which are related to the parts of a building. These uniform groups are known as "elements," and an element may be defined as an easily recognisable and essential part of the building. For example, all buildings have roofs, walls and floors. Each of these elements also performs certain specific functions irrespective of materials or construction. For example "windows" allow daylight to enter the building no matter how constructed or of what material. An element is therefore "a major component common to most buildings which usually fulfils the same function or functions irrespective of its construction or specification."

There is no universally recognised list of elements in use for all types of buildings although that evolved by a committee of architects, quantity surveyors and builders for the "Architects Journal" in London (November, 1960), is probably the most used (mainly because the AJ has persistently espoused the cause of greater cost knowledge by architects and publishes 40 or more cost analyses for different types of buildings annually—would that we had the same service here!).

It will immediately be seen that there could be varying interpretations of how specific elements are defined and it is therefore important that a common list of elements and their definitions is adopted in this country to suit our circumstances, so that our cost information is readily exchangeable. It doesn't really matter what interpretations are adopted provided they are adhered to in all cases.

Since the word analysis implies a close scrutiny there has been an attempt to break down the total cost into as many elements as possible. However, because of the "trades" form of most Bills of Quantities, it has been found that it involved too great an expense in time and money to distribute the costs of the painter to the individual elements and as a result this trade has been shown as the element "decorations." When the total costs of different elements have been isolated from the Bill, it becomes necessary to have a common denominator to allow the costs of the elements in different buildings to be compared irrespective of shape, size or construction. The unit of measurement which has been chosen is the square (100 sq ft). It is felt that area, rather than volume is the best yardstick for a number of technical reasons and is, in addition, meaningful to the client, as it represents for him his main concern, the amount of accommodation.

These techniques, cost analysis and cost planning, were recently successfully employed for two residential colleges at the University of New England. Robb College, a two-storey building of 188 squares for 82 men, was analysed from priced bills to provide the elemental basis for cost planning Duval College, two three-storey buildings, a total of 496 squares for 196 women. Both colleges were designed by the Government Architect's Branch (PWD) (E. H. Farmer, Government Architect, with Peter Hall and Peter Webber Architects-in-Charge). Robb College had just been completed and contract documents for Duval College were just starting to be prepared by the firm Clarke Gazzard Yeomans when the cost plan was prepared.

The cost plan estimate for Duval, based on the Robb analysis and prepared by the architects and Thompson and Wark, the quantity surveyors, was approximately £263,000 or £533 per square. The lowest tender price was £278,000 or £560 per square, an increase on the preliminary estimate of less than 5%.

It was felt that this was a very satisfactory result for the first use of a new technique which augured well for the future. Without the cost plan, the building would undoubtedly have suffered in architectural quality. In normal practice, when economy is as pressing as it was here, we would probably have decided, through uncertainty, to omit many items which would clearly play an important part in the visual and long term maintenance qualities of the building. They were confidently included as the cost plan showed that they were all feasible within the overall cost target and this has now been justified by the tender price. The contract price (increased by a percentage to correspond with the second tendered price) is now being analysed as a basis for estimating and planning the next college. A section of this analysis is shown here.

Let it not be thought that preparing the cost plan is an automatic process. Simple cost analyses providing the cost per square for each element such as shown for these colleges identify and evaluate differences in cost between elements. They do not, however, explain why the costs are different nor do they provide sufficient information for detailed cost planning. Apart from differences in price levels, differences in cost are due to two factors, the quantity and quality of the elements. These two factors are therefore included in the description of the element in the cost analysis. Some of the elements will bear no relation to one another and an estimate for that element will have to be

Appendix A

DEFINITION OF ELEMENTS FOR COST ANALYSES

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General

Descriptions of the elements and their costs should include all the component parts as indicated by the definitions. The description of each element should be sufficient to leave no doubt as to what items the cost includes, and should also give some idea of the quality of the work.

In cases where the definitions cannot be followed, the description is to make clear what items the element cost covers. For example, if windows in curtain walling are included in external walls, the element "Windows" should be marked "included in external walls." If there is nothing to be put to a particular element, the word "Nil" should be shown against the heading. The floor area used for the calculation of element costs is to be the gross area of enclosed floor space measured within the internal faces of the external walls, overall partitions, stairwells, etc., except in the case of multi-storey dwellings in which it is to be the net area of the dwellings only. This should be measured to the inside face of walls enclosing the dwellings, excluding private balconies, public access space and other ancillaries. A statement of the gross area should, however, be given in these cases. The areas of walls, finishes, etc., are to be the net areas after deduction of openings.

Unit costs of items are, in sq yd, the total cost (including small quantities and labours and other work in conjunction therewith) divided by the total quantity, e.g., each floor finish should include screed, skirtings, etc. Except for these unit costs and individually priced items such as fittings, all other costs of elements (and items shown separately within them, such as builders' work) should be expressed to the nearest ¼d. per sq ft of net floor area.

1. Preliminaries and Insurances includes priced items in Preliminary Bill and Summary excluding quantity surveyor's fees and contractor's price adjustments. Besides the cost per sq ft of floor area, the element should be expressed as a percentage of the cost of the remainder of the contract.

2. Contingencies includes sums reserved for unforeseen expenditure. If the analysis is based on the final account no cost should appear against this element.

3. Work below lowest floor finish includes work below the underside of the screed including the damp-proof membrane, relevant excavation and foundations.

STRUCTURAL ELEMENTS

4. Frame includes load-bearing framework of concrete, timber or steel. Main floor and roof beams, ties and roof trusses. Casings to stanchions and beams where these are for structural purposes.

5. Upper floors includes structural floors and balconies, including structural screeds. Beams, other than main beams, included in frame.

This element should also include any suspended floors over a basement, in which case this fact should be stated. Further information required is the area and cost of each type of floor per sq yd.

6. Roof includes construction of roof. Beams other than main beams in frame. Gable ends, internal walls above wall plate and parapet walls if any. Screeds and coverings. Gutters, flashings and rainwater pipes. Also to be given is the area on plan of each type of roof, measured to the external edge of the eaves but excluding the area of roof-lights, the area of glass in north-lights and monitors and the cost of each type of roof per sq yd.

7. Roof-lights includes frame, glazing and opening gear. The area of structural opening for each type of light measured parallel to the roof surface in sq yd should be stated. The cost of each type of light in sq yd is also required.

8. Staircases includes staircases and intermediate landings. Finishes to treads, risers, strings and soffits. Balustrades. Information required is the number and total vertical height of each type of staircase giving the width overall of the tread.

9. External Walls includes external walls of building, excluding windows, doors and shopfronts. Curtain walling and sheeting rails giving horizontal and vertical spacing and fixings. External applied finishes. Lintels, sills and cavity damp-proof courses. If the wall is self-finished internally this should be stated. If proprietary curtain walling is used the area and cost should be given as a whole including opening lights. The area of each type of wall excluding window and door openings and its cost in sq yds is required. If basement walls are included this should be stated and the area and cost per sq yd given.

10. Windows includes sashes, sub-frames and frames. Glazing. Ironmongery where fixed before delivery to site. The area of clear openings in walls in sq ft. Cost of each type of window per sq ft should be given.

11. External Doors includes doors, frames and architraves. Fanlights. Glazing. Ironmongery where fixed before delivery to site. Also the area of clear openings in walls in sq ft. The number of single doors and pairs of double doors.

12. Internal Structural Walls

N.B.—This refers only to crosswall construction. Often it is impossible to define which internal walls are load-bearing and which are not as in traditional house construction. In the case of crosswalls the delineation is clear.

If the walls are self-finished this should be stated. The area of each type of wall excluding openings and its cost per sq yd should be given.

13. Partitions includes all internal walls, screens and borrowed lights except where included under Internal Structural Walls. Lintels.

If wall is self-finished this should be stated. If room-dividing cupboards are treated as partitions this should be stated. If proprietary partitioning is used the area and cost should be given as a whole, including doors, etc.

The area and cost per sq yd of each type of wall, excluding doors, etc.

The area and cost per sq yd of each type of wall, excluding openings should be given.

14. Internal doors includes doors, frames, linings and architraves, fanlights, glazing and ironmongery when fixed before delivery to site. The area of clear openings in walls in sq ft, and the cost and number of doors, single and double, to be given separately.

15. Ironmongery includes supply and fixing of all ironmongery except that which is delivered to the site fixed (e.g., to metal windows).

FINISHES AND FITTINGS

16. Wall Finishes includes all preparatory work and finishes applied in situ to the internal wall. Surfaces which are self-finished should be described under the appropriate headings. Area and cost per sq yd of each type of finish.

17. Floor Finishes includes all preparatory work, top finish and labours to form surfaces. Skirtings.

Area and cost per sq yd of each type of finish.

18. Ceiling Finishes includes all preparatory work, finishes applied in situ and labours to form surfaces. Suspended ceilings and framings. Cornices.

If a ceiling is a source of heat or light it should be included in the appropriate engineering service and reference to this made here.

Area and cost per sq yd of ceiling finishes.

19. Decorations includes all decorations both internal and external including wall mosaics, murals and sculptures. The total cost of these latter items or similar ones should be shown separately.

20. Fittings includes all built-in equipment and furniture giving detailed list of what items are included.

All major or special fittings should be listed and priced separately, if possible with the quantity involved (e.g., cost per ft run of benching).

SERVICES

21. Sanitary Fittings includes supply and installation of fittings, including taps. Number, type and quality of each fitting.

22. Waste, Soil and Overflow Pipes includes traps,