ESTIMATES AS A TOOL FOR

BUILDING PROJECT COST CONTROL

BY

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DECLARATION

I hereby declare that this thesis has been written by me and that it is a record of my own research work. It has been presented in my previous application for a higher degree.

All quotations are indicated and the source of information are specifically acknowledged by means of reference.

PETER ADAMU CHORI

DATE: JULY, 1939.

CERTIFICATION

AHMADU BELLO UNIVERSITY

DEPARTMENT OF BUILDING

We certify that we have read this thesis and in our opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a thesis for the degree of Master of Science in Construction Management.

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Lastly, I want to give my special appreciation to my wife, Mercy, and children, Patrice, Phillipper and Pamela for their warmth, unending support, and encouragement for me to accomplish the audious task of completing the thesis.

DEDICATION

This thesis is dedicated to my wife Mercy, and children Patrice, Philipper and Pamela.

INSPIRATION

I take the view, and always have done, that if you cannot say what you have to say in twenty minutes, you should go away and write a book about it.

Peter Adamu Chori

ABSTRACT

Estimates as a Tool for Building Project Cost Control is a phenomena by those who have been monitoring the cost of building construction. The building industry is characterised as highly competative, very risky and with low profit margin. The cost of construction in the past years has also been on steady increase with varied reasons which includes political influence, poor tendering procedures and inflation. But for a construction firm to maintain a competative edge in the market and also ensure "Good Profit Margin" and the client to have "Value for the money expended" for a construction project, the method by which they Design, Estimate, Plan and Control this project must be ACCURATE and EFFICIENT. The lack or inadequacy of the said method can be said to constitute some of the main perennial problems and reasons for the high cost of building construction. It is in the light of the above that the theme of the study was chosen in order to investigate on a building cost control system for minimising the cost of building construction during the project execution phase with much emphasis on the estimating process of the said cost control system.

To achieve the above topic of discussion the study was divided into six chapters. These chapters dealt vividly on an introduction to the objective and structure of the thesis, concepts of a building cost control system, cost estimates and estimating procedures, contractor's cost elements, three site investigations, conclusion and recommendation. It is hoped that the study will be useful for a building cost control by contractors and client and for future researches on areas that were not extensively discussed.

GLOSSARY OF TERMS

1. ALL-IN-RATE: The total amount of money allocated to a unit quantity of an item in the Bills of Quantities which covers the cost of material, labour, plant, overheads and profit.

2. ATTENDANCE COST: Cost incurred by the main contractor in providing services to a sub-contractor and/or supplier including public bodies and other persons engaged by the client to execute certain work items on the project.

3. BILL OF QUANTITIES: A document prepared in accordance with the standard Method of Measurement of Building Works which includes for all items of works and cost systematically described and classified with quantities of work done inserted alongside the descriptions. This document can then be given to contractors to price for bidding purposes.

4. COST ACCOUNTING: Is a communication monitivation and appraisal device which serves as incentive, standard or budget for the achievement of an organisation's plan objectives.

5. COST CONTROL: Control is designed to check or verify, and hence to regulate certain activities or costs. It is to make situations behave according to certain desired performance criteria. Cost Control therefore is to regulate costs during a project in order to achieve desired objective, that jobs are being designed and executed to give maximum value for money.

7. DIRECT COSTS: Cost of items of building works incurred which are reflected in the completed project. These includes for labour, material and plant costs.

8. ELEMENT: An element in a building is that part of a building which performs the same function irrespective of the position or construction, e.g. a wall can be of timber, blockwall or brickwork with components as doors, window rendering, lintel, sill and door frame.

9. INDIRECT COSTS: Cost of items of building works incurred which are not reflected in the completed project. These include, Insurance overheads, and othe associated costs resulting from the acquisation and utilization of labour, materials and plants.

10. LIFE CYCLE OF CONSTRUCTION PROJECT: Is the development of a project from an idea to reality. This includes conceptual and feasibility study, engineering and design, procurement construction start-up and implementation, operation or utilization.

11. NOMINATED SUB-CONTRACTOR: A company given a portion of the main contract to execute. The appointment is done with the consent of the client through the consultant.

12. NOMINATED SUPPLIER: A body appointed by the client to supply materials or components to building sites but not to install or execute same which may be consumed by such supply.

13. SUBCONTRACTOR: A company given a portion of the main contract to execute. The appointment is done with the consent of the client through his consultants.

14. UNIT PRICE: The price bid for completing an item on a unit price contract. The total bid price for a unit price contract is the sum of the products of all quantities for the various job items and their respective unit prices.

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CHAPTER ONE

1.0 INTRODUCTION:

1.1 Background

Cost Control in simple terms is the controlling of cost of building projects within the limit of predetermined sum throughout its design and construction. It is aimed at ensuring that resources are used at the best of advantage. In these days of increasing costs of building construction, promoters are insisting on work being designed and executed to give maximum value for money. Constructuon work has now become more complex and clients being more exacting in their cost requirements. It has now become necessary to improve and refine the cost control process. According to Seeley (1981)[19] "rising prices of building restriction on capital allocation including the high interest bank charges on contractors will necessitate the involvement of an effective cost control".

Barrie and Paulson (1978)[6] are of the opinion that "Control should commence right from the client brief through detailed designs, project execution and maintenance phases". The cost control processes would involve estimating, budgeting, planning, cost evaluation, feed back and corrective actions. Such an effective cost control will utimately ensure that:

(a) The client obtains value for the money expended.

(b) Money budgetted for the project is not exceeded.

(c) Funds put into the project are rationally and evenly distributed during the construction phase.

(d) The client, consultant and contractor could be able to monitor the cash flow of the project throughout its execution process.

"Estimate as a Tool for Building Project Cost Control" in this context refers to the control of a project cost with reference to the estimating process. This process serves as a relevant input data to building project cost control system during project execution.

The term "Estimate" is loosely used in the construction industry. Its precise meaning must often determined from the context in which it is being used. It may refer to budget cost estimate, preliminary and detailed estimates of the quantities involved in the job item. It could also refer to estimates of money (payments) due to the contractor (Progress) estimate) for work done. In other words, cost implications/ computations during the project execution.

The estimating function therefore forms an integral part of a systematic planning and project cost control. It also provides data for the physical, technical, economic and feasibility analyses of a project. The client and contractor alike need an effective building cost control system. The former who is the financer, wants the money put into the project to be judiciously expended while the later strives to achieve his goal and objective of business being that of the maximization of profit.

The realization for the need of a building cost control system with the use of accurate, comprehensive cost estimates during construction phase has not yet been given the deserved attention by clients and contractors in the Nigerian building industry.

It is now ripe for the building industry of the developing countries to use an effective building cost control systems. The use of detailed estimates for the cost control system is to be emphasized. The study will deal with one aspect of the problem. The control of cost during project execution using comprehensive estimates as important data. The contractor's estimate will be emphasized because practical site costs incurred are by the builder

1.2 Need for the Research

The need for Estimates as a Tool for Building Project Cost Control should be emphased to the contractor and client. It is paramount in view of the global economic recession. Various countries are now introducing building cost control processes to revamp their economy. The research will be carried out in order to recommend a building cost control systems during project execution as a means to minimise the cost of building construction and to satisfy the objectives of the client and contractor.

Furthermore, the need for estimates as a relevant imput data for building cost control for most contracts should be recognised by clients and contractors. This is because a huge amount of money is spent by the client to prepare these estimates which are supposed to be used as a means of check or control of the project costs.

1.3 OBJECTIVES:

The primary objective of formulating the study is to identify a control system using accurate detailed cost estimates for minimising cost of building construction during its execution phase.

It is to be noted that though estimates are used as a basis for planning, budgetting, schedulling, cost evaluation and cost control of a building project, the study is not intended to do the following:

(a) Discuss intensively all the building cost control processes
(b) Discuss all the said cost control factors such as policy, bidding procedures, type of contracts and other relevant site control processes which affect the cost control depending on the type and magnitude of the project.
(c) Explain the other construction phases like the design and maintenance phases.
(d) Exhaust all the types of estimates during the project construction phase.
(d) Be a definative analysis of estimating procedures
(f) Execute the recommended cost control system
(g) Be a 'how to' manual on control of building project cost

1.4 APPROACH AND PRESENTATION:

With reference to the objective of the study, the approach and presentation was done by presenting the said study in six chapters. This is to enable the study to be understood through a literature review, practical experiences at site, analyses of the study conclusion and recommendation.

The first chapter is intended to briefly introduce the reader to the meaning of building cost control, estimates; the objective of the study, scope, limitation and methodology.

Chapter two considered the structure, characteristic and format of a building cost control system while chapter three is a discussion on the types of estimates and their structure which meets the criteria for building cost control including the duties of client and contractors estimators.

The forth chapter is on the builder's cost elements which are estimated and used as standard source data for the other building cost control processes. The fifth chapter is a case study on three project sites. The case studies are meant to investigate actual happenings based on the literature review in order to make comparison and analysis. This chapter also seek to make proposal for a building cost control system for adaption by contractors.

Chapter six is the suggestion and conclusion based on the findings for future reseaches.

1.5 SCOPE AND LIMITATIONS

Bearing in mind the main theme of the study, its scope and limitations can now be vividly defined. The life span of building includes as follows:-

(a) Demand: The demand for a building may be as a result of its market shortage or fashion.

(b) The Project: In order to get the supply for the demand of a building the acquisation or indentification of the space is paramount. Then the clients brief of what is needed is followed. The project planning is effected in order to produce the tender documents (Drawings, Specifications and Bills of Quantities). Once these documents are ready, tendering procedure are followed and the contract is eventually awarded. Construction phase is then followed and when completed defect liability period commences.

(c) Supply: This is when the building has been completed, handed over and put into use. As it is being used it is maintained until it is demolished.

In view of the phases of a building, the study will be limited to the construction phase. This is the phase when much money is actually committed to the project after the planning has been completed.

The study is also restricted to the information got from few books and documents received from construction firms and consultants. It is to be noted that these firms approached were reluctant in releasing information of their firm and the projects studied.

1.6 METHODOLOGY

In order that a realistic assessment of an effective building cost control system during project execution be obtained from the study, the following methodology was adopted:

1. Literature review in order to define the problems. This was done by the use of relevant text books, magazines, journals and experience.
2. Case Study of three different project sites to examine the building cost control processes. It was achieved through site visits and inspections, scrutiny of some of the contractual documents associated to the projects and own experience.

3. Analyses to compare the theory (literature review) with the realities of the case studies and a proposal as to improvement of the system.

4. Conclusion and recommendation based on the findings and overall some solution of the problems identified from the study.

CHAPTER TWO

2.0 A REVIEW OF BUILDING COST CONTROL SYSTEM

2.1 Introduction

The term CONTROL implies regulation, that positive action can be taken to influence the relevant activity. The timing of the activity is of great importance. The ability of a project cost to be influenced varies at different stages of its evolution. This is because the magnitude of investment is decided after a feasibility study has been carried out , estimates prepared and the cost of individual elements determined. Once the contract is signed, the owner is committed. Thereafter, the interest of the client is best served by co-ordinating the activities of the parties involved in the building construction and commissioning and ensuring adequate control of design changes.

From the foregoing, it is evident that the effective cost control of physical realization of a project relies on the correct definition of objective, careful planning of design, construction and commissioning. It is also the regular monitoring of the clients actual commitments against the target set by the plan.

Planning is a continous control process in order to detect where unexpected difficulties arises. It is the project commitment while the actual payments to be made for work done are the liabilities.

Departure from the agreed plan once construction is in progress may result in an increase or reduction in the building cost.

It is therefore apparent that planning is essential for an effective building cost control. Since the study is not focused on planning it will suffice to mention that planning by the contractor provides a logical and complete method statements of how the various works operations contained in the project will be carried out within the agreed terms of the contract. The planning of a project will therefore aim at establishing the followings:

i. Project Organisation and staffing

ii. Programme of work in form of bar chart or critical path etc.

iii. Procurement schedule for labour, material and plant

iv. Cash-flow forcast to meet financial arrangements.

Estimates are a major source of imput data of a building cost control system during its execution. It is a process in the said cost control that provides formal costs information source such as labour, materials, equipments overheads, profits, preliminaries and attendances. Its application will require the keeping of relevant information through time cards, purchase orders, invoices, field reports and quality control

When all these factors have been duely considered, it will then provide a feasible framework for achieving the project goals and objectives and serves as a platform for monitoring and controlling actual cost and progress during the execution of the plan.

2.2 Cost Control Elements

There are observable elements of building cost control in order to obtain a viable and workable cost control system. These elements are described as follows:-

1i Establishment of standard of objective for desired results.

ii. Measurement of performance within specified time.

iii. Comparison of objective with trend.

iv. Report feedback.

v. Decision to correct deviation

Cost control elements of a control system can be represented graphically as shown in figure 2.1.

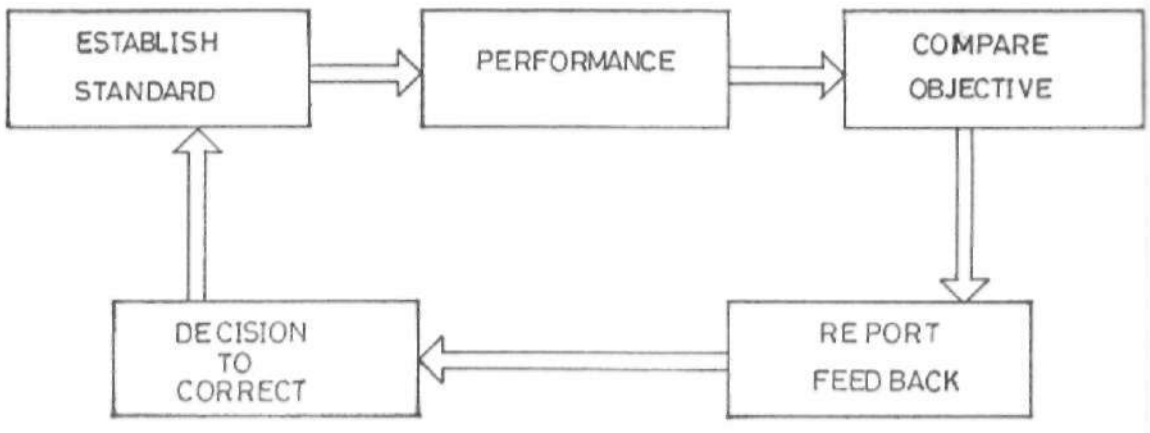


Fig. 2.1 Graphical Presentation of Cost Control Element.

2.2.1 Standards

Abdu in his thesis submission (1985)[1], defines Standard as "unit of measurement against which results are compared". Without standards, cost control will be difficult and meaningless for management to judge how well they fulfil the objective of the organisation. These standards remain valid during the project execution and are constantly being compared with the trends. If the trends compare unfavourable with the objective during construction, in other words, progress is slow or costs are running higher than anticipated, then prompt corrective measures are desired.

The established standard of a building cost control during its construction will includes production, finance and personale standards.

These standards are quantified or measured. That is, quantities and quality of materials, plant costs and outputs, labour costs, establishment costs, suppliers schedule of delivery, capital for the project during its execution, labour turnover and wages and salaries of the project.

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2.2.2. Measurement of Performance

Measurement process in cost control involves the determination of deviation from plan with corrective action on the said deviations. It also includes the qualification or expression in discrete terms of the plans and performances in order to allow comparison between them to be made. To measure performance quickly data have to be arranged in a scale of performances and compared with data of control scales. The said data must be completed and adequate to give accurate comparison.

Measurement of performance by contractors will be the ascertainment of the actual unit of site production (cubic metres, square metre, linear metre) including other costs.

In intangible standard, performance can be measured through personal contact or discussion with personale at the site or the use of questionnaire. This can assist in ascertaining and resolving labour problems that exists at the site during construction.

It is important that a building cost control system should ensure that these unmeasurable goals and objective are not overlooked as against the measurable ones.

2.2.3 Comparison of Objective with Trend

This includes the determination of the progress or status of the operations of a project. Quantities of work units in place is physically surveyed and compared with those shown on the drawing or established estimates. Elapsed time is compared with the estimated activity or project duration, money committed or expended is compared

Then resource used is plotted versus expected requirements for labour, materials, equipment and overhead.

Barrie and Paulson (1978)[6], reasoned that "just as pulse temperature, blood test and X-rays give several different readings on the condition of one's body; each of the measures above tells something about a project". All of them are necessary to gain an in-sight into the status and progress of the operations. These operations are then compared with the plan and objectives while deviations are given the necessary corrective actions.

2.2.4 Report Feedback

Feedback is that action in the control system which interrelates standard, measurement and corrective action. For any action to be taken a feedback is desirable. A feedback process operates continously throughout the project execution.

A feedback should be timely so that the operators of the project receive accurate and up-to-date information. It enables decision and formulation of plans of action to have maximum impact to the controlling of these operations which are generating the information in the first place.

2.2.5 Decision to Correct Deviation

Corrective action is a control element which seeks to detect significant changes of the entire result from standards of an operation. It includes decisions and action taken in phases and involves the changing of plan, modifying the objectives and adjusting standards or changing some key factors in the general situation, so that the end justifies the means.

When a cost control report indicates that something is 'wrong' with an operation, that is, measures are deviating significantly from the plan, it is important to investigate to find and understand the reasons behind the symptoms reported. If the sources of the problem is identified, the course of action is to update the reporting system to reflect the reality of the job. Because of the dynamics of the operations of the project the situation as it exists is actually better in some ways than that which was planned. From the inception of the project to the final handing over day, the management will continously have more information than the planner conceived. Corrective action should not always be taken to conform with the original plans. This means that, budgets, schedules and related standards are tools to be used by project management. The control system should be used as a guide and need to be flexible. It should be prepared to take advantage of and adopt new conditions and improvement as it arises.

2.2.6 Review of Elements of Control

In every building Cost Control System, the elements of control as already mentioned should be observed. The objectives remains valid for the project duration. They are constantly compared to the trend of the actual progress of the project to ensure conformity with the desired objectives. Any deviation from the established objectives is given a timely corrective action.

If implementation requires extensive feedback (as always) and the trend is marginally favourable, then the strongest cost control measures must be taken to move the project towards a successful conclusion. This means that the main purpose of a building cost control is to ensure that the established objectives of the project by both the client and contractor are realised. That is, cost savings.

2.3 General Perspective of a Building Cost Control System

A building cost control system gives a model of operation, flow of information and decision making processes characteristic by a feedback control system appropriate for a building construction project. This system is desirable so that works at the site can be done on schedule and within a reasonable cost.

The said building cost control system must have the following important processes:

1. Estimating
2. Budgeting
3. Planning and Scheduling
4. Cost Accounting
5. Cost Evaluation

These processes will have to operate within the already discussed elements of the building cost control. The study is not intended to discuss these processes in details, though a short explanation of planning has been given at the beginning of this chapter.

Definition of cost accounting and evaluation will surface in the glossary. Estimating is elaborated in chapter 3 and budgeting will be explained in view of its relevance to this study. A diagram of a control system to illustrate the interdependences and operations of the processes will be presented at the end of this sub-section.

2.3.2 Budgeting

Budgeting is the pricing of the management aims and objectives in monetary terms. Whenever a contract is to be commenced it is important that the client and contractor know what capital is going to be involved. It is an important step since the client's estimate is a probable cost and only serves as a guide to the contractor. Budgeting is the identification of the limit of expenditure basically for each cost centre and ultimately for the whole project objective of profit maximization and or cost savings is realised.

Budget can be prepared for labour requirement, materials plant and overheads for a project. It is normally based on past experiences and data collected from estimates of previous projects. A budget will therefore seek to:

1. Service as a control measure in monitoring the actual expenditure against budgeted amount and reveal trends of spending.
2. Provide a device for periodic appraisal of the financial progress of a project.
3. Provide a device for management to assess likely profit and savings that may accrue from a project.

A budget is not supposed to be rigid but flexible and thus subject to changes. Provision in a budget is not expected to be sticked to bearing in mind that it may have problems and limitations. Deviations in a budget can either be good or bad but it serves as a sign for the management to make investigations, corrections and reviews.

Implementation of a budget involves too many personnels than at the budgetary stage. Thus the success of the budget will depend on the involvement of the personnels at the preparation stage, understanding of the purpose, aims and objectives of the budget, communicating and taking timely corrective actions.

A successrul budget of a project should include the following:

i. Estimating the plans: The plan of the project is estimated in order to establish the anticipated cost. The budget estimate must have to consider the resource requirement of labour, material, plant, overheads, preliminaries and profit.

ii. Comparison with Tender Allocations: The estimates prepared is compared with what has been included in the tender documents or Bills of Quantities. This is necessary so that a reconciliation between these estimates can be effected and where a deviation is detected review and corrective steps can be taken.

iii. Final Budget: It is when all necessary estimates, comparison, review and corrections have been effected and a budget prepare for the consumption of all the personnel involved in the execution of the project. The objective of the venture can be achieved here when the client, contractor and the project manager initiate a condusive atmosphere within the rank and file of the construction team through consultation, communication and personal discussions.

iv. Achievement of Budget: Having established a budget the method of achieving the target set will have to be deviced through budgetary control. This is a technique done on continous basis and aimed at comparing actual achievement with the plan. It gives room for detecting deviations from plan so that corrective actions can be taken to normalise events to plan objectives. The techniques of budgetary control can be illustrated as follows:

(a) Non-Repetative Projects: Assuming that a contract was entered into with the client and that payment for works executed will be within 14 days after the end of the month in which work was completed. Retention is to be 10% initially with a minimum of 5% of the contract sum of ₦80,790.00. Half of the retention to be released 14 days after the completion of the works while the other half to be released at the end of defect liability period of 6 months.

The cost per operation from the estimate has been ascertained and allocated to the master construction plan. The expenditure for each month is as shown on Figure 2.2

WEEK	OWN EXPENDITURE ₦	PAYMENT TO SUB-CONTRACTOR ₦	COMMULATIVE EXPENDITURE ₦
4	4,220	--	4,220
8	6,340	--	10,560
12	6,440	--	17,000
16	7,380	--	24,380
20	5,160	--	29,540
22	--	540	30,080
24	3,230	--	33,300
26	--	2,700	36,000
28	6,980	--	42,990
30	--	2,574	45,564
32	9,870	--	55,434
34	--	6,462	60,896
36	3,140	--	65,036
38	--	3,222	68,258
40	2,730	--	70,988
42	--	1,582	72,570

Figure 2.2 - Expenditure

Adopted from "Management Techniques Applied to Construction Industry" by R. Oxley (1968) Page 127.

Similarly it is possible to arrive at the programme of income for the project after ascertaining the value of each operation on monthly basis from valuations as shown in figure 2.3.

WEEK	OWN INCOME ₦	RETENTION ₦	INCOME LESS RETENTION ₦	PAYMENT FOR SUBCONTRACTOR ₦	CUMMULATIVE INCOME ₦
6	4,590	459	4,131	--	4,131
10	6,890	689	6,201	--	10,332
14	7,000	700	6,300	--	16,332
18	8,020	801	7,318	--	23,850
22	5,660	566	5,094	600	29,544
26	3,780	378	3,402	3,000	35,946
30	7,840	406	7,434	2,860	46,240
34	11,320	400 (Limit of Retention)	11,320	7,180	64,740
38	3,620	--	3,630	3,580	71,940
42	3,090	--	3,090	1,760	76,790
- 46,50) 54,58) 62)	-	2,000 (Repaid Retention	-	-	78,790
	-	-	-	-	78,790
66	-	200 (Repaid Retention)			

Figure 2.3 - Income

Adopted from "Management Technique Applied to Construction Industry" by R. Oxley (1968) Page 127.

The graphical representation for this income and expenditure is shown in figure 2.4. The capital at any given time can be computed from the difference between income and expenditure.

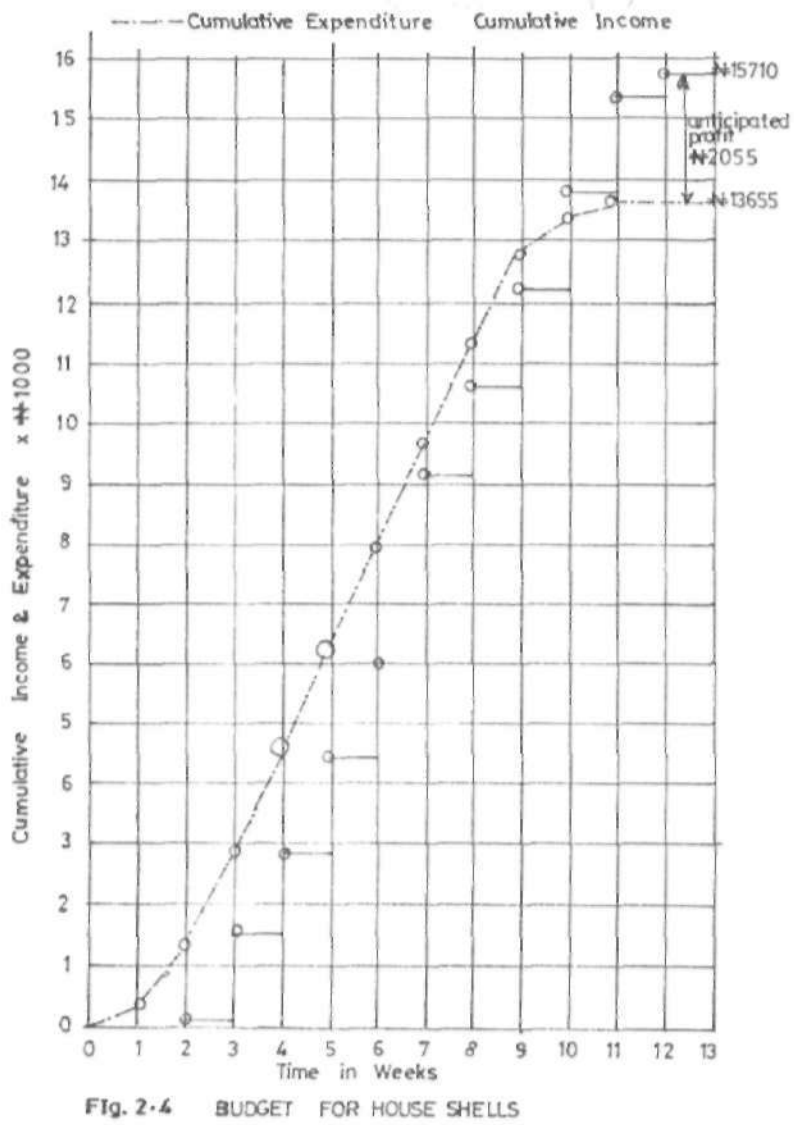


Fig. 2·4 BUDGET FOR HOUSE SHELLS

Adopted From "Management Technique Applied to Construction Industry" by R. Oxley (1968) Page 129.

(b) Repetative Construction: Assume a contract entered into by a client and that payment should be made in stages for each work item that is excavated, concrete foundation, blockwork, carpentry and roofing. Payments are to be received one week after completion of each work item and no provision made for retention money.

The total cost of completing this project costing of the blocks is ₦13,650.00 with the following build up as indicated below:-

(a)	Excavation	165.00	=	₦16.50/block
(b)	Concrete foundation	3,190.00	=	₦319.00/block
(c)	Blockwork	6,340.00	=	₦634.00/block
(d)	Carpentry	1,320.00	=	₦132.00/block
(e)	Roofing	2,640.00	=	₦264.00/block

WEEK	WEEKLY EXPENDITURE ₦	COMMULATIVE EXPENDITURE ₦
1	280.50	280.50
2	1,074.00	1,354.50
3	1,463.50	2,818.00
4	1,727.50	4,545.50
5	1,686.25	6,231.76
6	1,686.25	7,918.00
7	1,686.25	9,604.25
8	1,686.25	11,290.50
9	1,447.00	12,737.50
10	653.50	13,391.00
11	5,204.00	13,655.00

Figure 2.5 - Expenditure
Adopted from "Management Technique Applied to Construction Industry" by R. Wiley (1968) Page 129

The contract sum of the project is ₦15,710.00 from the priced Bills of Quantities and with the following breakdown:-

(a)	Excavation	190.00	=	N 19.00/block
(b)	Concrete foundation	3,670.00	=	₦367.00/block
(c)	Blockwork	7,290.00	=	₦729.00/block
(d)	Carpentry	1,520.00	=	₦152.00/block
(e)	Roofing	3,040.00	=	₦304.00/block

The allocation of this values in the programme of work in the distribution can be seen in figure 2.6.

WEEK	WEEKLY INCOME ₦	COMMULATIVE INCOME ₦
1	0	0
2	38	38
3	1,520	1,558
4	1,286	2,844
5	1,609	4,453
6	1,582	6,005
7	3,104	9,109
8	1,552	10,661
9	1,552	12,213
10	1,552	13,765
11	1,641	15,406
12	4,304	15,710

Figure 2.6 - Income

Adopted from "Management Technique Applied to Construction Industry" by R. Oxley (1968) Page 130

Both sets of figures can be represented in a graph (Figure 2.7) and by substracting the income from the expenditure, the capital required at that particular time of the project execution can be ascertained.

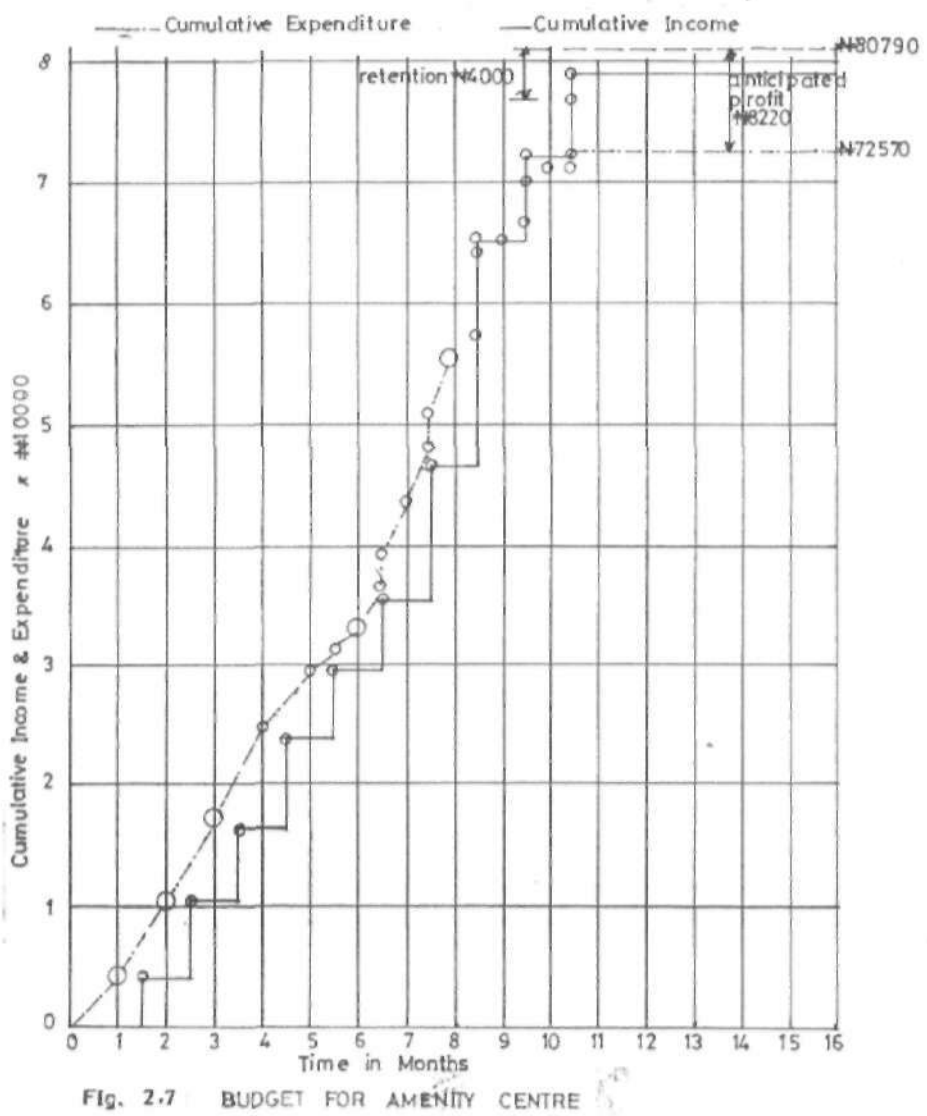


Fig. 2.7 BUDGET FOR AMENITY CENTRE

Adopted From "Management Technique Applied to Construction Industry" by R. Oxley (1968) Page 131

The two examples illustrated for non-repetative and repetative construction enable a chart of income and expenditure to be prepared in order to determine the pulse of monitary transactions. Descrepancies can easily be detected for an effective cost control system for possible correction to be taken.

The Development Cost Budgeting of building project includes for the cost of land, survey, development with the land, consultancy and construction. This cost is normally found to be more or equal than the Expected Capital Value of the project. The expected capital value is determined through valuation payments.

2.4 Cost Control System for Adequate Flow of Information (Diagramatic Presentation)

Figure 2.8 shows a model of cost control operation, flow of information and decision making characteristic of a feedback control system which is adequate during building projects execution. The control system has been designed and modelled for the purpose of explaining this study.

Figure 2.8 shows that for a project to be executed, its aims and objectives should be initiated (Box A). The operations is planned within the project period as in Box 'B'. As the construction operations are being carried out, the standard of building cost control system as contained in box 'C' are compared with the initial concepts of the plan. Deviations from the standard is given timely corrective action. The actions provide information received from these processes and are compared with planned standards such as schedules and budgets to show deviations, variance and trends. The information are then analysed and made available through report and also stored for future references (Box D).

External factors (Box E) as a result of weather, economy,precurement delays, labour disputes, excavation problems or unexpected good conditions may cause the mode of operations to differ from the plan objectives. Atimes it improves the plan. The operations normally generate indicators of progress such as quantities in place, elapse time, money expended or resources consumed.

Data obtained from the processes communicated as a feedback to the management for decision making. Information received are compared with the individual knowledge, experience, policies and other qualitative and quantitative information for the purpose of producing new or modified plans. These important element of building cost control can be discussed thus:-

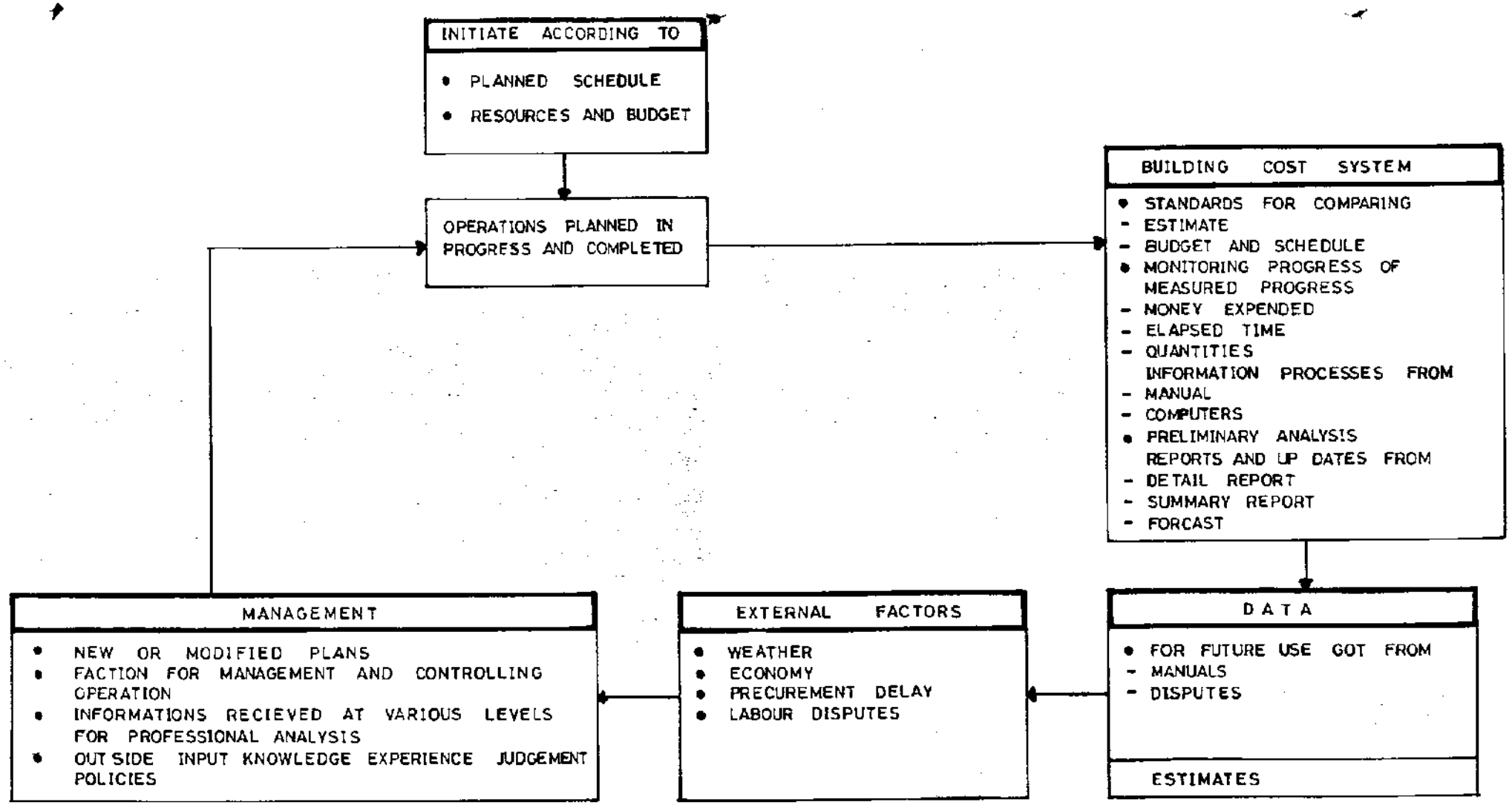


FIG. 2.8 A GENERAL PROJECT COST CONTROL SYSTEM ADOPTED FROM "PROFESSIONAL CONSTRUCTION MANAGEMENT BY MC GRAW-HILL BOOK COMPANY, U.S.A.

2.4.1 Feedback: This feedback control system as previously discussed operates continously throughout the construction phase of the project. It should be timely so that members of a construction team can receive accurate and up-to-date information. Decision and formulation of plans of action can have maximum impact on the control of operations.

2.4.2 Status and Progress: Numerous measures can be taken to determine the progress or status of operations of a project. Quantities of work and units in place can be physically surveyed and compared with the one shown in the drawings. The elapsed time will equally be measured with the estimated activity or project duration. Money put into the project are compared with the budget while resource usage plotted against expected requirement for labour, plant and materials. With experience, the judgement to estimate the percentage completion of individual activity can be done for a whole project. However, field measurement are more accurate estimate than the judgement. This is because it is more practical. Note too that judgement can replace qualitative factors not evident in the quantities themselves.

2.4.3 Source of Data: Data to be reflected in the status and progress of a project can be got from labour and equipment time cards, purchase orders, invoices, field quantity reports, quality control reports etc. The accuracy, timeliness and completeness of the data are important while human considerations are essential in order to provide good management information.

Figure 2.9 shows a weekly time card use for a project site. The disimation of information received from this data should always be timely.It should take the proper course to avoid failure.

2.4.4 Information Processing: It is a process where data is analysed and converted into useful information through activity and resource scheduling tools such as bar charts, critical path networks, budgets, cash flows, materials precurement and statistical quality control. This information processes takes into consideration data and progress status for comparison against established standards. Standards as budget and schedules provide results which are subsequently converted to information needed for the control of the project during its execution.

The level of detail, the variety and the frequency of reports that are to be provided for the project execution should be appropriate to the users. It should be feasible for means of processing information (manual or computer), recognise the skills available and realistically assess the value of the information. The information should then be compared with the cost of obtaining it. The system should also be fast, efficient and accurate.

ASTLE NIGERIA LIMITED

NAME _____ WEEKLY TIME CARD JOB _____

BADGE No _____ CRAFT _____ JOB No _____

WEEK ENDING _____ PREPARED BY _____

COST CODE	HOURLY RATE	MON	TUE	WED	THUR	FRI	TOTAL HOUR	TOTAL COST
	R							
	O							
	R							
	O							
	R							
	O							
	R							
	O							
	R							
	O							
	R							
	O							
	R							
	O							
	R							
	O							
	R							
	O							

FIGURE 2.9 WEEKY TIME CARD
(CULLED FROM "A COSTROL SYSTEM FOR CONSTRUCTION SITE — A CASE STUDY OF THREE SITE BY ABUBAKAR ABUDU, 1985).

2.4.5 Reporting: Reporting could take the form of conversation, telephone, graphical representation on bar charts, commulative 'D' curves and critical path method (C.P.M) diagrams. Figure 2.10 shows a graphical presentation of building cost data. It can serve as a useful means of drawing attention to the principal features of the project situation. The estimated contract sum of the project is plotted against its duration. It is then compared with the programme expenditure or budget, actual expenditure and progress estimate (Valuation) during project execution. Any trend should be easily visualized on the graph.

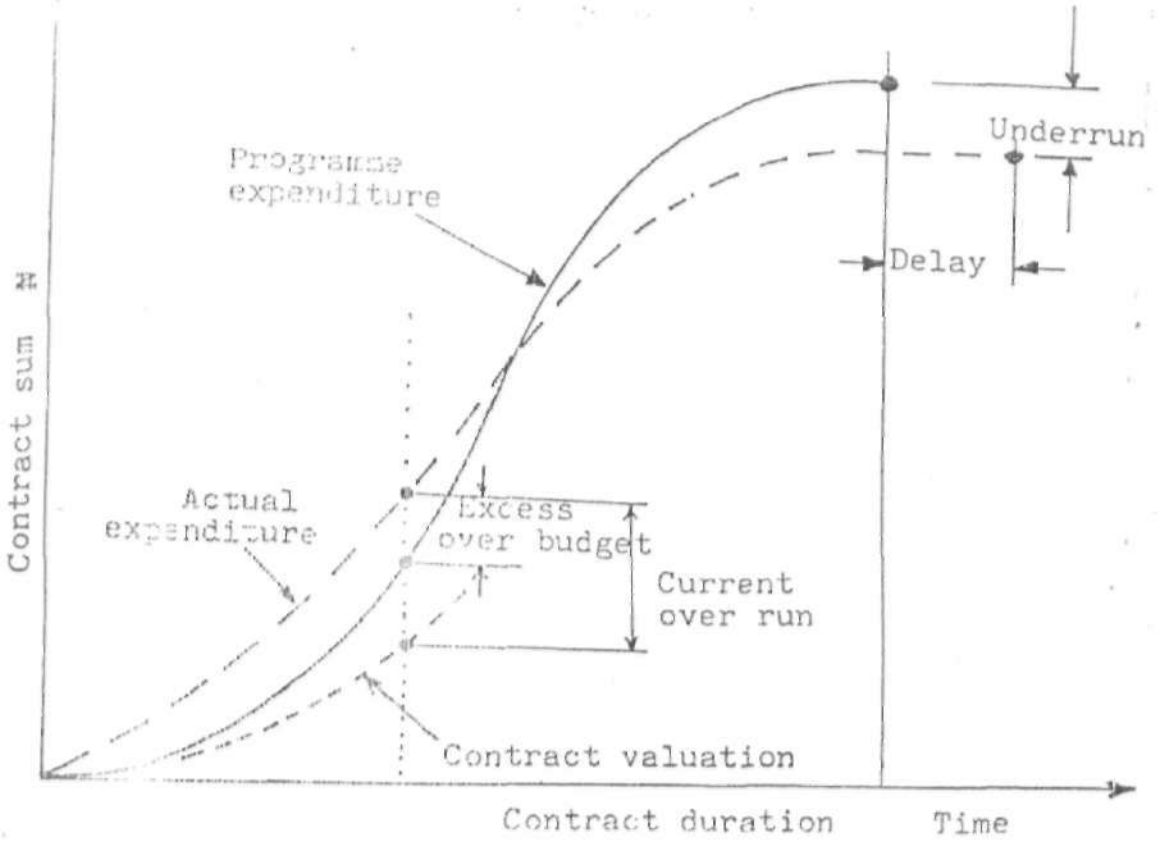


Figure 2.10 Graphical Presentation of Reporting of Project Data adopted from Anekwe C.M. "et al" (1988)[5]. Short Course at University of Port Harcourt Page 100.

This should be used to up-date report from time to time. The components for an effective cost control report as suggested by Barie and Paulson (1979)[6], are as follows:-

i. Estimates: Either total, to-date or periodic that should provide performance standard against which to compare actual or forecast results.

ii. Actual: Periodic or to-date happening.

iii. Forecast: What should happen to the project and elements in future based on knowledge at hand.

iv. Variance: Differences between the actual and forecast results and from planned and estimated.

v. Reasons: Anticipated or unexpected happenings that account for the actual and forecast behaviours of the project's operations. It may explain significant variance from the plan.

Figure 2.11 shows a report indicating the ideas explained. The report is selective with only operations that are of interest to the site supervisor. It also shows items with progress variances exceeding ten percent. A great deal of the information are provided which are, estimated, actual and projected schedule time, costs, quantities, unit costs, variances and trends.

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AHMADU BELLO UNIVERSITY
ZARIA, NIGERIA.

PROJECT NUMBER: 197501
PROJECT TITLE: EXAMPLE CONCRETE BRIDGE
PROJECT LOCATION KADUNA

START DATE 04/5/88
DATA DATE: 07/5/88
REPORT DATE: 07/5/88

LAB. CODE	ACTIVITY DESCRIPTION	UNIT	ESTIMATED	ACTUAL TO DATE	EST. TO COMPLETE	EST. TTL @ COMPL	PERCENT COMPL	FORECAST VARIANCE	PERCENT VARIANCE	TREND
CFF.0310	CONCRETE FORMWORK FOR FOUNDATION	SM	-	-	-	-	-	-	-	-
EST START:	06/02/88	DURATION	34	29	9	38	76%	4	11.8%	HIGH
ACT START:	06/02/88	COSTS:	₦24,900	₦23,800	₦ 7,450	₦31,250	76%	₦ 6,350	25.5%	HIGH
EST FINISH:	07/18/88	QUANTITIES:	15,860	13,600	4,150	17,750	77%	1,890	11.9%	HIGH
ACT FINISH:	/ /	UNIT COSTS:	₦ 1.57	₦ 1.75	₦ 1.80	₦ 1.76	-	₦ 0.19	12.1%	HIGH
CRF.0320	CONCRETE RE-STEEL FOR FOUNDATION	LM								
EST START:	06/90/88	DURATION:	29	21	9	30	70%	1	3.5%	
ACT START:	06/12/88	COSTS:	₦19,700	₦15,850	₦ 6,805	₦22,655	70%	₦ 2,955	15.0%	HIGH
EST FINISH:	07/18/88	QUANTITIES:	82,400	74,410	31,890	106,300	70%	23,900	29.0%	HIGH
ACT FINISH:	/ /	UNIT COSTS:	₦ 0.24	₦ 0.21	₦ 0.21	0.21	-	₦ 0.03	-10.9%	LOW
CFF.0330	CONCRETE PLACING FOR FOUNDATION	CM								
EST START:	06/16/88	DURATION	34	16	21	37	43%	3	8.8%	
ACT START:	06/19/88	COSTS:	₦36,700	₦17,770	₦23,330	₦41,100	43%	₦ 4,400	12.0%	HIGH
EST FINISH:	08/01/88	QUANTITIES:	1,200	690	850	1,540	45%	340	28.0%	HIGH
ACT FINISH:	/ /	UNIT COSTS:	₦ 30.58	₦ 25.75	₦ 27.45	₦ 26.69	-	₦ 3.89	-12.7%	LOW
CRW.0320	CONCRETE RE-STEEL FOR WALLS	LM								
EST START:	06/30/88	DURATION:	34	9	26	35	26%	1	2.9%	
ACT START:	06/30/88	COSTS:	₦18,900	₦ 4,160	₦12,470	₦16,630	25%	₦ 2,270	-12.0%	LOW
EST FINISH:	08/17/88	QUANTITIES:	70,750	19,730	59,170	78,900	25%	150	0.2%	
ACT FINISH:	/ /	UNIT COSTS:	₦ 0.24	₦ 0.21	₦ 0.21	₦ 0.21	-	₦ 0.03	-12.2%	LOW
		END OF REPORT								

FIG. 2.11 Control Report.
(Adopted from Professional Construction Management Third Edition - Page 168, by R.E. Calvert, (1970).

This format assists a project manager to reason quickly and take appropriate action and decision. The report is only an example to illustrate the type of information that might be provided for a building cost control purposes during its execution.

A building cost control report should further indicate the following:-

(a) That the estimate has changed.

(b) The item is complete including expenditure incurred

(c) Expenditure has been incurred where there is no estimate for the item.

(d) Measurement of an item is reported but no expenditure recorded.

(e) Projected expenditure exceeds estimate

(f) Labour material and plant of the contract has been incurred

2.6 Summary

The chapter primarily explained what building project cost control is all about; as a strong management function which must be exercised in order to achieve managerial aims and objective. It involves the preparation of estimates and cost of all the individual elements of building and ensuring their effective control during its execution. The control processes includes estimating, planning, monitoring budgetting and cost evaluation.

The chapter further dealt with building cost control element to be considered for any viable cost control system. The system should have an established standard, aims and objective.

It should at all times measure the performance relatively to the objective and initiate timely corrective action from observed deviations. And finally, an effective communication system is desirable to ensure feedback of activities so that the pulse of the project can easily be felt.

The need for a building cost control system at the site was explained. A model was then presented to show the interdependancy of the cost processes. The operations of the system will present a good building cost control aimed at achieving the initial conception of the project. In the light of this, the basic elements in each of the processes was presented and their necessity for control by contractor and client.

CHAPTER THREE

3.0 ESTIMATES AND ESTIMATING PROCEDURES USED FOR BUILDING COST CONTROL

3.1 Introduction

Barrie and Paulson (1978)[6], were of the opinion that "there are various methods and levels of accuracy for estimating the capital cost of a construction project at different phases of the contract". Each method has its appropriate applications and limitations and done mostly by approximation based on sound judgement and experience. As a result of this, estimated cost of building project differ considerably with the reported cost figures of the completed project.

Barrie and Paulson (1978)[6], further contended that "Estimates range in scope and detail from educated guesses to contractor bid estimate". These estimates are based on complete plans and specifications. They involve the application of historical units costs to compute quantities. To compute the costs the estimator should build the project on paper and assess materials reflected on the drawings, temporary materials; such as formwork to concrete and temporary plant. It also means that the estimator should hypothesize alternative methods that could be used to build the different components of the project; ascertain the resource of labour, equipment and materials that would be required each method, evaluate the productivity and cost and select the methods which when taken together will complete the projections schedule and at the lowest overall cost.

Construction estimate are prepared prior to constructing a project in order to determine the probable cost of the project. Thus an estimate at this stage is at least a close approximation of the actual cost whose true value will not be known until the project is completed and all cost recorded.

Various types of estimates are required for a project throughout its life span. Detailed estimate based on computed quantities are prepared on a comprehensive design and specifications. It may become more expensive when it is detailed and accurate. This may sometimes cost hundred and thousands of naira for big projects however, when accuracy are not required, simpler form of estimating can suffice.

The study will discuss the types of estimates that can be used for building project cost control during its execution and later introduce the estimating procedures. In general, the discussion will proceed from the less detailed to the more accurate estimate in the following sequences:-

(a) Budget Estimate

(b) Preliminary estimate

(c) Detailed estimated by client and contractors

(d) Progress and Re-measured estimates

(e) Final estimate

The basic building elements and work section which enable the cost elements to be determined will be discussed.

These elements form the basis for which building cost control is aimed at on site.

3.2 Contract Stages and Equivalent Estimating Operations Includging Estimators Responsibilities

Estimates are necessary at the various contractual stages of a contract and as shown in figure 3.1. It is necessary to discuss all these phases in order to understand the estimate during project execution. The stages are as follows:

1. Consultation (feasibility study)
2. Clients brief and investigation
3. Construction design
4. Final design and tender stage
5. Construction process
6. Finished structure (Handover and maintenance)
7. Final cost (ideally within prescribed figure).

The types of estimating and techniques including the responsibilities of the client's and contractor's quantity surveyors are listed in the figure mentioned above. The Estimators are seen to be influential in determining the final cost of project costs due to their close monitoring of the costs.

Estimates are quite desirable at all these contractual stages in order to:

1. Provide the design and supervision team with data on particular skill of a contractor. It has the advantage of producing cheaper and faster building.
2. Satisfy the contractor's quantity surveyor that the interim payments and assessment of work executed on site are in agreement with the actual work done.

STAGE OF CONTRACT	CONSULTATION (FESSIBLITY STUDY)	CLIENTS BRIEF AND INVESTIGATION	CONSTRUCTIONAL DESIGN	FINAL DESIGN AND TENDER STAGE	CONSTRUCTION PROCESS	FINAL STRUCTURE (HANDOVER AND MAINTENANCE)	FINAL COST (IDEALLY WITHIN PRESCRIBED FIGURE)
3-0 METHOD AND TECHNICS	3.3 BUDGET ESTIMATE	3.4 PRELIMINARY ESTIMATE	3.5 DETAILED ESTIMATE (ELEMENTAL)	3.6 DETAILED ESTIMATE (TRADE) 3.7 CONTRACTORS ESTIMATE	3.8 PROGRESS ESTIMATING	3.9 RE-ESTIMATING	3.10 FINAL ESTIMATE
METHOD AND TECHNICS	Assesment of clients outline requirement investigation of type of materials plants and availability of labour	Determination of general requirement. Assessement of plan shape volume, floor areas selection of economic plan shapes	Final revision and amendment to initial sketch design	Completion of working drawings with which Bill of quantities are prepared. Acceptance and award of tender	Analyses of programme of work. Adoption of alternative scheme and methods of working	Balance design and distribution of clients outlay	Determination of final account
CONSULTANT'S QUANTITY SURVEYOR'S RESPONSIBILITIES	Providing cost information generally based on similar project in the past and present	Preparation of approved estimate in relation to owner/user requirement Establishing cost limit and cost of different plan shapes	Advise on alternative economic materials. Give breakdown of the cost limit to give elemental cost target	Estimates and price Bill of quantities cost check including quotations from sub contractors. Bid analyses provide tender report	Regular check of estimated and actual cost. Cost and value control Adjustment of prime cost and provision cost. Measurement of variations. Site meeting attending to claims and disputes. Preparation of valuation interim payment	Ensuring soundly completed building within client price level. Preparation of practical completion valuation with little deviations from pre tender estimates except change of scope of work	Preparation of final account and release of retension money keeping of cost record for future use
CONTRACTOR'S QUANTITY SURVEYOR'S RESPONSIBILITIES	Providing cost information and advice base on experience to assist the consultant Q.S. (Normally in negotiated contracts)	Assist the consultant Q.S. with design alternative to meet the client requirement Yet value for money	Assist in the recommendation of materials in respect of cost, availability and durability	Estimates and price Bill of quantities based on his rates. Submits tender for sub-contract works of his interest	Checks on estimated and actual costs cost control Measurement of variations Site meeting and making claims Assist in preparation and aggreeing of valuation for interim payment	Assist the consultant Q.S. in preparation of final practical valuation Ensure the release of half of the retension money	Assist in the preparation of the final account Ensure the release of the final retension money Preparation of the cost records for future use

FIGURE 3.1 CONTRACT STAGE AND EQUIVALENT ESTIMATING OPERATIONS INCLUDING ESTIMATORS RESPONSIBILITIES (FROM AUTHORS EXPERIENCE)

3. Provide a forum for the construction team to suggest alternative materials within the affordable cost.
4. Allow analyses of cost implications to be made.
5. Provide data for judicious management or control of labour, materials and plants.
6. Give information and records for present and future use.
7. Allow effective comparison of initial cost against the actual cost which has to be maintained and not exceeded as far as possible.
8. Provide data for the assessment of variation and fluctuation.
9. Give records for the settling of claims and disputes
10. Allow the client, consultants, and contractors to be aware of their responsibilities to the projects.

Most estimates are prepared by the client's quantity surveyor or consultants quantity surveyors in cases where the client does not have the quantity surveyor under its employment. The estimator should provide these estimates for the building team right from the inception of the project to the final handover. The purpose is to protect the client's interest. Contractor's estimator on the other hand prepares estimates to monitor the cost of the project in order to enable them maximize profit.

3.3 Budget Estimate

When the construction of any project is envisaged, a market research should be started to determine whether it is a new construction or expansion of an existing building. The size and location of the project should also be determined. The clients building department could carry out this research, however, when this department does not exist it is done by the consultants. The client may be the government (Federal, State, or Local Government) Parastatals and organisations who may not have technical manpower to carry out these feasibility studies. Thus, the conceptual stage estimate of the contract are done by the client's consultants who submits timely report for decisions and deliberations. The contractor needs the survey during tendering in order to get acquainted with the conditions of the contract.

The pre-estimate survey according to Patrascu (1978)[18], will include for area survey, climate, soil accessibility, transportation availability of labour cost, present and future economic charges in the area, union, regulations, present contracts and their expirations, available utilities and many other items that will influence the cost of the project during its execution. Any subsequent significant departure from the basic assumption made at this stage may render the venture unprofitable. It is at this stage that the basic parameters are set and the final objectives established.

It is a very important step for the execution of a project as funds are more often than not appropriated based on the figures developed here. Unless there are changes of scope, the whole project and its profitability will be measured against the budget estimate. The initial step should be developed by the client. The owner has the obligation to fully review the estimate and satisfy himself of its reliability. With this estimate the client can allocate money for execution of the project after management has approved.

The contractor should also prepare such estimate before the commencement of the execution of the project.

3.4 Preliminary Estimates

These estimates are prepared based on past experiences and the quantities arrived at are normally called approximate quantities. The procedure followed in preparing the estimate for tender is similar to that employed to obtain detailed building tenders, except that instead of producing a comprehensive bills of quantities for the contractors to price, the surveyor takes off composite items of quantities that are priced as all-in-rates.

Wainwright (1970)[21], was of the view that "the extent to which the building items are brought together will depend on individual preference, the degree of accuracy required and the stage which the drawings have reached in the planning process".

There is no particular rules of measurement and pricing of the composite items. These items are results from research into pricing carried out by the estimator.

An example of this from concretework, as illustrated by Wainwright (1970)[21], is given thus; supposing a research may have shown that for a particular building construction the cost of concrete in beams is roughly the same as the cost of formwork, which in turn is about the same as the cost of 1 percent reinforcement. That is the cost ration between concrete, formwork and 1 percent reinforcement is 1:1:1, inclusive of all labour and sundry items. If this cost ratio can be established then the beams can be measured as a total cubic content. The composite items concrete beams of average section including formwork and reinforcement with 1 percent reinforcement.

The items can be priced at three times the concrete rate. Engineers should indicate the percentage of reinforcement in particular beams and columns accurately enough for the estimate being prepared. Similar items in composite form could read thus:

(a) 150mm Concrete bed spread and levelled on and including 150mm bed of hardcore and including all necessary excavation reinforcement with and including fabric reinforcement (m^2)

(b) 225mm Block walling in cement mortar (1:4) including rendering both sides and decorating with emulsion paint (m^2)

(c) Storeware drawn pipe laid in trench on and including 150mm concrete bed haunched up at sides, including excavation in normal soil average 150mm deep (The rate will allow for reasonable number of bends at junction etc. (m)

In this way the work involved in a building is taken off for estimating purpose in considerable rules set out in the standard method of measurement of building works.

Figures 3.2 and 3.3. illustrate examples of preliminary estimates. Other types of estimates that exist at the earlier stages are based on information related only to the general characteristics of the building i.e. the number of occupants, the floor area and the volume.

The preliminary estimate at the onset serves to check the design against the onwner's original budget or appropriation estimate. If cost appears to be over the budger, alternative concepts is explored before any detailed estimate is prepared. The estimate is also significant for preparing realistic overall project schedules for the project. It is a vital tool for building cost control during project execution and procurement and extremely useful in ascertaining the proper size of the contract package that stimulates prudent resource utilization.

Preliminary Cost Estimate
For Kaduna State Distribution Agency:
Dry Storage Warehouse
(From Preliminary Drawings)

Job No. XY2
Date: 5/5/88
By: PAX
Sheet: 1 of 2

Code	Description	Quantity	Unit	Unit Cost ₦ k	Amount ₦ k	Total ₦ k
1.1	Site earthwork	46,000	cm	2.25	-	104,000.00
2.1	Structural concrete	450	cm	175.00	79,000.00	
2.2	Yard paving	3,500	cm	55.00	198,000.00	
2.3	Fencing	4,700	lm	6.50	31,000.00	308,000.00
3.1	Structural steel	500	t	850.00	425,000.00	
3.2	Metal roof deck	165,000	sm	0.60	99,000.00	524,000.00
4.1	Double tee walls	60,000	sm	4.00		240,000.00
5.1	Fire protection	150,000	sm	1.00		150,000.00
6.1	Plumbing	150,000	sm	0.30	45,000.00	
6.2	Sheet metal	2,000	lm	10.00	20,000.00	
6.3	Heat-vent-air cond.	150,000	sm	0.50	75,000.00	
6.4	Yard utilities	Lot	-		50,000.00	190,000.00
7.1	Electrical	150,000	sm	1.10		165,000.00
8.1	Roofing and Insul.	165,000	sm	0.90		149,000.00
9.1	Special floors	144,000	sm	1.90		274,000.00
10.1	Doors, windows, carpets	150,000	sm	0.50	75,000.00	
	Painting	150,000	sm	0.40	60,000.00	
10.2	Dock hardware	Lot	-		70,000.00	
10.3	Block, part, glass and					
10.4	miscellaneous	150,000	sm	0.60	90,000.00	295,000.00
10.6	Estimated total cost	150,000	sm	16.00		2,399,000.00
	Contingency	2,369,000	-	10%		241,000.00
	Total Const. cost	150,000	sm	17.60		₦2,640,000.00

Figure 3.2: Preliminary Cost Estimate - Work Items
(Adopted from Professional Construction Management by Donald S. Barric and Boyd C. Paulson Jr, (1978)[6]

Preliminary Cost Estimate — Job No. XY2
For Kaduna State Distribution Agency — Date: 5/5/88
Preliminaries & General Conditions — By: PAX
Sheet 1 of 1

Code	Description	Quantity	Unit Cost	Amount (₦)	Total (₦)
1 .1	Field const. management	8 mos	2,300.00	18,400.00	
1.2	Clerk	7 mos	800.00	5,600.00	
				24,000.00	
1.3	Payroll, Taxes, Insurance benefits	30% (say)	-	7,200.00	31,200.00
2.1	Office trailer rent	8 mos	250.00	2,000.00	
2.2	Telephone	8 mos	300.00	2,400.00	
2.3	Reproduction	8 mos	100.00	800.00	
2.4	Office equipment	Lot	-	2,000.00	
2.5	Safety equip. & supplies	Lot		500.00	
2.6	Utility bills - office	8 mos	200.00	1,600.00	
2.7	Move in expenses	Allow	-	5,000.00	
2.8	Job Pick-up truck	8 mos	300.00	2,400.00	
2.9	Travel & misc. expenses	Lot	-	1,100.00	17,800.00
3.1	Sanitary toilets	8 mos	120.00	1,000.00	
3.2	Trash removal	8 mos	250.00	2,000.00	3,000.00
4.1	Surveyor (initial layout)	Allow	-	5,000.00	
5.1	Temporary lighting	Allow	-	5,000.00	
6.1	Final clean up	Allow	-	8,000.00	
7.1	Utility bills - field	8 mos	750.00	6,000.00	27,000.00
8.1	Estimated total	(Lot)	-	-	16,000.00
9.1	Escalation	(₦76,000.00)	(3%)	-	2,000.00
1 0.1	Contingency	(₦78,000.00)	(10%)	-	8,000.00
11.1	Est. reimbursable cost	(2,640,000.00)	(3.25%)	-	86,000.00
12.1	Fixed fee, general overhead and profit	(2,640,000.00)	(3.80%)	-	100,000.00
	Grand Total	(2,640,000.00)	(7.05%)	-	186,000.00

Figure 3.3 Preliminary Cost Estimate - Administration and General Conditions.
(Adopted from Professional Construction Management
By Donald S. Barie and Boyd C. Paulson Jr. (1978)[6],

3.5 Detailed Estimate (Elemental)

After conceptual design has been approved, and after most or all of the detail design work is complete, preliminary estimates are generally supplemented by detailed estimates which are elemental or according to trades.

The detailed estimates require careful tabulation of all the quantities for a project or a portion. In the overall a Bills of Quantities is in the form of a contract document. In this, quantities are multiplied by selected or developed unit costs and the resulting sum represents the estimated direct cost of the facility. The addition of indirect costs plant and equipment, home-office overhead; profit and contingengency develops the estimated project cost. The builder's unit cost is to be explained in the subsequent chapter, with detailed drawings and specifications including a careful take-off the amount of unknown works performed is minimized or eliminated and the margin of errors considerably reduced.

Proper evaluation of labour productivity; effect or local practices, market competitiveness, weather conditions and completeness of plans and specification are extremely vital in the preparation of detailed estimates. Significantly different appraisals of these factors results in sizeable differences in the finished estimates based on exactly the same quantity take-off.

Detailed estimates prepared in the form of Bills of Quantities by client or client's representative are used for tender purposes. The builder relies the estimate and prices the quantities to arrive at the bid price which should be scrutinized by the client. The contractor further breaks down the estimate into labour, materials and plants for the purpose of budgetting planning, cost monitoring and cost control during the project execution. The cost of the project is measured against what has been allocated in the estimate and deviation from the estimate are given timely correction. Detailed estimate could consists of measured work grouped into elements or trades. The later is to be discussed separately.

An element is described by Seely (1981)[19], as "part of the building which always perform the same function irrespective of the type of construction". For example, a roof provides horizontal protection from the weather no matter what form or construction is used and therefore all items constituting the roof are grouped in one section-Roof. The roof element may consists of Asphalt roofing, screeded beds, and precast concrete hollow roof slab and concrete crossed steel beams set out under suitable headings. A summary of a detailed estimate billed into elements is as shown in figure 3.4.

The procedure for arriving at the quantities is to be discussed in the later part of the chapter while the pricing to enable cost per unit be obtained is to be discussed in chapter four. Although this form of estimate is the most convinient for the purpose of obtaining cost data for building cost planning and control it is not

SUMMARY OF COST OF ELEMENTS

FROM ELEMENTAL BILLS OF

QUANTITIES

CODE	ELEMENTS	AMOUNT(SAY)	SUB - T O T A L
1.0	Substructure	-	₦ 20,000.00
2.0	Superstructure		
2.A	Frame	₦ 10,000.00	
2.B	Upper floors	5,000.00	
2.C	Roof	6,000.00	
2.D	Stairs	3,000.00	
2.E	External walls	7,000.00	
2.F	Windows and external doors	5,000.00	
2.G	Internal walls and partitions	4,000.00	
2.H	Internal doors	6,000.00	46,000.00
3.0	Internal Finishes		
3.A	Wall finishes	2,000.00	
3.B	Floor finishes	5, 000.00	
3.C	Ceiling finishes	1,000.00	8,000.00
4.0	Fittings and furnishings	-	5,000.00
5.0	Services		
5.A	Sanitary appliances	3,000.00	
5.B	Services Equipment	2,000.00	
5.C	Disposal Installations	1,000.00	
5.D	Water Installations	2,000.00	
5.E	Heat source	1,000.00	
5.F	Space heating and air treatment	1,000.00	
5.G	Ventilating system	3,000.00	
5.H	Electrical Installations	5,000.00	
5.I	Gas Installations	1,000.00	
5.J	Life and conveyor installations	8,000.00	
5.K	Protective Installations	2,000.00	
5.L	Communication Installations	1,000.00	
5.M	Special Installations	2,000.00	
5.N	Builder's work in connection with services	1,000.00	
5.P	Builder's Profit and Attendance on services	1,000.00	34,000.00
	TO	COLLECTION	= ₦ 113,000.00

CODE	ELEMENTS	AMOUNT (SAY)	SUB - T O T A L
		Brought forward	₦ 113,000.00
6.0	External Works		
6.A	Site works	3,000.00	
6.B	Drainage	4,000.00	
6.C	External Services	2,000.00	
6.D	Minor building works	5,000.00	14,000.00
7.0	PRELIMINARIES		6,000.00
8.0	CONTINGENCIES		5,000.00
		CARRIED TO COLLECTION	₦138,000.00

C O L L E C T I O N

		₦
Page	71	113,000.00
Page	72	25,000.00
	T O T A L =	₦138,000.00

Figure 3.4 Summary in an Elemental Estimate.
(Adopted from the Author's Experience)

popular amongst estimators. This is because there are a great deal of repetitions due to the appearance of the same items in the different elements. However, the estimate is quite essential at the construction phase so that the cost of each element can be visualized easily. Should the cost of an element be exorbitant the design team can suggest alternative materials for that element.

3.6 Detailed Estimate (Work Section)

The procedure of preparing this estimate is the same with the elemental in terms of quantifying, description and specifications, however, the grouping or billing of the measured items are different i.c. based on work section (trades). Since the building industry relies largely on crafts processes, contractors estimators usually prefer the work to be divided into trades and work section. Clients and contractors often find it convenient to sub-contract one or more of the trades e.g. plumbers, plaster, asphalt roofing etc. It is advantageous if all the work in this trades is grouped into separate sections together with their own preamble so that they can easily be extracted from the bills photo-copied and sent to the various sub-contractors for pricing.

The grouping of the works in this type of estimate id divided as follows:

(a) Preliminaries
(b) Substructure
(c) Concretework
(d) Blockwork
(e) Roofing

(f) Carpentry & Joinery
(g) Structural Steelwork
(h) Metalwork
(j) Electrical Installations
(k) Plumbing Installations
(l) Mechanical Installations
(m) Finishings
(n) Glazing
(o) Painting and Decorations
(p) External Works
(q) Contingencies

This grouping is arrived out from the summaries of the Bills of Quantities prepared. Dr. Arumala in a Seminar presentation (1988)'et al' feels that "there may also be the need to produce the bill of materials and labour. Appendix A and B shows examples of these type of bills.

Most estimates prepared in this country for pre and post contract administration are based on work sections. A bill of quantity is prepared which include item by item of the measured work grouped into the work section. The rates of these items are inserted by tender to arrive at a tender figure. During execution, the quantities and prices form the basis for which the various sections can be controlled. As far as possible the estimator ensures that these prices are not exceeded except where variations are introduced.

The measured work is used for making payments to the contractor.

In that respect a contractor thinks of the estimate within the following categories:-

(1) Labour

(2) Materials

(3) Plants

(4) Establishment charges

(5) Subcontractors

The contractor's estimate is discussed in this chapter to emphasize the need for it at tender stage. This is to enable the contractor prepare owns estimate to be able to acquainted with its problems. The contractor's cost elements will be explained vividly in next chapter to explain, the need for the control during construction.

3.7.1 Labour

Labour includes for payments made in respect of wages and salaries of junior supervisory or clerical staff employed in the execution of works. Formally this used to be estimated by dividing the project into operations such as earthwork concrete forms, concrete burnt brick etc., then estimates of labour costs of each operation can be done. The labour should also be classified according to the works performed and the time taken in man-hour assessed The wage rates for each labour is computed for each operation.

Production rate as defined at a seminar presentation by Dr. Arumala (1988) 'et al' as "the number of units of work produced by a man in a specific time, usually an hour or a day".

This rate may specify the time in man-hours or days to produce specific number of units of works. It should be realistic to give room for human lapses, such as climatic conditions, job supervision, complexities of operations, health or other factors.

Date on rates from previous similar work performed is vital. Such information are obtained through accurate labour cost record keeping of operations as the works progresses. These records includes for the number of units of work completed, labour employed by classification, completion time, job description climatic condition and other factors militating against the output of labour. Labour estimate is very important to the contractor because it is used for making payments on daily, weekly or monthly bases as the work progress. Excessive cost incurred through labour cost on site is as a result of overstaffing in an attempt to increase productivity. It may perhaps be due to poor motivation of the workers.

3.7.2 Materials

Estimate for materials are made by calculating the quantity of materials from plans and specifications. A schedule of materials are prepared from the estimate. The schedule will involve all materials placed in the project plus earth excavation and fill. Materials for each operation should be separately listed in the correct quantities, according to their classification and unit costs. The unit costs should be obtained from reliable source and taking cognisance of the delivery costs to the project site.

KASHIM IBRAHIM LIBRARY
AHMADU BELLO UNIVERSITY
ZARIA, NIGERIA.

The quantities must also include for wastes. These materials can be procured, delivered and stored at the site when required. Most of these materials are purchased on cash and carry bases and the cost may differ based on the quantity purchased. However, specialist materials such as steel works require orders to be placed for the supply and fixing. When estimates are prepared, the contractor must differentiate the types of materials that can be obtained at the time they are required. It is necessary to avoid undue delays in the execution of the project.

3.7.3 Plants

Estimates for the plants and machinery are made by the contractor even before works are started. It is always important to ascertain which plants are required for each jobs and make provision for whether they are to be purchased or hired on monthly, weekly or daily basis. The cost of owing, operating and for removing these plants after works has been completed should also be computed and included in the rates.

3.7.4 Establishment Charges

Establishment charges represent cost incurred by the contractor in running the company as a whole and which cannot be attributed to any contract-head, office expenses, builders yard, salaries of supervisory, office staff and directors. Establishment charges varies with different firms.

They are influenced by the annual turn-over, the class of works carried out, the ability of drive of the administrative staff and the analysis as to which elements of cost are allowed as establishment charges.

In the estimating the contractor should ensure that clear cut line is drawn as to those elements of cost that are establishment charges as against other costs. This could be done by allowing them in the estimated cost the plant labour and materials or estimating their cost and allowing them on a lump-sum basis. They may also be by percentage of the estimated cost of the building. As in the later example, labour insurance are strictly labour charges but their cost may readily and simply be allowed for in estimating by adding a percentage to the estimated cost of the building.

3.7.5 Sub-contractors

The estimate for sub-contractors are normally allowed by the contractors or job section which cannot be constructed by the contractors. These are specialist jobs such as structural steel works, mechanical installation, electrical installation etc. If the contractor has no adequate, labour, plant and materials to execute these works, the contractor allows for an estimate from the sub-contractor and incorporates this estimate into the main estimate. Payments to the sub-contractor will be based on the amount of work executed during the construction phase.

Sometimes the specialist sub-contractor may be appointed by the client. Figure 3.5 shows an example of competitive contractor's estimate for the structural steelwork of a warehouse.

For many years, numerous successful contractors were able to compute project cost effectively using the unit-cost estimates. This involves ascertaining the overall unit costs of labour, materials, equipment and overhead and applied directly to actual quantity take offs. However, with the sharp price charges over for all components in recent years, the method is becoming increasingly unsuccessful. Almost all successful contractors now estimate projects with separate categories and evaluations for labour materials equipment usage and sub-contractors.

During construction, the contractor measures performance against what was initially estimated. It is to enable proper control of the cost elements of the project in order not to exceed the amount allowed for the items. Maximization of profit is also envisaged by the contractor. Any deviation from what was previously allocated for in the estimate will be given timely attention and proper correction. These are all the constituent of control measures.

Title _____ Job No. _____

Client _____ Location _____ Date _____ By _____

Subject Structural Steel Estimate Summary Sheet _____ Of _____

Code	D	Description	Quantity	Units	Man-hours	Labour	Material	Equipment		Man-hours	Labour	Material & Subs	Equip-ment	Total
1.0		Fabricate in shop				$ 12.00/Hr								
		Beams & Columns	280	Ton	10 Hrs/Ton	120	310	50		2,800	33,600	86,800	14,000	134,400
		Roof joists-purch.	200	Ton	-	-	390					78,000		78,000
		Detailing etc.	300	Hr.		10.00				300	3,000			3,000
		Sub-total directs	480	Ton						3,100	36,600	164,800	14,000	215,400
		Shop overhead	80%	labour		.80					29,300			29,300
		Estimated Cost									65,900	164,800	14,000	244,700
		Profit & Overhead	12.5%											30,600
		Estimated Shop Price												275,300
													say	275,000
2.0		Erection & Field												
		Steel Erection Crew												
		1 Foreman	1 @	17.50		17.50								
		4 Ironworkers	4 @	15.75		63.00								
		1 Operator	1 @	17.50		17.50								
		1 Oiler	1 @	14.75		14.75								
		2 Ironworkers	2 @	15.75		31.50								
		9 Total Crew			9Hr @ 16.03	=144.25								
		Furnish Fab Steel	480	T			L.S.					275,000		275,000
		Erect Struct. Steel	280	T	7 Hrs/Ton	112.00				1,960	31,400			31,400
		Erect joists Steel	200		5 Hrs/Ton	80.00				1,000	16,000			16,000
		Equipment Usage	2.0	Mos.				6000					12,000	12,000
		Misc. Supp.& Tools	10%	Labour								4,700		4,700
		Deck-Subcontract	L.S.									71,000		71,000
		Estimated Cost								2,960	47,400	350,700	12,000	410,100
		Profit & Overhead				20%	3%	-			9,500	10,500		20,000
		Estimated Price												430,100
		Final bid price											Use	430,000

Schedule Computations

$$\frac{2960 \text{ Hrs}}{72 \text{ Hrs/crew day}} = 41 \text{ days}$$

= 8.2 weeks

Duration = 2.0 mos.

Figure 3.5 Competitive Contractor's Estimate for Structural Steelwork of Warehouse (Adopted from Professional Construction Management Page, 190 & 191 by Barrie D.S and Paulson B.

3.8 Progress Estimate

Progress estimate consist of the measurement of works executed by the contractor from time to time for the purpose of interim payments. The valuation or measured work will be based on detailed estimate prepared (Bills of Quantities). The items of work which have been completed are abstracted from the estimate and the total amount is included in the interim valuation subject to retention money which should be according to the terms of the conditions of contract. An example of such a valuation is as indicated in figure 3.5 (see appendix 'c' for the certificate of valuation. The items and cost are from measured items from the contract bills of quantities.

From this estimate it would be possible to ascertain the progress of work executed and to know whether the works executed is as scheduled or planned. Through this, estimated items are adjusted in the light of the site instructions given during the progress of the work and from which the final cost can be obtained. In addition, errors in quantities, or specifications or costing can be detected and corrected. Variation and claims are also estimated and recorded to enable a final cost to be reached. Adjustment for prime cost and provisional sums are also done in the progress estimate. Sub-contracts and supplies jobs are given proper accounts. As already mentioned, the progress of work through this estimate can be easily visualized by preparing progress charts, graphs or other forms of pictoral representations.

CONTRACT: WAREHOUSE FOR KADUNA STATE DISTRIBUTION AGENCY

VALUATION NO. 5 (FIVE)

DATE OF VALUATION: 2 March, 1988.

CODE	WORK TRADE	ITEM	VALUED WORK EXECUTED	A M O U N T
1	SUBSTRUCTURE	H/2A	N 4,500.00	N 8,350.00
		"/2B	3,000.00	
		"/2F	500.00	
		WH/2G	350.00	N 8,350.00
2	BLOCKWORK	WA/4A	2,500.00	
		"/4C	3,000.00	
		"/4D	1,000.00	6,500.00
3	CONCRETEWORK	WH/6B	450.00	
		"/6D	1,200.00	
		"/6F	2,000.00	3,650.00
4	ADD FOR MATERIALS ON SITE	400 bags of cement @ 12 per bag	4,800.00	
		Reinforcement bars 1000 kg @ N1.80/kg	1,800.00	6,600.00
5		SUB - TOTAL		N25,100.00
7		Less 10% Retension		2,510.00
				22,590.00
8		Less Previous Payments Made On Say Certificates NO. 1-4		10,500.00
		TOTAL AMOUNT NOW DUE FOR PAYMENT TO CONTRACTOR =		₦ 12,090.00

Figure 3.6 Sample of a Valuation for Interim Payments (Based on Author's Experience).

3.9 Re- Est ting

This is the re-estimation of preliminary or detailed estimates which have been prepared on elemental or trade section for tendering purposes. A detailed or indeed any estimate used for tender may consists of provisional and prime cost sums. When construction is in progress or at finished stage all these provisional and prime cost items are to be re-measured to ascertain the accuracy or otherwise of the quantities. The rates in the bills forms the rates for pricing the new quantities. However, these rates may differ where fluctuations has been established and agreed by the client and contractor.

The re-measurement of all the items are necessary by the clients and contractor's estimator as the quantities initially quantified may either be high or low. Adjustment is therefore effected as variations. The sub-contractors estimates should also undergo a re-measurement to ensure that the estimated quantity and cost is in conformity with the actual cost incurred. This re-estimating process will protect the interest of both the client and contractors alike and the actual realistic cost of the project will be ascertained for future plan and use.

3.10 Final Estimate

Final estimate is that estimate where the final cost is arrived at after the re-measured quanti*ies have been got, all prime cost and provisional items determined, variation and claims such as retention money settled. The final estimate therefore gives the detailed estimate of

the job. It forms a document which can be kept for future references and use.

The estimates involved in the post-contract administration of contract as discussed as a "control tool" of the building. It is therefore of importance that all these estimating techniques be adhered to in all the stages of a project so that cost control processes are effected. It will then ensure that the client receives value for the money expended and the contractor maximises profit.

3.11 Estimating Procedures

Before the cost of a project can be ascertained, certain estimating procedures have to be undertaken with the ultimate goal of producing a tender documents for cost control. It is called the Bills of Quantities. These processes includes taking-off, squaring, billing and pricing. They are perculiar of detailed estimates and most appropriate if building cost control may be adequately exercised. The processes will be briefly explained as follows:-

3.11.1 Taking-off

It involves the measurement of quantities from the drawings and specifications for a project. The quantities are measured in accordance with the rules of the rules of the Standard Method of Measurement of Building of Civil Engineering Works (SMM). The S.M.M. has many advantages for the builder.

Each element of a building is measured in a particular manner which is presented in the bills of quantities in a standard unit of measurement. It could be an item, supperficial, cubic, provisional or prime cost sum.

Appendix 'D' shows a taking-off sheets and measurement in preparation for squaring and abstracting.

3.11.2 Squaring and Abstracting

This is a process where the quantities which have been measured and inserted in the taking-ff sheets are calculated to determine the actual quantities of the elements. Where fractions are observed it is rounded up to give a whole number. It also involves the bringing together of similar items or elements and adding or substracting to arrive at the final quantities.

3.11.3 Billing

Billing requires the arrangement of measured items according to the work or element of the project. The arrangements are made in order with the quantities of the items (as shown in appendix 'E') so that pricing is easily effected. Each item is identified by an alphabetical letter and page number. Thus this becomes the code number of the item for any reference to it where necessary.

3.11.4 Pricing

This is the final stage of the estimating procedures which requires that the proper cost of items in the bills are inserted. This can be done by making a market survey/ research on the prices of labour, materials and plant.

A calculation of the unit price (as will be previously explained in the next chapter) is arrived at and multiplied by the total quantity of the items required for the project. This process is done for one work item with a summary of cost of the sections or elements of the project. Then a general summary of the cost at the end of the Bills of Quantities to give the contract sum of the project. Figure 3.4 shows the general summary of a building project based on elemental estimate.

As stated previously, the aims of these procedures is to produce and provide adequate data for cost control of a project. The documents so produced is called Bills of Quantities. It supplies adequate information and guarantees accurate estimates to the builder. Any errors that may be contained in the descriptions and/or quantities or omissions of an item are treated as variations and adjusted in the final estimate of the project.

At tender stage the prices of the builder are carefully checked by the client's estimator or consultant to identify arithmetical and clerical errors in order to arrive at the tender sum before finally awarding the contract. Once the contract is signed, the contract bills and all the rates cash extensions and totals are considered accepted by both parties to the contract. The procedure is therefore subject to errors in computation, descriptions, compilation and judgement. The bills of quantities is thus a preliminary estimate which require review when a project is completed.

3.12 Accuracy of Estimates

Patrascu (1978)[18], contended that "the accuracy of the estimate depends on the type of estimate being prepared, on the available information for its preparation, the time devoted to its preparation and, of course, its end use". It is only through the realisation of these conditionalities can a realistic estimate be prepared. Because estimates have uncertainties a contingency sum on experience is normally allowed for works which cannot be easily identified during the preparation of the Bills of Quantities. The sum is added to the base sum estimate to have a chance to come within the eventual cost. As earlier mentioned the estimating procedures is necessary during project execution. According to Wearde (1979)[22], the "amount of money which has to be predicted all through the cycle of a project is the actual construction cost the total amount finally paid to the contractor or contractors involved". Due to the uncertainties of estimates as a result of the several procedures of estimating, prime cost sums, provisional sums, fluctuations, and claims, the total cost of a project is not often known until after its completion.

Prediction of project cost is less accurate at the feasibility study stage (during budget estimate) as compared to when the project has been completed (final estimate prepared). The distribution of the probable error in the cost estimate is consequently widest at the feasibility study and narrow to zero only when all cost incurred in terms of payments to the contractors have been settled.

An illustration of this assertion is on figure 3.7. Consider the section described ABCD. Point 'A' indicates that the probability is one in three that the present cost is 10 percent higher than the actual cost of the project. Point 'B' is the unknown actual cost while Point 'C' shows the median of current estimate. Point 'D' is an indication of the current cost of the project. This is an evidence that the lower limit of the line is further separated from the actual cost than the upper limit line. This could be the reasons for contingency sums being on the positive rather than negative.

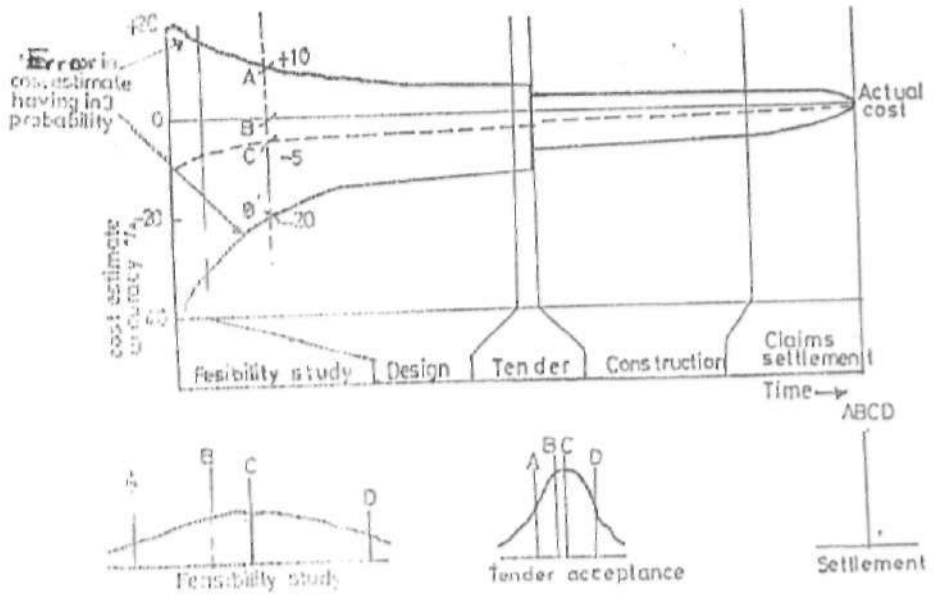


Figure 3.7 Probability of Accuracy of Estimates (Adopted from Control of Engineering Project by Wearne S.H.(1979) Page 137.

The need for estimates throughout the construction stages of a project is not disputable in view of its importance in the arriving at its actual cost. Estimators should be deligent, give enough time for the estimate, explicitly present it and make review in order to ascertain the actual cost.

3.13 Summary

The need for estimation of the capital cost of a project during its execution is considered important in order to determine the cost of the project. Different types of estimates can be prepared from 'Guestimates' to detailed estimates in order to provide comprehensive data for the building cost control. These type of estimates includes budget, preliminary, detailed progress, re-measured and final estimates.

Estimates are desirable at all the various stages of a building contract execution. The estimating process are better handled by the contractors and client's Quantity Surveyors to ensure efficient cost control of the project. Estimates prepared especially detailed estimate, forms a source data for the building cost control, monitoring, evaluation, analysis, and for future use.

Estimates are arrived at or properly documented through procedures such as taking-off, squaring, billing and pricing.

Comprehensive documents the "Bills of Quantities" is produced and forms as a cost data bank requisite for post contract administration. The total cost contained in the Bills of Quantities after all amendments have been made and agreed by both parties to the contracts binds the said parties. The accuracy of estimates will depend on the type of estimate, source of data, timing and use. The true value of a project is only then determined after all costs in respect of the project have fully been accounted and settled. Prediction of cost varies during the project site implimentation. Estimate resolves cost related problems. Building cost control measures are highly dependant of these cost data.

This chapter has given the relevance of estimates in all the facet of the cost control. Estimates forms the live wire of any building cost control system.
The next chapter is to discuss the need for ascertaining and controlling the cost of a builder's cost elements.

CHAPTER FOUR

4.0 BUILDER'S COST ELEMENTS

4.1 Introduction

The cost of any project is made up of various individual elements of cost, the aggregate of which constitutes the total cost of the work. The estimation of this total cost consist of the following:-

i. Estimating the cost of the individual element of cost.
ii. Building up the total cost of work by taking into consideration each individual element of cost concern.

Individual elements of the cost which contributes to the total cost of the building work and which should also be considered for estimating and site control by the contractor contractor includes:-

i. Labour
ii. Materials
iii. Plant
iv. Preliminaries
v. Attendance
vi. Overheads and Profit.

Figure 4.1 shows the structure of the builders cost elements. The figure indicates a simplified contractor's building constituent that should be estimated and used for monitoring and controlling the project cost in the construction phase.

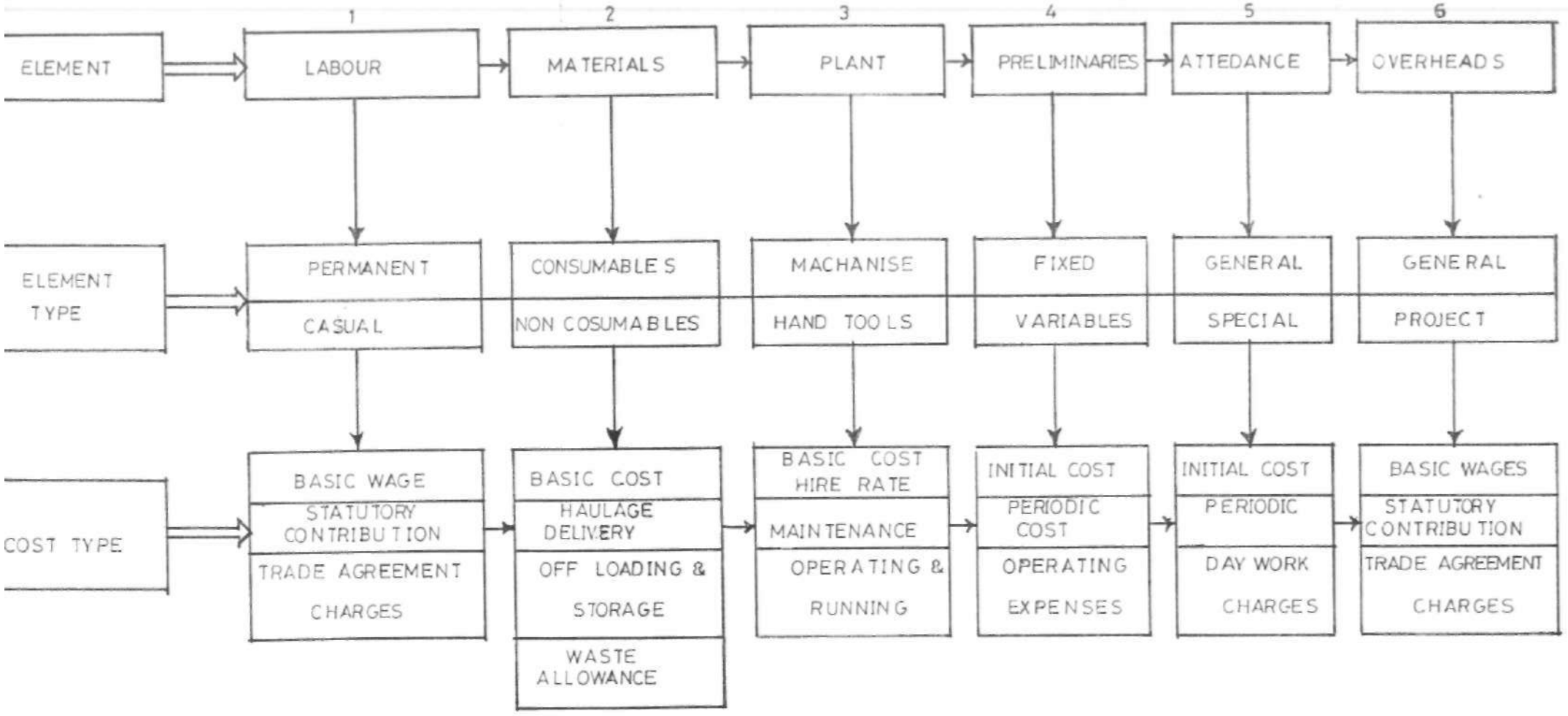


FIGURE 4.1. BUILDERS COST ELEMENTS
SOURCE; ADOPTED FROM "A COST CONTROL SYSTEM FOR CONSTRUCTION SITE ~ A CASE STUDY OF THREE SITES" BY ABUBAKAR ABDU (1985)

It is therefore desirable to discuss these contractors cost elements because the actual cost is incurred by the contractor during the project executions.

4.2 Labour Cost

Labour costs are determined by production rates of individual worker or gang of men. Production rates are the output/work done per unit time. It is computed and paid for after the expiration of a day's work. The builder uses his experience to arrive at the rate. The compilation of these rates provides a contractor's cost estimator a useful cost data for the present and future use.

Labour cost could be considered permanent or casual depending on whether it is statutory or trade-agreement charges. The former is associated to an employee of the organisation and the latter is for a given period. In respect of the kind of labour cost, the computation of the cost would have to be direct or indirect cost. Direct labour cost is for daily output/wages paid to unskilled, skilled, and semi-skilled workers. Indirect labour costs on the other hand is the fringe benefits such as pension plans, health, funds, apprentiship, progress, travelling expenses, rains and public holidays. This forms a percentage addition to the direct payroll of the worker and is computed depending on the type of skills and firm involved.

Statutory legislation, working rule agreements and wage rates continue to change from time to time as such all-in-rate are not constants.

However, a principle of arriving at this rate has been built up based on an annual calculation in accordance with the code of estimating practice published by the Chartered Institute of Building. The components involved in building and the hourly rates of craftsmen and labourers as illustrated by Wainwright (1970) is as follows:-

		CRAFTSMAN ₦	LABOURER ₦
1.	Guarenteed minimum weekly earnings	42.00	36.00
2.	Increment weather allowance (2%)	0.84	0.36
3.	Sick pay	0.40	0.35
4.	Tool money (average)	0.50	-
5.	Training levy	0.70	0.12
6.	National Insurance & Pension	8.00	8.00
7.	Annual holiday credits & public holiday allowance	5.00	5.00
8.	Death benefit scheme	0.10	0.10
9.	Severance & redundancy payments, etc.	1.60	1.50
10.	Trade Supervision	3.80	2.80
11.	Additional bonus payments	10.00	8.00
12.	Travelling expenses	3.00	3.00
13.	Overtime including non-production element	8.50	8.50
14.	Employer's liability and third party insurance add ₦2,00 per ₦100	3.05	2.58
	Weekly cost per operative	155.78	132.03
	Hourly cost based on a 45-hr/week	₦3.46	₦2.93

The calculation of labour rates for operative serves as data for the compilation of man power requirement needed for a project execution. Labour requirement of a project can be compiled on a daily or weekly bases to serve as a control measure. A graph of labour strength can be drawn. Where it is shown that the labour demand will exceed the supply, a sketch of non-critical activities may make it possible to maintain the original established cost.

If such is not feasible the available labour can be allocated to various activities to the best advantage of minimizing the cost of the project. Figure 4.2 shows an approximate guide of labour requirement of a project. Labour requirement can be regularly compared with the anticipated requirement of a particular tradesmen as shown on figure 4.3. The maintenance of the requisite labour force should be judged in conjunction with the progress record.

CONTRACT:- CONSTRUCTION OF BARNAWA LOW COST HOUSES

Class of Labour	Qty	Contract Week Nº																													Output
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Compressor Driver	—		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1											—
Outfit A Drains	1880m		5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5											100m/Wk
Outfit B Drains	1,600m				5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5											100m/Wk
Backfill Team	—			4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4											—
M.H. Bricklayers	372m^3			3	3	3	3	3	3	4	4	4	4	4	4	4	4	3	3	3											6m^3/Man Wk
Formwork Joiners	3500m^2					3	3	9	10	10	10	10	10	11	11	13	13	11	11	8	8	7	7	5	5							20m^2/Manwk
Steelfixers	—					2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1							—
Concretors	1340m^3				4	5	5	6	6	7	7	7	7	7	7	7	7	7	7	6	6	5	5	5	5	4						Av.61m^3/wk
Attd Plant Erectors	—																			2	2	2	2	2	2	2	2	2	2			—
Fitter and Office Attd.	—	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	—
Other Works	—				2	2	3	3	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	4	3	3	3	—
Weekly Totals		2	8	15	26	32	33	40	42	44	45	45	45	46	46	48	48	45	45	43	32	23	23	20	20	12	8	8	7	7	5	

Fig. 4.2 ESTIMATED LABOUR BUILD-UP (ADOPTED FROM INTRODUCTION TO BUILDING MANAGEMENT THIRD EDITION BY R E CALVERT Page 145)

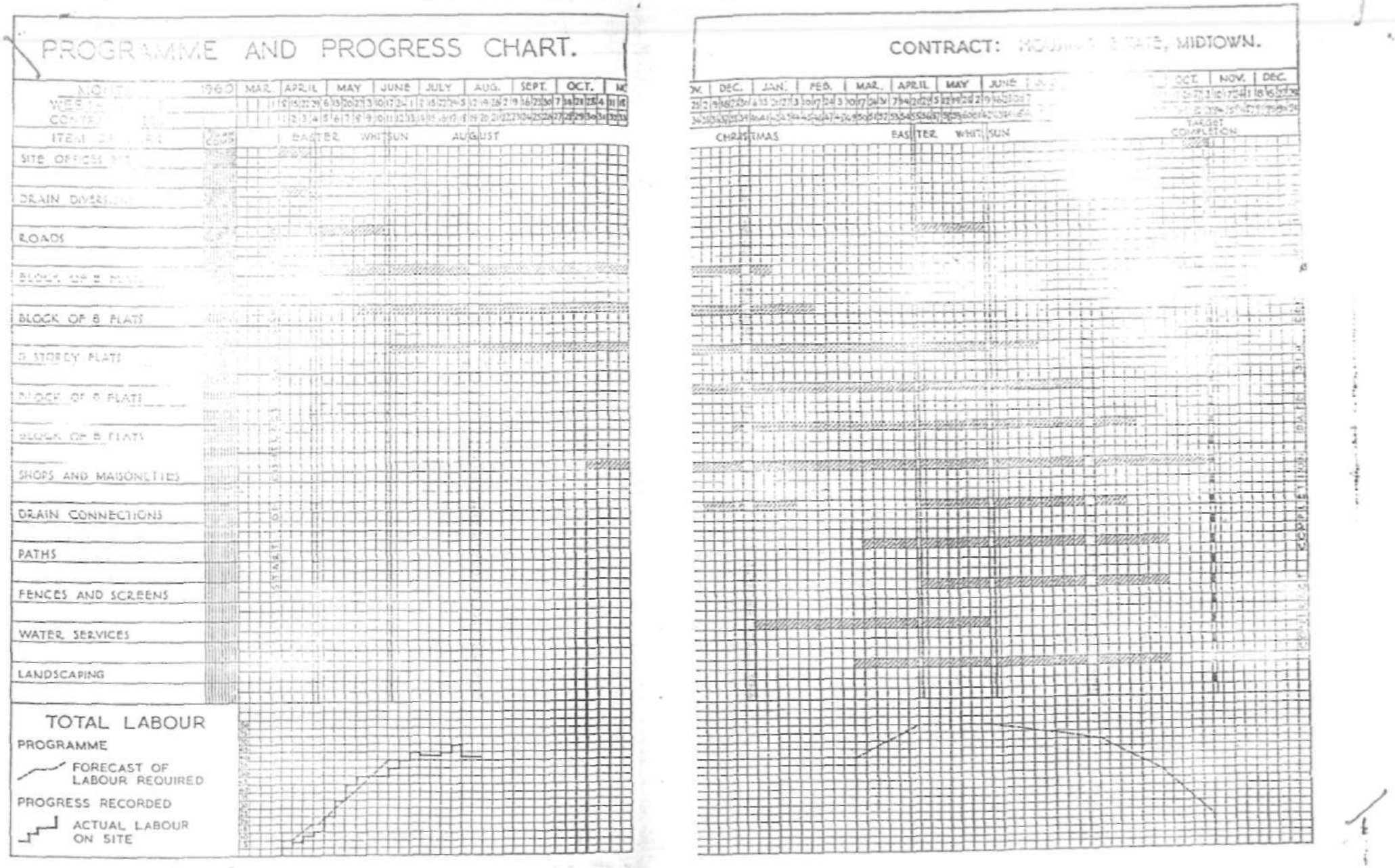


Figure 4.3 Programme and Progress Chart (Adopted from Introduction of Building Management; Third Edition Page 136 & 137, By R. C. CALVERT (1970)[7].

4.3 Materials Cost

The builder considers materials cost in estimating. The cost of the material involved in a unit cost is influenced by the following:=

i. Availability of sufficient supply delivered at regulated intervals. Correct amount, ensuring adequate plant and labour utilization.

ii. The cost of material delivered "on site" which requires loading, off-loading, handling and placing them in the work complete.

Having taken these factors into consideration and computed the cost of materials delivered "on site" the cost of material per unit of work is ascertained by multiplying the quantity of material requirement and the unit cost. The quantity of the specified material is obtained from tender documents such as the Bills of Quantities. But for the purpose of clarity it is expected that this quantity is ascertained from the drawings submitted to the contractor. During execution this quantities can be practically checked through re-measurement. Deviation from specified quantity is given the appropriate attention.

Timed schedules of the materials requirement of the project is prepared as shown in figures 4.4 and 4.5, in order that all components are actually requisitioned. The materials should be ordered in good time. Chasing of supplier becomes important so that the materials are delivered at the appropriate time at the site when required.

BILLS OF QUANTITIES	MATERIAL	LOCATION	P. C. VALUE	DATE SUBMITTED	DATE APPROVED	SUPPLIER	ORDER NO.	REMARKS
80e	Brown Bricks	Toilet	450/m	10/7/88	15/7/88	Nimco (Nig) Limited	101/6	-
90a	Cast Iron Manholes	All Manholes	-	6/9/88	16/9/88	Ahmed Metalworks	103/5	-
Spec. 24	Facing Bricks	Shop Front	300/m	10/7/88	17/3/88	Nigeria Bricks Ltd.	106/2	Registered Mid October

Figure 4.4 SCHEDULE OF MATERIALS (PROVISIONAL) FOR SHOPPING COMPLEX - BARNAWA

Source: (ADOPTED FROM INTRODUCTION TO BUILDING MANAGEMENT) By Calvert, R.E. (1979)[7] page 133

MATERIAL	DESCRIPTION	QUANTITY	FIRM	DATE ORDERED	DATE REQUIRED	ORDER RECEIVED	ORDER NUMBER	PAGE NO. IN BILL	REMARKS
Nimco Bricks	75mm-50mm Thick	$1000m^3$	Pax Transport	12/2/88	2/3/88	8/3/88	2/611	5/7A	-
Portland Cement	Ordinary	150 Ton.	Incorporated Cement Ltd.	"	6/3/88	-	3/628	3/2B	-
Coarse Aggregate	-	$110m^3$	Astle (Nig) Limited	"	7/4/88	-	3/612	5/8C	-
Sandcrete Blocks	100mm	$700m^2$	Adams Limited	-	15/4/60	-	-	2/60G	-
Sawn Timber	See Spec.	$200m^3$	Black Enterprises	-	11/6/60	-	-	-	Treated

Figure 4.5 SCHEDULE OF MATERIALS FOR BARNAWA HOUSING ESTATE.

SOURCE: (Adopted From Introduction To Building Management), By Calvert, R.E (1979)[7]. Page 133.

Ahudja (1976)[3] , gave the major causes of excessive materials cost during project execution as follows:-

1. Wastage
2. Pilferage
3. Inaccurate measurement of quantities
4. Poor timing of supplies to sites
5. Excessive transportation cost
6. Poor handling of materials
7. Improper selection of materials
8. Excessive storage cost
9. Lack of priority purchasing
10. Late payments for materials
11. Poor bargaining in purchasing

4.4 Plant Cost

There are two types of plants used for unit of work when plant cost are to be considered;

i. Small plant such as barrows, ropes, pails, block and tackle, saws, shovels, scaffold poles, scaffold boards, putlogs, steps, and other mechanical plants of non-mechanised nature.

ii. Mechanical plant such as, mechanical excavator, concrete mixer, lorries dumpers, power hoist etc.

Plants can be hired or purchased for a project execution. The mechanical plant cost per unit of work is obtained by multiplying the plant's constants as may be contained in the estimating tables by the prevailing hire rate or working cost of the plant per hour. The cost of small plants or tools on the other hand are allowed for in the estimating by adding a percentage to the estimated cost of the work.

The plant rate will account for the followings:-

1. The hire rate of the plant per hour, allowing for depreciation, repairs and renewal.
2. Wages of plant driver per hour
3. Cost of fuel, lubricating oil, and grease consumed per hour.
4. Plant insurance (if any) on hourly basis

In a project it is important initially to prepare required plant schedule and to ensure that they are brought on site at the appropriate time and return when it becomes redundant. Figure 4.6 shows a plant schedule for a project. Plant cost forms a major cost to the budget of a project and should be given thorough investigation by the contractor. Factors that affect plant costs are as follows:

1. Unsuitable plant for a given project
2. Uneconomical mode of acquiring and replacing plant
3. High operating and maintenance costs
4. Obsolescence
5. Lack of preventive measures

Maintenance programme, poor selection of plant would cause excessive plant cost. By studying the plant usage reports, accounts, cash outlays and indirect expenses the right plant can be obtained for a project. Actions of control and correction can only be done with the factors mentioned above.

CONTRACT	Industrial Insurance Offices		DATE: 11th	Jan.1988	
Plant	Accompanying	Planned Date Regd.on Site	Approx. Date of Release from site	Source of Supply	Remarks (Including purpose for Plant
14/10 Conc. Mixer c/w Scales	Scrap foul	21-3-88	End Sept. 1988	Depot	Electric
20 T Cement Silos	Electric agitator	"	3/10/88	"	"
22 RB Excavator	Fitted dragline	2-2-88	End Aug. 1988	To be fixed	"

Figure 4.6: Plant Schedule

SOURCE: (Adopted from Introduction to Building Management by Calvert R.E. (1977)[7], Page 153.

4.5 Preliminaries/Attendance and Overhead

In the preparation of tender documents there are certain items of cost which forms the project overhead. They are normally calculated as lump-sums and are placed in the preliminary part of the Bills of Quantities.

These items in a typical building project are summarised as follows:

1. General foreman
2. Insurance
3. Plant, tools, vehicles
4. Compound and boardings
5. Watching, lighting, security etc.
6. Temporary services(Water, Electricity, Telephone etc)
7. Temporary roads
8. Scaffolding
9. Temporary buildings
10. Removal of rubbish
11. Special overtime
12. Special travelling expenses,lodging allowances etc.
13. Advertising

They include for the usual proportions of overheads and profit in the same way as any other unit rate. Contractors have wide difference in the way they show and calculate the cost of these items. The cost may be accounted separately in the preliminary section of the Bills of Quantities or they may be included in every rate throughout the Bills. As may be seen, the preliminary cost items are often numerous and cover a range of expenses that may be omitted.

Therefore the estimator should always check the accounts for overhead against the project cost.

Besides the direct and indirect cost items found under labour, plants, material and preliminaries there are other reasons that prevents effective building cost control.

They are as follows:

1. Resistance to change
2. Lack of a management development programme
3. Inadequate insurance
4. Lack of co-ordination between various agencies responsible for the job
5. Unplanned and inadequate information
6. Failure to make optimum use of resources
7. Lack of emphasis on purposeful job meetings
8. Over extention of programme
9. Disproportionate capital resulting in shortage of working capital
10. Failure to establish line of credit
11. Bad Debt
12. Lack of suitable experienced personnel
13. Unrealistic or inadequate targets
14. Failure to predict market fluctuations
15. Unsuitable type of contracting

16. Inadequate cost and financial accounting procedures
17. Irregular after-the-fact progress and cost reporting
18. Inaccurate charging of labour materials, equipment and overhead costs.

The preliminary items during project execution should be controlled. It can be done by way of comparing the percentage of the total cost spent on each item to the percentage spent by other firms in similar circumstances or in past projects. In large projects the employment of labour should be done with care to avoid excessive cost. The job may have been finished at the site and the employees are still being paid in the main office. This type of situation are normally difficult to detect since the excess personal always appear busy. The productive work perpetuating the type of repetative effort normally occurs in a labour intensive project.

Example of Estimating and Pricing of Contractors

.6 Building Cost Elements

An example of a calculation and pricing of a contractor's cost elements as analysed by contractors is as follows:-

Supposing specification and quantity are in a Bills of Quantities, is described thus:

(A) Concrete (1:3:6-40mm aggregate) in foundation trench (20m3) (using a 10/7 mixer contineously).

The contractor would account for the cost of the various costs elements from the following procedures:-

(a) Materials	N	k
- Ordinary Portland cement delivered to site in paper bags per tonne	560	. 00
- Off-loading etc. per 1 hour labour at N6.00	6	. 00
- Proportion in weight of concrete (1:3:6) is cement 1420 kg/m3; sand 1600kg/m3 and coarse aggregate 1400kg/m3		
- Cement including unloading 1m3 @ 1420kg/m3 @ N566.00 per tonne	803	. 72
- Sand 3m3 @ 1600kg/m3 @ N50.00	240	. 00
- Coarse aggregate 6m3 @ 1400/kg @ N80.00/tonne	672	. 00
	N2,065	. 72
- A 10/7 mixer takes in 0.28m3 of dry materials and produes 0.20m3 of concrete. By working continously at the rate of 12 mixers per hour will produce approximately 2.40m3 of mixed concrete in an hourly period		
- Allow for shrinkage and wastage (say 20%)	413	. 14
	N2,478	. 86
- Divide by parts of mix (i.e. 10)		

$$= \frac{2478.86}{10} = 247.89$$

Total cost of Materials = 247.89

(b) Labour

The labour gang for such machine are as follows:-

1 driver, 1 filler, 3 wheelers, and 2 spreaders = 7hours @ N3.00/hour and addition of N1.00 for driver = 99.00

- Output of plant per hour is 2.4m3 cost to produce 2.43m 99.00
- Cost for 1m3 $= \frac{99.00}{2.4} = 40.83$

Total Cost of Labour 40.83

(c)	Plant	₦	k	₦	k
-	Hourly cost of a 10/7 mixer				
-	Owing Cost				
	Cost ₦10,000.00				
	Depreciation on average life condition of 8000 hours = 10,000 / 8,000		1.25		
-	Interest, taxes and insurance (10%)		0.01		
-	Repairs and maintenance (15%)		0.02		
			1.28		
(d)	Operating Cost				
	Fuel per 8-hour day, 7 litres of diesel oil @ ₦35.00		245 . 00		
	Lubricating oil, 4 litres per week @ ₦25.00 = 25.00 / 5 days per		5 . 00		
			₦250.. 00		
-	Fuel and oil per hour = 350.00 / 8 =		31.25		
•	Hourly owing and operating cost = (1.28 x 31.25)		40.00		
•	Mixer produces 2.4m3 per hour working contineously				
	Cost/m3 = 40.00 / 2.4		16.67		
	Total Cost of Plant				₦16 . 67

Summary of Contractor's building Cost Elements

(a)	Materials	247.89
(b)	Labour	40.83
(c)	Plants	16.67
	TOTAL	₦305 .39

From the proceeding calculations the cost of materials labour and plant have been established. A percentage of profit margin of 10 - 35% of the gross amount say, (₦305.89) is added to the rate. The profit margin will depend on the project and contractor. The preliminaries rates as already mentioned may be calculated at the initial part of the Bills or may be included as a percentage of the above rates. Its percentage also will depend on the project and the contracting firm. It is to be noted that each of the contractor's building cost elements is costed at the construction phase to final completion in order to arrive at the actual estimating cost of the project. The data obtained can be used for budget, planning cost evaluation monitoring and cost control. Deviations from these estimated costs of elements are given corrective action in order not to incure any excessive building cost.

The method of building up the total cost of the work where element of profit has to be allowed is a procedure that is perculiar to builders or contractors cost element. The cost system by builders is considered as a library of of resource data to be used for estimates, monitoring, reporting and evaluation of cost. It should be differentiated as direct and indirect costs recorded in the form of all-in-rates and made available for estimating, monitoring and controlling of a project. These cost elements are of great importance to the building cost control at the site.

It is because they influence the actual cost of a building project.

Contractor's building cost system depends on the magnitude of the project. The cost information may differ from a small project to large ones. It is so because a contractor may decide to limit the field cost control to a particular element of the project that is expensive and far reaching effect on the overall cost of the project. It is at times possible not to have control measures on small projects and yet obtain high efficiency. The possibility is only through experience of similar jobs supervision and skills. The qualities of the project construction manager as well as the foreman is of great advantage for a proper building cost control at the site. The next chapter will seek to investigate actual happenings of three projects sites with a view of comparing the literature review and the results of the site activities.

4.7 Summary

Since a project is normally implemented practically by contractors during project execution, it was desirable for the estimation and control of these builders cost elements to be emphasized. The contractor is usually concerned with the estimating and controlling the cost of labour, materials, plants and preliminaries and also ensuring maintaining a high profit margin.

Building project cost control therefore is provided by a fulcrum of estimates without which there will be no balance in the actual cost of the project. It is when an estimate has been prepared or data stored from past estimates of the building cost elements, can the other processes of cost control such as budgetting, planning, and cost monitoring be fully implimented. It has been shown in this chapter.

CHAPTER FIVE

5.0 INVESTIGATION AND ANALYSES OF BUILDING PROJECT SITES

5.1 Introduction

In order that the study be fully comprehended it is important to undertake a thorough investigation of what is obtainable of a project at a construction site. The findings will be compared with the theory or literature review of the previous chapters. It is only at a building construction site that 'Practical building cost control processes can be assessed'.

Three sites investigations was studied to arrive at a fair and better analyses of what is being practiced at the sites. These investigations will enable conclusions and suggestions of what should be of an effective and suitable building cost control, system.

There are different approaches to estimating and building cost control by clients and contractors. These approaches range from mere guesses to comprehensive and orgainsed estimating, planning, record keeping, monitoring and proper control of project costs. These case studies will be based on three sites in which the author was a principal actor in the construction of one of them. The other two sites are from an organised construction company very much acquainted to the author. In these two sites interviews were conducted at a general level of discussion with the relevant key personnel involved in the execution and administration of the projects.

The reported findings of this chapter is the integration of the interviews, observations of the firms procedures for estimating, project execution, budgetting planning and to ascertain what kind of estimate was utilized in the post contract administration. The analysis is based on the author's experience and judgement for having worked as a Quantity Surveyor with contracting and consulting firms and presently with the public sector. The results are without any bias or prejudice to the operations of the contracting firms concerned.

5.2 Case Study 'A'

5.2.1 Background of the Contractor

The Kaduna State Housing Authority was established amongst other objectives to construct low cost houses for the low income groups. The methods of how the houses were to be constructed were not defined. Hence the Authority not only execute their projects through contracts but also by constructing itself (by direct labour). It also execute projects for other state organisations; in this case Kaduna State Distribution Agency.

The organisational set up of the Authority is not only aimed at supervision of projects being executed by contractors, but also for direct labour. The organisation is herethito headed by a chief Executive (General Manager). It has four departments namely, Administration, Building, Engineering and Accounts (see figure 5.1 the organisational chart)..

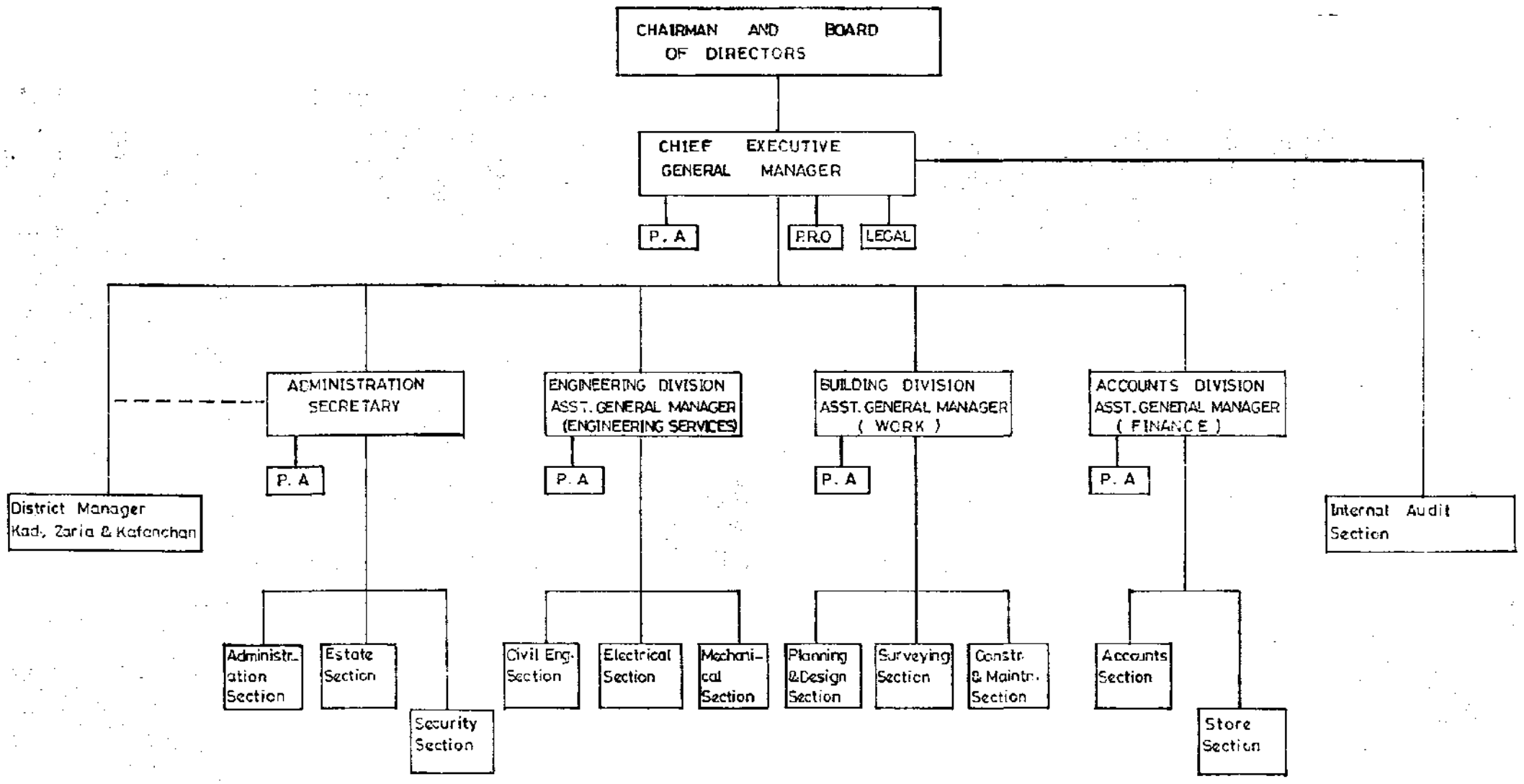


Figure 5.1 Organisational Chart of Kaduna State Housing Authority

The General Manager oversees the activities and accounts for the said activities and transaction of the Authority. The policies of the Authority is formulated by the Board.

The administrative department is headed by a Secretary. The schedule of duties in this department includes, employment , discipline, leave, promotion, incentive and overtime. It co-ordinates all staff requirement in the various departments mentioned for the purpose of recruitment. It also co-ordinates the activities of the mangement committee and Board and reports same to the State Government.

The Building Department's duties includes amongst others planning, budgetting, estimating, supervision, construction, maintenance and evaluation of all the building projects. It also has a special assignment of implimenting the direct labour policy of the Government (as contractors) including offering consultancy services to other Government Agencies. It keeps all construction cost data which are used for the management's planning budgetting and cost policies. The department recommends its staff requirements, promotion, overtime, training and incentives and communicates to the administrative department for implimentations. It does the purchasing of building materials for direct labour projects.

It prepares all pre and post contract documents, makes recommendation on award of contracts, advises on direct labour works, sales of the Authority's houses and other building cost implications.

The Engineering Department liaises with the Building Department in the planning, estimating, supervision, maintenance and evaluation of engineering projects. It also makes recommendations on its staff strength, promotion overtime, incentives. It makes procurement of materials necessary for engineering works on direct labour. It recommends contractors for engineering works and monitors their execution.

The Accounts Department is involved in the monitoring of the Authority's monitary transactions. It ensures that adequate revenue is disbursed to the Authority from the State Government including internally generated revenue for the execution of the projects. It goes into transactions with Banks in terms of banking and loans, makes settlement of claims, and pays salaries. It also recommends its staff strength, promotion, incentives advancement and training.

The Authority also has other sections like the Internal Audit, Legal and Public Relations which are directly under the Chief Executive.

It is to be noted that the organisation is presently undergoing a re-organisation to fall in line with the Federal Government policies on the restructuring of the Civil Service Set up.

5.2.2 Projects Information

i) Project; Rehabilitation and Conversion of Disused Factory to Ware-houses and Associated Works

ii) Original Contract Sum: ₦1.30 million

iii) Client: Kaduna State Distribution Agency

iv) Contractor: Kaduna State Housing Authority

v) Budgetted Contract Sum: ₦1.50 million

vi) Final Contract Sum: ₦1.30 million

vii) Completion Period: 52 weeks

5.2.3 Description of Work

The works comprised of the rehabilitation/conversion and completion of an existing vandalised factory complex into a Warehouse together with anxillary buildings and associated external works. These included blocks A,B, and C which were inter connected into wings of approximately 1.800 square metres floor area. The works included the construction of structural steel roof and roofing, touch up of plaster and painting internally and externally.

The Administrative Block 'D' had an approximate area of 280 square metres floor area and the existing walls, foundation including roofing, carpentry and joinery, metal work, electrical, and plumbing works, finishing painting and decoration were completed. Similarly block 'E' and 'J' which are Hardware and Generator House respectively were completed. The external works included block wall fencing, gates, rehabilitation of ground and overhead tanks, road works, parks and security lighting.

5.2.4 Cost Control Processes

(a) Planning: The pre-contract planning viz, drawings, site surveys, preparations of Bills of Quantities were done by independent relevant qualified Architects, Quantity Surveyors and Engineers appointed by the clients. These professionals, however, did not participate in the actual execution of the project. The site was planned and controlled by the Project Manager who was a Building Engineer of the contractor. The Building Engineer had supervisory Architects and Quantity Surveyors including works Suprintendents who assisted in the planning, estimating, and monitoring the pulse of progress of the project.

The project was divided into simple and specialised jobs and subcontracted. The sub-contracted jobs included the structural steel works, services, aluminium roofing and fixing of metal doors and windows.

An initial project plan of activities was prepared based on a bar chart (see figure 5.2). This shows the activities and their duration. However, at the site, the project requirements and estimates of labour, plan and materials were ascertained. The assessment of plant type, plant use rates and operational crew were not worked out before and during the project execution. There was no critical path network for the activities. This method of hap-hazard arrangement became difficult to understand the progress of the project.

S/No	ACTIVITIES	DURATIONS (WEEKS)
1	Fencing	
2	Demolishing & Removal of Disused Plant & Structures	
3	Site Clearance	
4	Erections of Temporary Store / Office	
5	Fabrication & Erection of roof structure	
6	Roofing	
7	Fixing of Doors & Windows	
8	Electrical Works	
9	Finishings	
10	Demolishing & Alterations	
11	Block work & Concrete work	
12	Structural steel work & Roofing	
13	Doors & Windows	
14	Services	
15	Finishings	
16	Concrete Pavement	
17	Drainage work	
18	Parking Area	
19	Car port	
20	External Lighting	
21	Cleaning up & Handing over	

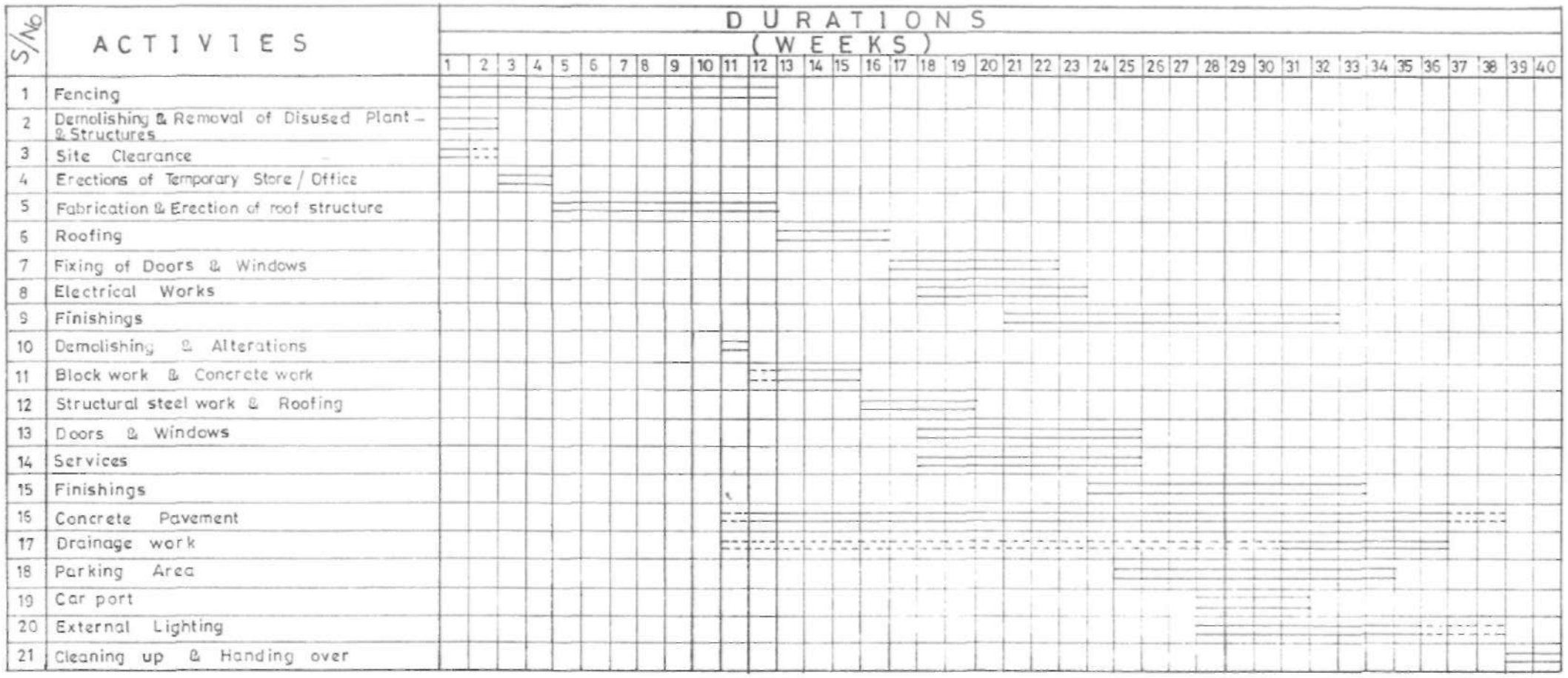


FIGURE 5.2 PROGRAMME OF WORK FOR REHABILITION AND CONVERSION OF DISUSED FACTORY TO WAREHOUSE AND ASSOCIATED WORKS FOR KADUNA STATE DISTRIBUTION AGENCY AS PRESENTED BY THE CONTRACTOR FOR CASE STUDY 'B'

(b) B ___g: The Kaduna State Distribution Agency budgetted the sum of ₦1.50m for this project. It invited contractors to tender for this job but incidentally they could not complete the tendering procedures when the New Military regime of Nigeria took over and introduced the Direct Labour System of project execution. The Kaduna State Housing Authority who had the manpower but inadequate machinery were approached to execute the project on Direct Labour.

Consequently, the contractor (KSHA) presented an estimate based on a discount of the budgetted sum and negotiation was done to arrive at the sum of ₦1.10m. As already stated, since Kaduna State Housing Authority was not profit orientated, the profit/overhead or preliminaries aspect of the contract were not easily account for. This was because the major labour costs especially technical were from the Authority's labour force whose payrolls were also from the Authority's subvention and not from the money accrued from the project. The negotiated cost thus formed the targetted cost of the project and therefore the contractor only worked towards completing the project within the negotiated cost without considering other cost benefits. At the site costs of the building elements as estimated in the Bills of Quantities were determined as a guide to the expense to be incurred on them.

Actual materials procurement, labour and plant cost of each building elements were controlled to ensure that they did not exceed the bills allocation.

(c) Estimating: The project was properly estimated with a comprehensive Bills of Quantities (BOQ) prepared by BUKA Quantity Surveyors, Kaduna. It was based on comprehensive detailed estimate (Work Trade). It was initially estimated at the sum of N1.50m and awarded to Kaduna State Housing Authority in 1966 at the sum of ₦1.10m based on negotiated contract. The Bills of Quantities was fully priced with prime cost sums for services and provisional sums for items whose quantities were not immediately ascertained at the time of the estimating.

The estimating and pricing procedures were all done by the consultants as the client did not have estimators. However, when the contract was awarded the contractors took over all the estimating processes to the completion of the project. The consultants acting on behalf of the client were only involved when variations were to be raised and measured. The interaction of the estimators were not adequate to stimulate better understanding and providing useful cost data to the project. Measurements of work done for the purpose of payments were equally done by the contractor's estimator while payments for same were not actually commensurate to the imput by the contractor. Infact, this was basically based on trust since it was a government client to government contractor on the guase of direct labour policy of the State Government.

Estimating of materials were done by abstracting the quantities from the Bills of Quantities. A purchasing team comprising the Quantity Surveyor, Building Engineer and Purchasing Officer were charged with the duty of purchasing these materials and to ensure that their cost did not exceed that in the Bills of Quantities. They were then kept in the store and recorded. The specialist materials such as the aluminium roofing sheets, doors and windows were negotiated with the manufacturers for their supply and fixing. (see figure 4.3 materials record). A labour gang was maintained. For each work item the labour requirement was estimated including the rates of the men per day. The workmen were paid on daily basis. (See figure 5.4 the labour records kept at the site).

The Authority purchased plants and machinery required for the project from the money received for the project. Since it was not a complex project plants and machinery were not hired.

The Authority did not estimate for any establishment charges since the project was executed by direct labour and with no interest profit or overhead. The cost of running the Authority was being taken care of by the government's subvention or salaries.

KADUNA STATE HOUSING AUTHORITY

The Store Officer — STORE REQUISITION NO. 2002

Please supply the following items to: PROJECT MANAGER

for use at DISTRIBUTION AGENCY, SITE WORKS — SIGNED 24/12/86

Head of Department

	Articles	Unit	Qty in fig.	Quantity in words	Ledger No.	Remarks Remarks
1	AFARA PLANK 2"x12"x12"	No	5	FIVE		
2	CORRUGATED IRON ZINC PAN	Bundle	1	ONE		
3	ZINC NAILS	PKT	4	FOUR		
4	WIRE NAILS	PKT	8	EIGHT		
5	BONDEX ADHESIVE	DRUM	1	ONE		
6	FIVE ITEMS ONLY					
7						
8						

Supplied By: Above goods were correctly receive and in good condition.

.....By SIGNED ..... DATE: 24/12/86 .....
STORE-KEEPER

Note:

(1) Original for Store

(2) Duplicate to remain in the book

Figure 5.3 Materials Records as kept by the Contractor (KSHA)

TIME SHEET FOR WORKER

PREPARED BY: Adamu Kaduna
MONTH: August, 1986
OFFICER IN CHARGE:
CERTIFIED: Abdulrazak Ahmadu
DATE: 28 - 8 - 86

PROJECT: KADP OFFICE/WAREHOUSE
MONTH OF: August, 1986
PAYING OFFICER: Adamu Kaduna
WITNESSED BY:

S/NO	NAME	APPOINTMENT	DATE: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	NO. OF DAYS	DAILY RATE	TOTAL AMOUNT	SIGNATURE
1	Bello Suleman	Security Man		31	₦5.00	₦155.00	
2	Bala Ibrahim	" "		"	5.00	₦155.00	
3	Idi Bello	Labourer		"	5.00	155.00	
4	Sunday Gandu	"		"	5.00	155.00	
5	Samson Umaru	Carpenter		"	7.00	217.00	
6	Alhassan Bako	"		"	7.00	217.00	
7	Bako Adamu	Mason		"	7.00	217.00	
				TOTAL	₦		

Figure 5.4 Labour Rate kept by the Contractor.

(d) Cost Monitoring: The cost monitoring included keeping of labour and material consumed. This was worked out by the Project Manager in conjunction with the Quantity Surveyor. Periodic checking of procurement and other transactions were carried out by the Internal Auditors of the Authority. The checking of performance of the sub-contractors was done to ensure that payments made to them were commensurate to what they had actually put on site. References were made to the estimates prepared in the Bills of Quantities to ascertain whether materials and labour cost estimated were not exceeded. Where inadequacies were observed the clients were informed but since it was a negotiated contract, variations were not raised. Gains from other items were used to upset losses from other work items. Therefore, the issue of variations only arose when the clients introduced new development that influenced additional costs.

The monitoring of cost therefore was left to the exclusive manuovres of the contractor without participation of the client.

The cost of sub-contracting works were not exceeded as these were cross-checked with actual allocation in estimated cost inserted in the Bills of Quantities. The cost of works carried out by the contractor were not well monitored. The progress estimating was therefore very essential during the execution of the works.

(e) Evaluation and Reporting: The clients will normally pay the contractor a sum of money irrespective of the work executed but most of the time it was an advance payment. Subsequently, the contractor only evaluated works executed by the sub-contractor and paid for work done. Frequent checks were undertaken to ensure that monies paid did not exceed the budgetted, or estimated cost of the work items. Areas of deviations were normally communicated to the contractor's management committee. The sub-contractors were given the chance to report their difficulties, cost variations and other deviations. Where corrective action were required they were given prompt action, especially when they did not conform to the initial agreed plan or estimate. For example the structural steel works sub-contractor did not have enough fund at a particular stage of the contract to execute the works. It was noticed that roofing was necessary to be completed for other works like plastering and painting to be done. The lack of fund necessitated the main contractor to purchase the materials for the sub-contractor who also provided the labour. The materials cost were then deducted in the actual payment thus the schedule for this work item was suppassed by a week. It might have been a longer delay if this action was not taken and the consequencies of the delay would have increased the cost of the project.

5.2.5. Contractor's Building Cost Control System: The major aim of the contractor was to execute the works within an estimated cost and complete it on schedule. Therefore the issue of profit did not arise very much. To implement this aim the contractor initiated a cost control process by an estimate and pricing the Bills of Quantities presented to it and making a discount to arrive at the negotiated cost of the project.

A breakdown of the cost of work items were produced with a view of obtaining the budgetted cost and monitoring the cost during execution. A plan of the works was prepared using a bar chart to show the activities and their durations.

Subsequently, all the specialist work items were sub-contracted and cost monitored during execution. Variations as introduced by the client were measured by the contractor's estimator and approved by the client. Other deviations that were noticed by the main and sub-contractor were given timely corrective action. The reporting system, cost data, cost monitoring and other cost control processes were not adequately observed as the main aim was just to complete the project within a reasonable time. The final estimate was not prepared to enable the contractor keep records for future use. However, the project was completed within the specified amount and duration and handed over to the client.

313634

Kashim Ibrahim Library
RECEIVED
2 OCT 1990
ZARIA, NIGERIA
Ahmadu Bello University

The building is now being used for the purpose for which it was completed.

5.3 CASE STUDY 'B'

5.3.1 Background of the Contractor:

E. D'alberto and Giampaoli was established as a Building and Civil Engineering Construction Company with the primary objective of business; to construct building and civil engineering works with profit. It is a reputable construction company executing works all over the country.

The Organisational Set-up of the company includes the Board of Directors, Managing Director and four departments namely; Contract, Project Execution, Yard Management and Accounts (See Figure 4.5 the diagram of the organisation set-up). The Board of Directors formulate policies of the company while the Managing Director inpliments these policies.

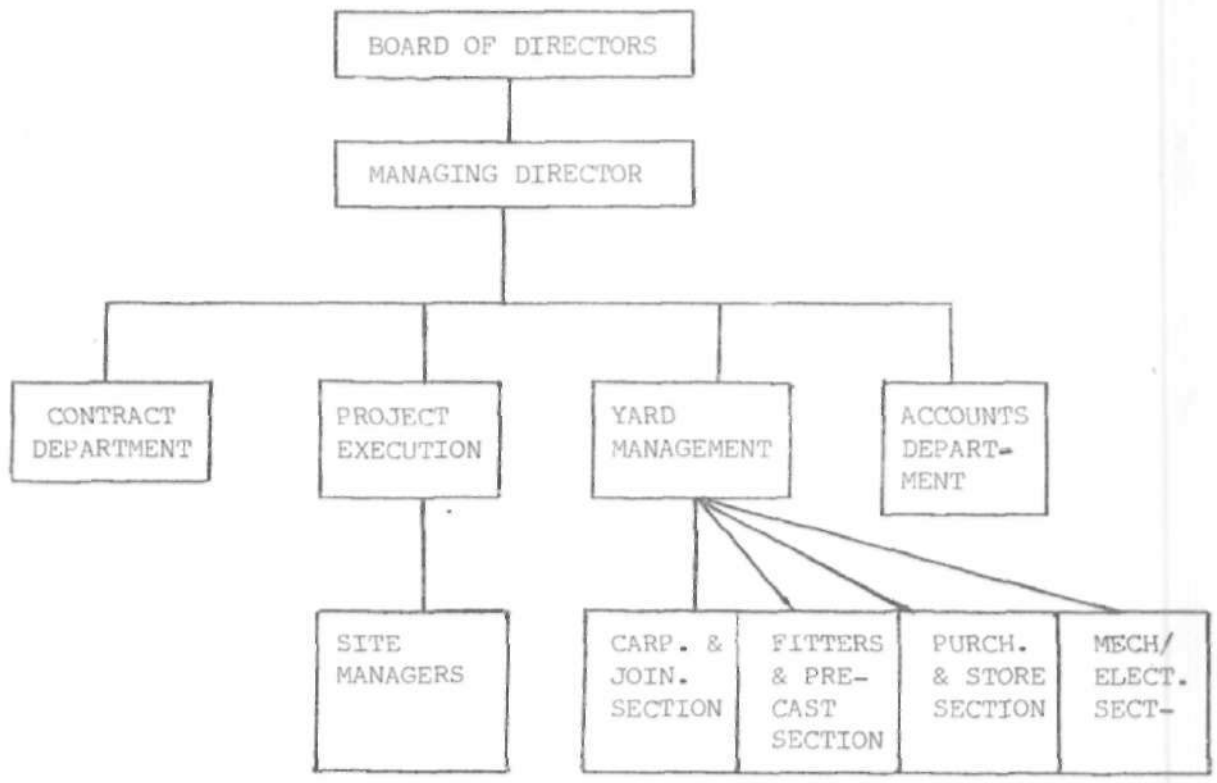


Figure 5.5 Organisational Chart of E. D'alberto and Giampaoli Construction Company.

The du of the Contract Department includes the following:-

1. Contract negotiations
2. Tendering, preparing and pricing of Bills of Quantities
3. Preparing of Variations and valuations for interim payment
4. Interpreting of contract documents
5. Cross checking of materials requirement and requisition.
6. Budgetting in conjunction with other personnel of the organisation.
7. Project programming in conjunction with the project manager
8. Keep all cost data and making cost analysis of projects.
9. Monitor and control cost of items in the contract to ensure that the cost of work executed does not exceed the planned and budgetted cost.

The duties of the Projects Department includes:-

1. Planning and programming for the project take off.
2. Budgetting in conjunction with the Contract Department
3. Supervision of works at the site.
4. Estimating labour and plant requirement at the site
5. Control the use of labour material and plant usage and ensuring that sub-contractors properly execute their work according to specifications.

The Yard Management Department has the following functions:-

1. Executing of carpentary, joinery, precast concrete, mechanical and electrical works included in the project.
2. Cutting and bending of steel works and transporting same to the site for fixing.
3. Maintenance of plant and machinery
4. Purchasing and supply of materials for a given project and keeping custody of excess materials for future use.
5. Keeping cost records of materials

The Accounts Department keeps all records of the firm's monitary transaction in the form of revenue and expenditure, i.e. payments for works done by the firm, salaries, overtime, incentives and bonus.

5.3.2 Project Information:

(i) PROJECT: NNPC Staff Housing Scheme, Kaduna

(ii) ORIGINAL CONTRACT SUM: ₦2,950,203.70

(iii) CLIENT: NNPC,Lagos

(iv) CONTRACTOR: E. D'alberto & Giampaoli

(v) BUDGETTED SUM(BY CLIENT): ₦2,065,000.00

(vi) FINAL CONTRACT SUM: ₦4,716,728.64

(vii) COMPLETION PERIOD: 62 weeks (actual 123 weeks).

5.3.3 Description of Works

The works comprised the erection of forty-eight single storey houses each having 186 square metres floor area together with external works within the plot boundaries. The general construction was strip foundation, reinforced concrete columns and ground beams, concrete hollow pots roof construction on block walls together with cement and sand rendering, painting and decoration.

The external works entailed works within the house plot boundaries and included entrance drives and paths, storm water drainage and general landscaping and external signs. The site is located at Tsauni Kura Village along Kaduna - Kachia Road.

5.3.4 Cost Control Processes:

(i) Planning: The initial conception of the project was born by Steveben & Associates, Consultant Architects from the client's brief. With the assistance of Civ-struct Consultant Structural Engineers, Services Engineers as the Consultant Electrical/Mechanical Services and Adesoye & Partners as the Consultant Quantity Surveyors, the contract package was struck. These consultants prepared all the relevant drawings, specifications and Bills of Quantities to arrive at the contract sum which was negotiated with the contractor.

The contract was however awarded with the Bills of Quantities which did not form part of the contract. The contractor's own Bills of Quantities was prepared which was used for the budgetting, planning, cost monitoring and estimates for payments of work carried out. A planned programme was prepared in the form of bar chart by the contractor to suit the duration of the project. (See figure 5.6 the programme of work of the project).

The planning also included the relevant assignment of duties to the contractor's staff. That is appointment of the site Project Manager and the Quantity Surveyor.

(ii) Budgetting:

The client allocated a budgetted amount of ₦2,065,000.00 as initially conceived through previous experience and top management deliberations. The designs were prepared to meet this budgetted cost.

When the contract was awarded the contract department in consultation with other departments prepared a budget estimate for the materials, plant and labour. The Project Manager prepared the labour requirement according to the planned programme of work. The Purchasing Officer equally prepared a list of material requirement. See figure 5.7 the materials schedule received on site and figure 5.8 the daily labour output returns. The estimator, Purchasing Officer, Accountants and the Project Manager met and tidied up the budget in readiness for the execution of the project.

PROGRAMME AND PROGRESS CHART — 1980 — 1981 — WORK:— N.N.P.C. STAFF HOUSING KADUNA

	DESCRIPTION	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
		7 14 21 28	5 12 19 26	2 9 16 23 30	7 14 21 28	4 11 18 25	1 8 15 22	1 8 15 22 29	5 12 19 26	3 10 17 24 31	7 14 21 28	4 11 18 25	1 8 15 2
	Preparation Site clearing & Pegging										
	Foundation Excavation										
	Conc. foundation & Wall To D.P.C.										
	Compacted Hardcore Filling										
	R.Conc. floor Slab										
	Block Wall To Lintel Level										
	R. Conc. Beam Lintel										
	Roof Slab										
	Parapet Above Roof Level										
0	Doors & Windows Frame Fixing										
1	Plumbing										
2	Electrical										
3	Roof Slab screed & Bit Felt										
4	Perforated Wall										
5	Rendering IN and OUT										
6	Floor Screed and Paving Slab										
7	1st Coat Painting										
8	Sanitary Fitting Fixing										
9	Joinery (Door Shelf & Windows)										
0	Glazing										
1	P.V.C. Tiles and Skirting										
2	2nd Coat Painting										
3	Fixing Electrical										
5	External Work										
5	Cleaning Up										

FIGURE 5.6 PROGRAMME OF WORK FOR CASE STUDY 'B' AS PRESENTED BY THE CONTRACTOR

DAILY RETURN SHEET

Contract: N.N.P.C. Site

Date: 30/11/82

Sheet No. E 1820

Contractor: E. D.Alberto & Giampoli

Supplier/ Waybill No	Invoice No	Material, Plant, etc received on site	Qty	Unit	Rate	Cost N	k
	E3981	Sixteen Nos of Gutters Precast slabs					
	E3980	Five gallons of 08B15 Emulsion	5		11.22	56	10
	"	Five gallons of 10B15 Emulsion	5		11.22	56	10
	"	Five gallons of 9102 white gloss	5		15.25	76	25
	3081	One trip of river sand	1		7.00	35	00
	KD1083A	Two trips of water tank	2				
		N20,756.10					
Report				TOTAL		N223	45

Number of workers
Visitors
Weather condition
Architects site instruction (if any)

Figure 5.7 Schedule of materials as received on the project site.

D'ALBERTO & GIAMPOLI LIMITED
P. O. BOX 8 - KADUNA

SITE N.N.P.C. STAFF QUARTERS DATE 1 - 9 - 80

DAILY NUMBER OF WORKERS

ITEM	QUALIFICATION	NO	ITEM	QUALIFICATION	NO
a	Foremen	1		B/F	6
b	Clerks	-	i	Fitters	-
c	Storekeepers	1	j	Welders	-
d	Drivers	-	k	Labourers	6
e	Operators	-	l	D/Watch	1
f	Mechanics	-	m	N/Watch	1
g	Masons	4	n	.....	-
h	Carpenters	-	o	.....	-
	Total	6		Grand Total	14

The Clerk .....

The Foreman .....

The Supervisor .....

FORWARD: This form should be drawn by the clerk and checked by the Foreman and Supervisor every day. It must be delivered daily at the Headquarter together with the requisitions and return sheets.

Figure 5.8 Daily records of labour as kept by the Contractor.

However, no amount was allocated for the execution. Comparison of the budget with allocations of the work items in the Bills of Quantities was made to ensure that they did not differ considerably. 35 percent was spread among the work items to cover the overhead cost and profit. There was no record of the budget prepared.

(iii) Estimating:

As previously explained the initial estimating of the project cost was done by the consultant estimator. The estimate was used only as a base for the award of the contract. The Contract Department prepared a comprehensive estimate using the contract drawings submitted.

The contractor's Bills of Quantities based on trades was used for the budgetting, cost monitoring and evaluation. It was this said Bills that was used for valuation (progress estimate) for interim payment, variation and observing of deviations in terms of additional works or works not shown in the drawings but must have to be executed.

The materials rates were computed based on their cost plus 50 percent for overhead and profit while the labour cost was arrived at by adding 35% to the basic rates on cost. Generally the rates of overhead differed depending on the work items. However, it ranged from 21-50 percent. The quantities and rates were reasonable since they were prepared by the contractors estimator except for Provisional and Prime Cost Sum Items.

The contractor did not prepare a comprehensive final estimate but the final cost of the project was higher than the initial contract sum. This was as a result of the introduction of several variations and extension claims. There was no fluctuation. A marginal profit was however realised by the contractor.

(iv) Cost Monitoring

The cost monitoring was carried out by the client and contractor's estimators. Cost of work executed were compared with the bills allocation. The contractor on the other hand compared the expenses with the budgetted costs of materials, labour and plant for each work item. Records of these expenditures was kept by a clerk while the contractor's Quantity Surveyor retrieved them for comparison with the quantities in the Bills of Quantities.(See figure5.8)the record sheets of the firm which was kept by the clerk, foreman and supervisor on daily basis.

(v) Evaluation and Reporting:

Apart from the planned programme the Site Supervisor was given targets for achievement. These targets were constantly being checked with the actual progress at site. The contractor's estimator also evaluated costs incurred for each work item based on the cost data presented by the clerk. The estimators from time to time compared these actual expenses with the Bills of Quantities allocations and raised claims where deviations in the negative occurred.

The reporting is basically in form of communication through writing or site visits to the consultants. Variations/alterations are also communicated to the contractors through writing. Several variations were raised for this project which resulted to the extended period of completion.

5.3.5 Contractor's Cost Control System:

The contractor prepared a detailed estimate after the award of the contract with which a planned programme of work, budgetting, cost monitoring, evaluation and reporting were made. There was no involvement of the contractor in pre-contract estimate. It was through the estimate that valuation for interim payments were made and variation raised. The method of issuing variations were cumbersome as variations which was mostly observed by the contractor went to the consultant Architect. Quantity Surveyor, to the Architect again before the contractor. In fact, the consultants were not given the absolute mandate to exercise their powers over the project execution which resulted to interruptions of the progress of works.

The main contractor was allowed to appoint sub-contractors which enabled the control of the costs of these work items easier. However, progress estimated or valuations were promptly settled. Sometimes the contractors were on site for a month without working due to the client's failure to the obligations of payments.

5.4 Case Study 'C'

5.4.1 Background of the Contractor

The contractor who executed the works was the same with that of case study 'B'.

5.4.2 Project Information

(i) Project: Completion of Nagwamatse House, Kaduna

(ii) Original Contract Sum: N1,009,783.00

(iii) Client: Bank of the North Limited, Kaduna

(iv) Contractor: E. D'Alberto & Giampaoli Limited

(v) Budgetted Sum (By Client):(Not specified)

(vi) Final Contract Sum: N1,570,500.00

(vii) Completion Period: 52 weeks

5.4.3. Description of Works

The works comprised the completion of three floor areas of a multi-storey building called Nagwamatse House, at Kaduna. The floors were the basement, ground and first floors.

The works at the basement included partitioning with block work into offices and computer room. It included for rendering and painting. The ground floors were constructed into banking hall, provision of concrete counter with marble topping; cashier's cubicles constructed with aluminium and provision of seats for customers. The works on the first floor was for the construction of the offices using bricks.

5.4.4. Cost Control Processes:

(i) Planning:

The pre-tender planning of the project was done by Consultant Architects and Quantity Surveyors. The said Consultants prepared sketch and detailed design, priced Bills of Quantities and specifications. These documents were used for the award of the contract.

The contractor was not part of the initial plan of the project. After the award of the contract the contractor prepared a planned programme based on bar chart. There was no any innovations to the plan; that is, it was the same planning pattern with the one shown on figure 5.6.

The contract department in conjunction with the Supervisors drew out the planned programme showing activities and their durations. There was no project Manager for this work except a site supervisor. It was in this planning stage that the modality of execution and source of financing the project were discussed and concluded.

(ii) Budgetting:

There was no budget prepared for this project. In other words, the construction team did not work out the blue print budget for the materials labour and plants requirements including the probable cost before commencement of the project.

During execution, the site Supervisor with the Project Quantity Surveyor would work out the materials, labour and plants requirement plus 21 - 50 percent for overheads and profit for each work items. This was cross checked and authenticated at the main office; money would then be made available for the procurement and subsequent execution of the work at the site.

(iii) Estimating:

A comprehensive Bills of Quantities based on trades was prepared by the consultants for the project. The contractor simply relied on this estimates for all the control processes. During the execution the progress estimate was based on already measured and priced bills of quantities. This was used as a base for effecting payment for works executed. There were not much deviations between the actual works executed and what was previously estimated. Variations raised were mostly as a result of the introduction of new work items. The calculation for rates records for materials, labour and plants requirements did not differ with that of case study 'B' already discussed.

(iv) Cost Monitoring

The monitoring of cost was mostly done by the contract department. With the use of priced Bills of Quantities, the quantity surveyors ensured that the cost incurred at the site for materials labour, plant used did not exceed the bills provision. Of course, the adherence to specifications and proper supervision was not sacrificed.

The clerk at the company's main office kept the same types of records for the materials, labour and plants as mentioned above. The records of these costs were constantly sent to the Quantity Surveyor to make analyses and comparison with the Bills of Quantities and to ensure that the firm was operating with profit.

(v) Evaluation and Reporting

The eveluation and reporting for this project has no significant differences as previously discussed in the proceeding project. A daily, weekly and monthly stock taking of work executed was done. All cost incurred were compared with what the Bills of Quantities allowed. Deviations were reported in writing to the Architect who gave written instructions. The instructions were then transformed into monitary terms to enable variations to be raised or alternative materials for the work items suggested.

Sub-contractors were nominated by the main contractor who also valued and paid for works carried out by them. The consultants, however, ensured that specifications and good works were carried out by the contractor.

(vi) Contractor's Cost Control System

The cost control system cannot be said to differ from the previous cost control. However, unlike the case study 'B', the contractor depended on the estimates prepared by the consultants. The contractor used this estimate to work out materials, labour and plant required at the site. There was no budget for the whole work items to be used for the cost control.

t of the control processes were effected from the contractor's main office in view of the fact that there was no project Manager who should have been given free hand to supervise and execute the project.

5.0 Analysis of the Case Studies

The discussion and presentations so far have been a literature review based on theory and practical report of three projects of various costs, nature and magnitude including their site practices. The findings of these projects will enable an analysis be made on the building cost control system and the processes, especially estimating. The analysis which is more or less a comparison between the projects practices and the reported theory of the previous chapters, forms the bedrock of a proposal of a building cost control system. This can be adopted or improved upon (if need be) by the contractor or client since a cost control system is not supposed to be rigid but flexible to allow for innovations.

(a) The Projects: The projects were mostly building projects whose actual cost were more than one million naira. One would expect that such projects of that nature and magnitudes should not be treated with levity in terms of estimating and cost control. However, all the cost control processes were not properly observed especially the estimating.

(b) Contractors: The contractors are reputable contractors with wide range of experience in the construction industry. They had all the relevant professionals in the building industry that can effect the most efficient costing system and observe a good building cost control system. But then they did see the need for an effective cost control system for the projects.

(c) Clients: The clients for all the project incidentally were State and Federal Government Parastals respectively. The source and availability of funding for the projects were not in doubt. The ability to manage the fund and ensure judicious resource utilization of public funds should have been paramount within the rank and file of the organisation. Unfortunately, this is not the case when it comes to any project which has the government invested interest. No one seems to be responsible or accountable to it.

(d) Planning: It is evident in all the three projects that planning was given due cognisance. However, the method of planning and the involvement of staff in the planning differed. In the pre-tender planning most of them were done by Consultant Architects, Engineers and Quantity Surveyors based on the clients brief.

At this stage the plan only seek to establish the type of construction, tendering, contracting and feasibility report of the site of the project. The client who were to disburse the fund had no relevant staff of the building industry to give useful advise. A Consultancy contracting firm should have been part of the planning team. On the award of contract the construction company seemed to have adopted the same planning procedure in the execution of the projects. These includs:-

1. The programme of work with duration in bar chart form
2. Preparation of estimate for materials, labour and materials for various elements of the project.
3. Sub-contractors involved in the project
4. Appointing of the project staffing
5. Establishing the source of finance.

Only in project 'B' that the contractor prepared a comprehensive estimate of all the works item and with which a planned programme was made. In project 'A' and 'C', the contractor simply put much relayance on the consultants estimates. In all the projects the planning of the project take-off was done by the top management staff who did not fully get involved in the project execution. Sub-contractors, were not involved in the planning and there was no plan for any cash flow. The contractor's usual practice was to depend on the payment for works executed and if these do not come by the contractor will suspend works.

This in turn brought an extended period of time and increased cost of construction as evidence in project 'B'. The need for planning of these projects assisted the management to prepare a budget for the works.

(e) Budgetting: This was a relevant step in the project execution since it transformed management aims and objectives into monitary terms. It is done immediately after the planning of the project is completed. It involves making actual estimates of materials, labour and plant and knowing what capital is involved. The Bills of Quantities prepared for the tender only serves as a guideline and should not be strictly adhered to. In the light of this, it can be said only in project 'B' that such an exercise was carried out. In project 'A' the budgettary allocation was based on the contract Bills of Quantities while in project 'C' periodic budget based on materials, labour and plants were prepared.

In all the projects there were no cash flow which seek to give data of expenditure and income in order to follow the trends of the transactions. All the projects suffer in delays in completion due to the funding of the projects since they were all dependant of payment from the client for work executed. Even though budgetting involves preparing a comprehensive estimate irrespective of the existing tender estimates, it is necessary since it will serve as a very good tool for the effective cost control of the project. It may be time consuming and expensive to prepare these estimates but highly appreciative in view of the fact that most contracts that are rushed with the use of pre-tender estimates

which have not been thoroughly prepared, if it is a fixed fee contract based on the estimate, then the contractor is likely to execute the project without a good profit margin.

(f) Estimating: There is no doubt that estimates forms the foundation for any successful building cost control. In all the projects preliminary estimates were prepared based on the sketch designs prepared to ensure that the cost is as per the client budget allocation. As the usual case in Nigeria only the Contultants were given free hand to come out with these pre-tender documents (drawings and estimates), without the involvement of clients or contracting firms. This could be unhealthy since the cost of construction determines the consultants fees - the higher the better. There is a possibility of making the cost higher than expected for the maximization of consultant's fee. The participation of the client's staff or consulting/contracting firm at the inception of the project would have been better. In project 'A' and 'C', detailed Bills of Quantities according to the building trades were prepared and used for the award of the contracts and was subsequently used for the control of the cost of the construction. In project 'B' on the other hand, the contractor's estimate was prepared as a base for both pre and post contract administration. As already emphasixed, there is always a need for the contractor's estimate for it will serve for the preparation of the budget, calculating overheads and profit and check deviation of prices in the Bills of Quantities,

ost data for present and future use, provide the data for the control of materials, labour and plant; indeed it gives a firm base for any successful building construction business. There was therefore no one form of estimating in all the cost control processes throughout the contracts construction phase.

(g) Cost Monitoring: Cost monitoring during the building construction is vital. It is a device for communication, motivation and appraisal of an organisation's objectives. It assist in establishing the plan and actual costs against established standards. In all the discussed projects this was achieved through keeping of cost data for materials, labour and plants. A standard record with the use of time cards for labour, plants and materials utilization records made it possible to ascertain the cost of each work item. A Quantity Surveyor was charged with the responsibilities of collating these records for analysis and comparison with the cost inserted in in the tender documents.

In project 'B' and 'C' the contractor monitored the overhead and profit by allowing 21-50 percent for each work item while in project 'A' nothing was allowed. The contractor simply ensures that a work item was completed without exceeding the Bills of Quantities allocation. Where a saving acrues, it was used to offset other items which had a shortfall. This form of monitoring also included for work executed by sub-contractors.

Project 'A' and 'C' was executed on schedules and therefore the preliminaries did not pose a problem. In project 'B' there was an extension of time as a result of irregular payment and variations. As already mentioned, the contractor was highly dependant on valuation for interim payment and normally suspends work when not paid. This is at times an intentional act by contractors in order to make claims on the preliminary items. Contractors and clients alike should try and avoid situation for extension of time of any project in view of the adverse effect it has on a project's cost.

(h) Cost Evaluation and Report: Cost evaluation is desirable in order to compile all cost records of the project for analysis. This is normally done after cost monitoring. In all the projects the same method was used. All cost data in terms of materials, labour, plants and overhead were compiled at the site. These were then sent to the Quantity Surveyor at the main office for analysis. In case study 'A' deviations were reported to the Management Committee for decision. All deviations that required any additional cost were not given a blessing as the project was not executed with an intent of making profit. This was not the case for project 'B' and 'C' where these deviations attracted claims for variations.

The reporting processes were similar in the projects as they have to be communicated to the top management of the contractor for decision. The top management would then intimate the client or client's representative; who will give an instruction for variations (if need be) for significant deviations. In project 'B' the client's representative (Consultant Architects) were not given a free hand. Communication of observed deviations had to pass from the site supervisor to the top management of the contractor, to the Architect then to the top management of the client and again to the Architect through the same channel back to the site supervisors for implimentation.

This was so cumbersome and time consuming. The site operators which included the Architect and site supervisor should have been given some leverage of taking decision on deviations within a specific amount. This could have averted the extended period and escalated amount of executing the project. In short, the feedback before implementation of deviations took rather a long wasted period before action was taken.

(j) The Cost Control System: It is always relevant to have a cost control system in order to have a library of cost data for effective and efficient planning, estimating budgetting and other cost control processes. There is no definite cost control system, however, the discussed projects seems to have semblance in their cost control system.

The cost control process already discussed were in actual operations though not adequately observed to have any meaningful effect on the minimising of the cost of the project. None of the system really saw the need of estimates throughout the life span of the project; that is, from feasibility studies through contract award and execution. There was over reliance on the consultants estimates right from the feasibility study to final completion. The contractors did not give due cognisance to making their estimates. The information flow were too bureaucratic and took a long period for any feedback. There were no functional cash flow and too much dependance on the client's payment for work done before the contractors proceeded on the execution of outstanding works. On the whole, the building cost control system observed depicted a typical feature of the Nigerian Construction Industry. There are even emmergency contractors who hire technical services such as Quantity Surveyors and building Engineers for a particular project and dispense of their services when the project is completed. Such contractors abound in hundreds and at times are favoured for contracts worth millions of naira. It is not un-usual to find out that these contractors may not see the desirability or otherwise of estimates nor even having a cost control system. At tendering stage they take their tender documents such as the drawings, specifications and Bills of Quantities to and independent estimator for pricing.

It may not be possible for such an estimator to know what is supposed to be allowed for the contractors preliminaries, overhead and profit. Contracting firms should therefore be well established and having all the technical staff and with adequate plant and machinery for the execution of the works. These technical staff are pronned to introduce cost control system to meet modern techniques of cost control.

5.6 Proposals of a Building Cost Control System

It is to be recalled in the earlier chapters that the desirability of a building cost control system was stressed. The discussion also explained the cost control elements and processes with more emphasis on the estimating process. It is not intended that the system will go into what the said elements and processes involves and entails. The proposals is meant to marry the cost control system presented in theory and observation of the three projects which showed a significant deficency.

Figure 5.9 indicates a flow chart of an improved building cost control system which is useful to clients and contractors alike. Figure 5.10 is a suggested summary of contractor's building cost control processes and operations after an award of a contract. All the systems are emphatical on the estimating process which is the bedrock of a successful cost control system.

The impression as contained on figure 5.9 is that a client/contractor after conceiving the objective of executing a project must set a machinery in motion to

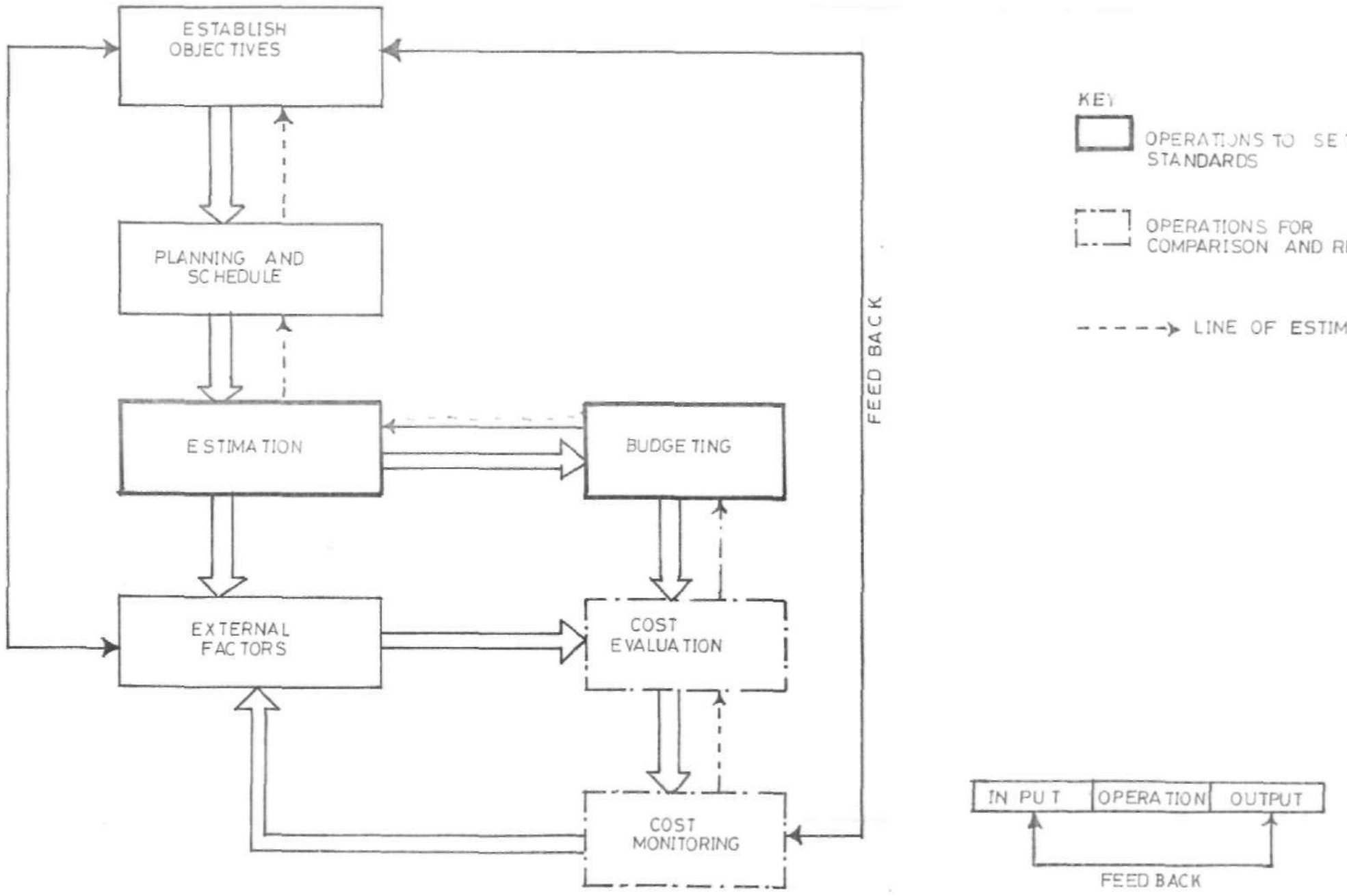


FIGURE 5.9 A PROPOSED BUILDING COST CONROL SYSTEM

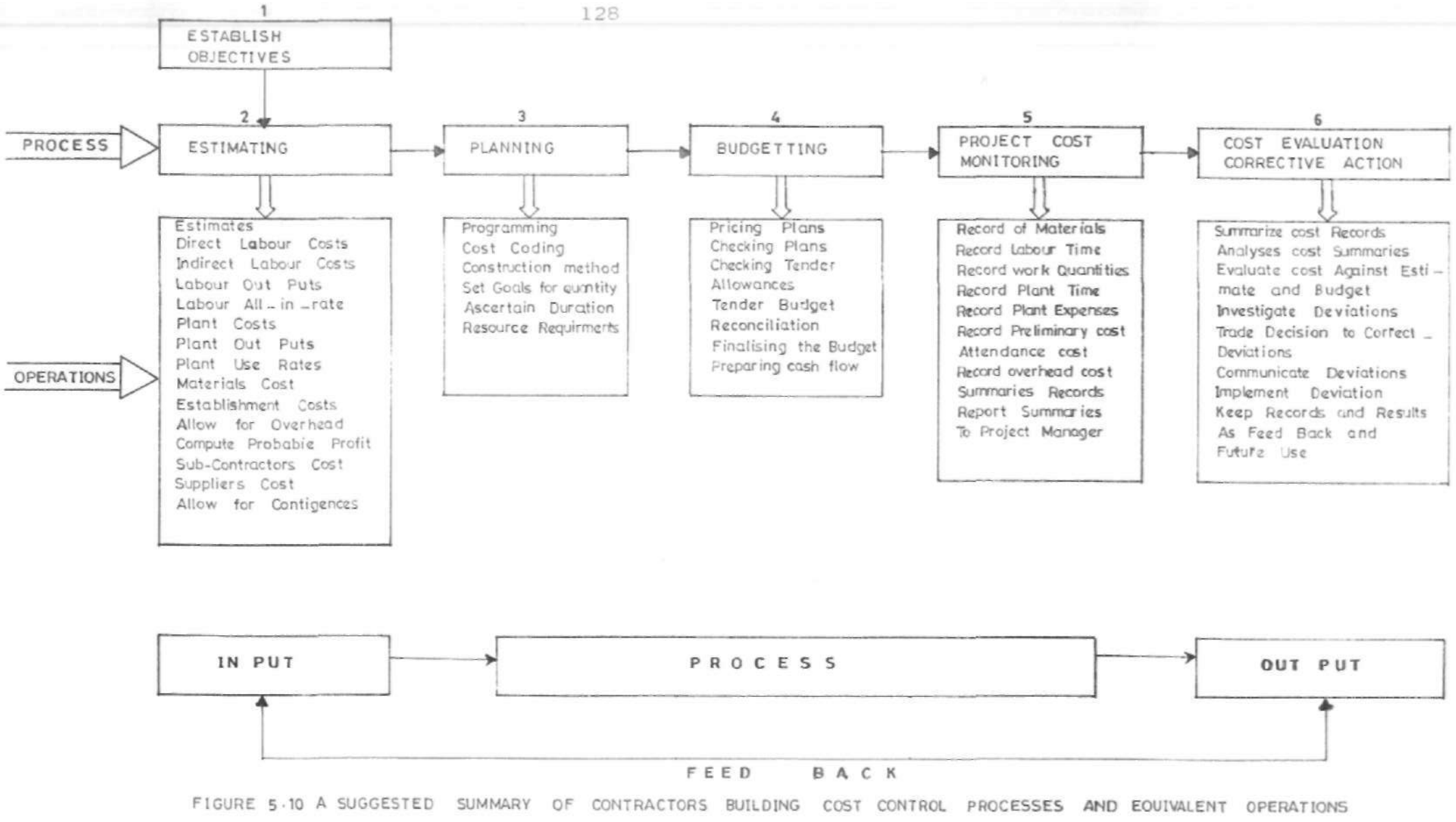


FIGURE 5.10 A SUGGESTED SUMMARY OF CONTRACTORS BUILDING COST CONTROL PROCESSES AND EQUIVALENT OPERATIONS

plan to achieve this desired objective. The plan should be immediately backed up by a budget and estimate and when the construction is in progress there has to be a project cost monitoring and evaluation with reported feed back of deviation for remedies or corrective action. The figure equally shows the estimating process as an intergral path of all the cost control processes. Figure 5.10 further amplifies the obvious need of the estimating process to a contractor immediately after an award of a contract for a building project. A contractor's estimate should be prepared whether the contract estimates (Bills of Quantities) exist or not.

With the data or information obtained from such an estimate the contractor can use as 'a tool' to prepare a plan programme of work, budget evaluate and monitor the cost of the project to its successful completion. It is through the estimate that there will be a report of deviations and remedies. Such estimates can be stored and used in present and future projects. Other cost control processes should be observed for the success of the system. In either cases there must be a fast and smooth flow of information in order to report the deviations and solutions. Comments in relation to the system will be elaborated in the next chapter.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATION:

6.1 CONSLUSION

It has been fully established that in any building project a Cost Control System is desirable to accomplish the objectives of the client and contractor. This entails the physical realization and correct interpretation of the objectives by adequate planning budgetting, estimating, cost monitoring and evaluation and a feed back reporting system.

The cost of a project is always the pre-occupation and concern of the client and contractor from the preliminary to the construction stage and even maintenance period. Therefore, the client often wants to ascertain what it cost to build and the contractor establishes the probable cost of constructing the project with profit. Thus, both prepare estimates and ensure that the project estimates are not exceeded through the use of all cost control processes whether crude or scientific.

There is no one way method of a building cost control system. Also various types of estimating abound. However, the actors of each project must have to principally identity and show interest in the achievement of the desired objectives of the project bearing in mind human weakness and capabilities.

It is worth concluding by discussing the building cost control processes which constitutes a cost control system in isolation.

(a) Estimating

Estimating has been identified to be the backbone or 'tool' of any building cost control system. The estimating process is in operation throughout the project's execution phase and should ideally require participation of clients and contractors estimators. Different types of estimating exists based on the timing, type of project and details provided by the designers. Estimates normally consider all elements of building cost which include materials, labour,plant, preliminaries overhead and profit. It is important to have an accurate detailed estimate which serve as a standard source data for effecting the other cost control processes. The said data could be used for reporting deviations and remedies, documented and stored for present and future use.

(b) Planning

Planning forms a basis for meeting desired objectives of a project cost control system once an estimate has been prepared. All other cost control processes hidges within the plan. Thus the planners should be technically knowledgeable and have experience in the building industry and should critically study and analyse the project at a conceptual stage. This will enable them produce workable plan and techniques for the project.

T[illegible]ost control techniques [illegible]h includes bar chart, cri[illegible]l path method etc., wi[illegible]end on the magnitude of t[illegible] project but must be ad[illegible]e to communicate the the planner's intentions. The cost control process discussed therefore should seeks to operate within the framework of the plan and the planners should participate in the project execution.

(c) Budgetting

Budgetting is an important function of a building cost control system since it seeks to price the plan and objectives of the project. Having received an estimate of a project cost, the client will have to budget and ascertain his source of finance and monitor the cost so that the eventual cost does not exceed the budget. Likewise the contractor who should prepare a budget according to the elements or trades of building and effect budgetary control during construction. A devise for the assessment of likely profit and saving from the expenditure and revenue operations should be implimented. A budget should be made flexible to accommodate positive deviation since its operation require many hands than at the budgetary stage. It should involve as many implimenting staff as possible at the budgetary stage. Data retrieved from budgets become useful for preparing present and future estimates. A cash flow should be prepared to monitor the pulse of monitary transactions.

(d) t Monitoring

This process is essential if a successful building cost control is envisaged. It involves keeping of adequate cost records of materials, labour plant and preliminaries. These are actual costs incurred at the site which can be compared with the estimated or budgetted costs in order to detect variances. The records should be kept according to the building cost codes allowed at the budgetary stage to facilitate easier analysis. Records are supposed to be codified for reference and kept by site clerks, supervisors, project managers and quantity surveyors through the use of standard cards as practiced in the building industry. Unfavourable actual cost divergence should be quickly communicated for remedies by way of claims for variations and fluctuations.

(e) Cost Evaluation and Report

This building cost control process is meant for the compilation of all the costs incurred at the site for comparison and analysis with the budget or estimate. The records of costs summaries are kept and are analysed; and significant difference are given timely corrective action. The compilation and analysis of those cost should be done by an estimator who is knowledgeable, experienced and was instrumental to the tender estimates, preparation of the plan and budget.

A successful building cost control system must have a good communication and reporting line. The report should be timely, up-to-date, frequent, objective and not ambigues.

Prompt corrective actions for deviation is necessary and should involve the bottoms, middle and top management staff depending on the magnitude of the deviations.

6.2 RECOMMENDATION:

The study has brought to light some constraints militating against the effective and successful implimentation of a building cost control system. A catalogue of other additional reasons can be advanced to include; lack of trained manpower in the building industry, ignorant contractors, political interference, global inflation, worldwide economic depression, foreign "experts" advise and interference; and inadequate technology, materials and plants. The recommendation is therefore rooted from the aforementioned problems listed as follows:-

1. All building projects should be based on sound and and accurate estimates as it can be used for an effective planning, budgetting and cost control. Tenders should not be rushed and awarded on lump sum basis but objectively and carefully estimated. There should also be given a reasonable profit margin by the client, consultants and contractors.
2. The clients and contracting firm estimators should be involved to offer useful cost advice from the feasibility study stage of a project, during construction and including the maintenance phase. This is to enable them appreciate site practices and take measurements to compare actual with planned.

3. The updating of historical cost data is essential. To this end, such professional bodies representing the interests of the Quantity Surveyors, Architects, Builders, Engineers, Contractors and the Federal Ministries of Works and Economic Planning should set up a cost Monitoring Committee which should research into ways of monitoring cost and provide regular useful construction cost data.

4. Cost information on a daily, weekly, monthly and yearly basis should essentially be kept by estimators. This records will include market survey of materials, records of resource usage such as time sheets, daily allocation sheets and weekly summaries sheets for resources used on operations. This vital production information could be utilized for present and future estimating, cost control, work measurement techniques and establishment of standards.

5. Proper estimating procedures as recommended by the Nigerian Code of Estimating Practice, and detailed designs will ensure soundness and thoroughness of the estimates within which contractor can control project cost and maximize profit while the client could obtain value for the money expended.

6. Contractors should employ the services of knowledgeable and experienced technical staff such as estimators, builders and skilled supervisory personnel to improve on the firm's competence and effecting of a cost control system.

The staffing should be based on functional organisation which recognises a feed back control system for timely corrective action of deviations. Good human relation should also be introduced into the rank and file of the organisational set up and operations.

7. The contractor should always prepare his estimates and budget after the award of a contract and to ensure sources of financing projects and prepare cash-flow devices. The client on the other hand must ascertain the availability of fund for a project at the inception and should not delay payment for works executed. This is to avoid extension of project time that may introduce claims in the preliminaries and inflations.

8. On the job training for labour force should be made compulsory so that the labour force know what to do at the right time without relying on frequent monitoring and repetitive instructions from senior officers.

9. Contractors should introduce other cost control techniques and methods such as critical path method (CPM)(PERT), D' Culves etc. These methods should depend on the magnitude of the project and be flexible for easy reporting and interpretation of the project's objectives.

10. The contractor should ensure judicious materials and labour utilization including plant. A schedule of these cost elements should always be prepared at the planning and budgettary stage.

11. Contracts should be awarded to competent, reputable and recognised contracting firms.

12. Finally, designers should as much as possible specify locally available materials and produce simple designs enough for the labour force to understand. This will eliminate provisional and prime cost sums allowed in contracts which are subject to manipulation by actors during the project implimentation period.

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APPENDIX 'A' BILL OF LABOUR FROM

BILL OF QUANTITIES INCLUDING

LABOUR RATES

CODE	DESCRIPTION	UNIT	QTY	RATE	AMOUNT N	AMOUNT K
A	Clearing the site of all weeds, brush and small trees etc if any and removing 150mm top soil	M^2				
B	Setting out the building	Item				
C	Excavation of foundation trenches not exceeding 1.5mm depth	M^3				
D	300mm Consolidated hardcore laying on compacted earth fill if required	M^2				
E	Laying 1:3:6 foundation concrete in trenches to required thickness including form work	M^3				
F	Laying hollow concrete block work wall in foundation and plinth in 1:4 cement mortar	M^3				
G	Mixing, laying 1:2:4 cement concrete in floors and D.P.C.	M^2				
H	Blockwork wall in superstructure up to roof level in 1:4 cement mortar	M^2				
J	Cutting, bending, binding and fixing into position M.S. reinforcement including 20 S.W.G. binding wire up to 20mm Ø	Kg				
K	Prepareing and laying 1:2:4 R.C.C. in lintels, beams etc in	M^2				
L	Preparing and fixing form work for various R.C.C. memebers for building including scaffolding	M^2.				
		To Collection →			N	

CODE	DESCRIPTION	UNIT	QTY	RATE	AMOUNT N	AMOUNT K
A	Fixing into position in block work walls doors and window frames	Nos				
B	Fixing into position roof trusses including the roof sheets ridges and noggins for ceiling	M^2				
C	Fixing into position all electrical wiring, switch D.B. for all long and short points, conduit and all materials for complete electrification as per drawing	Sum				
D	Fixing into position the ceiling	M^2				
E	Laying 12mm thick 1:3 cement plaster on block work inside and outside surface smooth finish	M^2				
F	Fixing into position all sanitary and water supply installation as per drawing	Sum				
G	Laying floor tiles on a sand cement screed 1:4.40mm thick	M^2				
H	Laying white glazed ceramic tiles on floor and wall	M^2				
J	Painting walls and ceiling with 3 coats of paint	M^2				
K	Fixing into position louvres on windows	Nos				
L	Fixing doors into position including fixing of fittings	Nos				
M	Fixing into position curtain pelmets and skirting	M^2				
N	Fixing into position mosquito proofing and burglar proofing on windows	M^2				
		To Collection			N	

COLLECTION N k

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APPENDIX 'B' BILL OF MATERIALS FROM

BILL OF QUANTITIES

BILL OF MATERIAL FOR JUNIOR STAFF QUARTERS 'TYPE A'

A BLOCK OF 3 FLATS

CODE	DESCRIPTION	UNIT	TY	RATE	AMOUNT N	K
A	Cement: Rapid hardening Portland cement	Bags				
B	Sand (fine aggregates) fresh from adhensive coating	M^2				
C	Gravel (Coarse Aggregates) free from adhensive coating	M^2				
D	Laterite (hardcore) free from adhensive coating.	M^3				
E	Crush marble, free from adhensive coating.	M^3				
F	Hollow blocks, 450mm long x 225mm high x 150mm thick	Nos				
G	Hollow blocks, 450mm long x 225mm high x 225mm thick.	Nos				
H	Asbestos ceiling board, 6mm thick x 1200mm wide x 1200mm long.	Nos				
J	Aluminium roofing sheets, long span 'industrial size', 650mm long.	Nos				
K	Timber noggins/ceiling joints, 50mm x 100mm x 3600mm long	Nos				
L	Timber purlins, 50mm x 75mm x 3600mm long	Nos				
M	Timber struts, 50mm x 100mm x 3600mm long.	Nos				
N	Timber Tie-beam, 50mm x 150mm x 3600mm	Nos				
O	Timber Rafters, 50mm x 150mm x 3600mm long.	Nos				
		To Collection			N	

CODE	DESCRIPTION	UNIT	QTY	RATE	AMOUNT N	K
A	Timber wall plates, 75mm x 100mm x 2600mm long.	Nos				
B	Barge/fascia boards, 25mm x 300mm x 3600mm long.	Nos				
C	Timber skirting, 50mm x 100mm x 3600mm long.	Nos				
D	Timber Frames, 50mm x 100mm x 2600mm long.	Nos				
E	Flush doors, 43mm thick x 750mm wide x 1950mm high.	Nos				
F	Flush doors, 43mm thick x 600mm wide x 1950 high.	Nos				
G	Flush door, 43mm thick x 850mm wide x 1950mm high.	Nos				
H	Plywood door (wardrobe) 18mm thick x 200mm wide x 1950mm high.	Nos				
J	Brass butts, 100mm long.	Pairs				
K	Mortice lock/furniture, standard sizes.	Nos				
L	Mild steel bolt, 150mm long	Nos				
M	Wardrobe lock, standard sizes.	Nos				
N	Crittall-Hope door, 1200mm wide x 1950mm high	Nos				
O	Louvre carrier, 1200mm high for 8 nos 150mm blade.	Set				
P	Louvre carrier, 675mm high for 5 nos 150mm blade.	Set				
Q	Louvre carrier, 600mm high for 4 nos 150mm blades.	Set				
R	Galvanised pipes, 75mm Diameter	Nos				
S	Louvre blades, 6mm clear sheet, 150mm wide not exceeding 750mm long.	Nos				
	I44	To Collection			N	

CODE	DESCRIPTION	UNIT	QTY	RATE	AMOUNT N	AMOUNT K
A	Louvre blade, 6mm clear sheet, 150mm wide not exceeding 950mm long.	Nos				
B	Low level W.C. Suites, standard sizes.	Nos				
C	Showers, standard construction	Nos				
D	Sinks, 610mm x 455mm x 225mm sizes.	Nos				
E	Reinforcement bars (Provisional), 12mm Diameter	Nos				
F	Vinyl Asbestos files, 225mm long x 225mm wide x 1.6mm thick	Nos				
G	Glazed wall tiles, 150mm long x 150mm wide x 18mm thick.	Nos				
H	Paint - Emulsion, Tin of 4 litres	Tins				
I	Paint - Gloss, Tin of 4 litres	Tins				
		To Collection			N	

COLLECTION N k

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TO SUMMARY N

APPENDIX 'C'

KADUNA STATE HOUSING AUTHORITY KADUNA

CERTIFICATE VALUATION - No .....

Contract No ..... for the erection and completion to

.....

.....

Contractor: .....

.....

Head ..... Sub-head ..... date .....

Amount of Original Contract Sum	₦
Estimated amount of Revised Contract Sum from page 2	₦
	₦
Total Value of Works executed to date	₦
Total Value of Materials on Site	₦
	₦
Less Value of retention money from page 2	₦
	₦
Add/omit cost of fluctuation clause	₦
	₦
Less previous nett payments to Contractor under Certificate Valuation No	₦
	₦
Less Liquidated and Ascertained Damages from page 2	₦
Total Amount due on this Certificate (inclusive of income tax)	₦
Less 2% Income tax deduction on this Certificate. Para (i)or (ii) Overleaf	₦
	₦
Net amount payable on this Certificate	₦

Amount in Words: _____

to be paid as follows:

From Project Vote of Charge Head ..... Sub-head .....₦

From Project Vote of Charge Head .....Sub-head .....₦

From Retention Deposit Account Head .....Sub-head .....₦

From Retention Deposit Account Head .....Sub-head .....₦

Peter A. Chori
P. Q. S.
Kaduna State Housing Authority,
Kaduna.

for: General Manager
Kaduna State Housing Authority
Kaduna.

APPENDIX 'D'

PROPOSED DISTRICT OFFICE AT ZARIA FOR KADUNA STATE HOUSING AUTHORITY

Work up to & incldg. grd. flr. Slab

fdn sprd
690
230
less wall / 460
1/2 230

	length	width
	23.800	9.525
Add 2/sprd	0.460	0.460
	24.260	9.985

Exc. veg. soil av 150mm dp & cart away

24.26		
9.99	242.36	
4/ 0.60		
0.23	0.55	
1.20		
0.60	0.72	
	243.63	

Ddt last

14.80	
0.60	8.88
0.60	
1.45	0.87
	9.75

Tran. Excn.

Ext walls	Int. walls
23.800	3/5
9.525	4/3
2/ 33.325	
66.650	3/2
less 4/230 0.920	
65.730	
2/1.20 2.400	
4/0.60 2.400	
70.430	

Add 2.00
2/0.80

70.43	
0.69	
1.35	65.61
69.24	
0.69	
1.55	64.50
4.53	
0.45	
1.35	2.93
	133.04

Exc. fdn. trc start from gr. lev. and av 1.5m dp.

&

Back fill as previously

PROPOSED DISTRICT OFFICE BLOCK COMPLEX

		UNIT	QTY	RATE	AMOUNT N	AMOUNT K
	SUBSTRUCTURE					
	The following All Provisional:					
	EXCAVATION AND EARTHWORK					
A	Excavate oversite to remove vegetable soil average 150mm deep and cart away from site	M^2	224			
B	Excavate trench to receive foundation starting from formation Level and not exceeding 1.5m deep	M^3	132			
C	Extra over all kinds of excavation in hard rocks	M^3	33			
D	Backfill Selected excavated materials around foundations	M^3	106			
E	Surplus excavated materials remove from site	M^3	59			
F	Bed of hardcore filling in three layers of 100mm thickness each, well rammed, and consolidated, 300mm thick overall	M^2	188			
G	Hand Packing vertical faces of hard-core to receive concrete not exceeding 300mm wide (225mm wide average)	M	5			
H	Blind surface of hard core with Sand or other equal approved fine materials to receive concrete bed	M^2	188			
J	Spray all surfaces of excavation with "Dieldarex 20" anti-termite solution immediately before laying concrete	M^2	257			
			TO Collection		N	

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