THE ROLE OF MICRO COMPUTERS ON THE CONSTRUCTION SITE.

Integrated Construction Management System

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S U M M A R Y

The control needed in the management of a project was analysed with particular reference to the unique needs of the construction industry within the context of site management. This was explored further by analysing the various problems facing managers within the overall system and determining to what extent the organisation would benefit from an integrated management information system. Integration and management of information within the organisational units and the cycles of events that make up the main sub-system was suggested as the means of achieving this objective.

A conceptual model of the flow of information was constructed within the whole process of project management by examining the type of information and documents which are generated for the production cycle of a project. This model was analysed with respect to the site managers' needs and the minimum requirements for an overall intergrated system.

The most tedious and time-consuming task facing the site manager is the determination of weekly production costs, calculation and preparation of interim certificates and valuation of variations occurring during the production stage and finally the settlement and preparation of supplier and sub-contractors' accounts. These areas where microcomputers could be of most help were identified and a number of packages were designed and implemented for various contractors.

The gradual integration of stand-alone packages within the whole of the construction industry is a logical sequence to achieve integration of management system. The methods of doing this were analysed together with the resulting advantages and disadvantages.

KEY WORDS

M.I.S. Management of Information System.
Construction Site Management.
Micro Computers On Construction Sites.
Micro Computer Applications.
Computer Aided Management.

I would like to dedicate this research

to
my daughter
Anousheh.

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L I S T O F C O N T E N T

L I S T O F D I A G R A M S

C H A P T E R O N E

INTRODUCTION

1.1 General introduction

The construction industry in the United Kingdom is diverse and heterogenous consisting of over 80,000 units, ranging from the small private concerns which employ only one or two people, to the major international organisations with extensive interests overseas. It is divided into functions i.e. in terms of professions and skills such as architects, civil engineers, construction engineers and surveyors and appears to the observer to operate as separate units of construction sites very much under the control of the site agent. It is not an industry which has readily adopted data processing techniques in the past but this situation seems to be changing. The penetration of such techniques has been very low and generally restricted to accounting functions. A slow and unsuccessful attempt to introduce the use of data processing to the site is perhaps explained by the small size of the average firm.

The overriding trend is towards more complexity at all stages of construction from planning onwards. There is the constant introduction of new methods and materials, greater emphasis on factory produced units and underlying research for more automation and drier construction. The proper supervision of site labour together with the integration of skills to produce high

quality goods in a given amount of time are the keys to success. Many new industries are struggling towards what might be termed a paper-free control system in which the application of computers takes a major role. The construction industry has already achieved this but only in accounting, payroll and cost reconciliation systems.

The construction site is the workplace of the construction industry, and the efficiency of the construction firm is heavily dependent on an effective site management system. Although computers seem to be well established in accounting procedures within the industry, it is important that they are introduced to facilitate the management of the site, which, unlike other industries, has not benefited from the use of computers. The pace of construction work demands a dynamic response in resources utilisation and managerial action, and it is this characteristic which suggests that an interactive computer system providing immediate information would be of value.

1.2 RESEARCH PROBLEM

This research seeks to identify the role and application of micro computers on the construction site and to identify appropriate information systems with the primary aim of assisting the decision making of the site manager by way of retrieving and storing the common data generated either through the earlier stages of a contract or during its production cycle.

1.3 Research strategy

The research approach may be divided into the following stages:-

a) To study the overall problems and needs of the construction industry.

b) To establish the general flow of information of a project in respect to the site management information.

c) To establish the criteria of a information system for an effective communication and feed back within all stages of a construction project.

d) To investigate and develop means of achieving integration of stand-alone systems between all stages of a construction project.

e) The identification of stand-alone packages for the construction site management.

1.4 PRESENTATION:

The format adopted for this work is to carry out a review within each chapter at the end of which a conclusion is drawn.

Chapter Two analyses the whole control involved in the management of a project and outlines and compares the problems and peculiarities facing the Construction Industry. i.e. within the context of site management.

Chapter Three analyses the business characteristics of the general construction organisation in order to outline the

problems facing managers within the system as a whole. This chapter attempts to identify the needs of an organisation for an integrated management information system.

Chapter Four, in two sections, explains the method of carrying out a postal survey and presents the analysis carried on answers recieved. the second section details the forms and abstract of interviews carried to collect information for the conceptual model of MIS.

Chapter Five details and constructs an overall flow of information within the whole process of project management, of a contract including the production cycle with the aim of achieving an overall integrated management information system for the application of microcomputers on site.

Chapter Six analyses the flow of information with respect to the requirements of the construction site manager and identifies the minimum criteria information required to achieve the integration of overall management procedures in order to avoid double-data entry.

Chapter Seven details the development of measurement and take-off system and discusses the use of the system within the whole organisation and in particular on the construction site.

Chapter Eight discusses the possibility of achieving integration of stand-alone packages within the whole of the Construction Industry where there is no common data base in use. Also outlined

is the minimum data requirements for integration and the methods which have been used for the integration of five stand-alone systems.

Chapter Nine presents four stand-alone systems identified and developed for use in the Construction Industry with particular benefits for site management.

Chapter Eleven presents the conclusion.

1.5 REVIEW

1.5.1 Historical

Leading researchers like Wiener (1) in the forties theorised that the major processes in a functioning organisation required for the realisation of an aim, are information transfer and control. A later theory by Churchman and Ackoff (2) developed the idea that the surrounding environment affects the interrelationship between an organisation's sub-systems.

Later Thompson (3) developed this theory of interrelationship further by indicating that if there is a need for interlinkage of sub-systems then the need for tighter control follows automatically.

Woodward (4) verified this by saying lack of co-ordination leads to uncertainties which in turn necessitate a high degree of sub-system interlinkage.

If the organisation is to function efficiently then any view to improvement must incorporate the organisation as a whole and not

in separate parts. Ansoff (5). He also believed that once a sub-system is functioning effectively it does not follow that the properties of that sub-system can be adapted to the whole organisation owing to the fact that systems have boundaries. Benien (6).

Less than twenty years ago, the need for computer-aided systems for large organisations was put forward by Oxley and Poskitt (7). This being so, a higher degree of control would also be needed.

1.5.2 Development.

Computer aided management systems have been available through computer bureau's for several years. However, successful introduction into many companies has failed because of the inflexibility of management systems or the inability of computer facilities to meet the needs of the organisation.

In 1974 Bramwell (8) completed his research under Interdisciplinary Higher Degree(IHD) for Bryants Civil Engineering Division. His task was to analyse the company's existing organisation (Civil Eng., Division) and to determine where the introduction of computer facilities would be beneficial. Bramwell found that computer aided management systems were DATA HUNGRY and so compiled a data base of work measurements covering the main drainage construction. This data base was designed to store the cost of manhole construction and pipeline for estimating and planning sections of the Civil engineering division. He then developed three computer programs to be used by

the estimators and planners.

Bramwell also developed a stochastic simulation suite of computer programs to model site construction into anticipated construction site durations and production to convert the data. This simulation suite of programs investigates the effects of factors which are affecting the site productivity using the actual Bryants'site efficiency measurements.

Finally Bramwell's system can be described as a system which determines the standard duration of each operation that is to be performed on site, by using the measurement data (from data base), quantify the required resources and investigate the effects of site simulation suite making allowances for the site productivity.

Bartram (9) in his research, which was a follow-up of Bramwell's work, validated the work measurement data base. He approached this by performing work studies on site to obtain global time measurements which were then compared to the computer synthesis. He also corrected the discrepancies found in the work measurement.

Owing to the changes in the construction methods and materials, Bartram updated and elaborated on Bramwell's data base system. He also developed a software for on-line command driven project analysis and simulation.

C H A P T E R T W O

THE ANALYSIS OF CONTROL SYSTEM USED IN THE MANAGEMENT OF A PROJECT

2.1 Introduction,

The Ashridge Management Centre (10) having studied various building firms formulated the opinion that the most appropriate organisational structure for a general contractor is organic, where there is a requirement for high integration but low control. Similarly contractors subletting most of their work require an organisational structure where there is need for low control and low integration.

The Ashridge team arrived at their theories partly by examining the factors which influence the degree of control which can exist in an organisation. i.e.

a) The type of work
b) The nature of the technology
c) The values and attitudes of the workforce.

From examination of these factors they reasoned that highly developed control systems are appropriate only when:

a) the nature of the bulk of the output is such that its properties can be precisely specified and measured, therefore output does not include a large proportion of creative work;

b) production runs are long, the range of products is few, and variations in the characteristics of products in the range are minimal;

c) there is a relatively high degree of mechanisation in the production process and

d) tradition is not a strong force.

It appears that a high degree of control cannot be attained for general construction works since the properties required for this level of control are all those which construction works tend not to have. However this is a short term approach only. An experienced contractor ought to be aware of the nature of the product. He would not tender for work if he had no idea of what was required. Past experience of similar work and the use of work study techniques, coupled with the knowledge that there is a limit to the creativity that can be employed, help to satisfy condition a) above. Production runs vary along with product range and character depending on the breakdown of work items desired. The control can, perhaps, be set to a limited number of significant items. Mechanisation within the construction industry is increasing and traditional approaches are declining.

It is possible therefore that a greater degree of control can be achieved than the Ashridge team appear to suggest.
There is an obvious need for better control in the construction industry; an industry which is often classed as backward and

inefficient.

The problems that concern construction management are the identification of areas of control and the means of implementing control methods with reference to the industry's special needs.

All too often examples are taken from manufacturing industries and presented as the cure for the building industry's requirements.

There is no area to which senior management attaches so much importance as the control of costs. As a consequence formal control systems developed for use on site tend to aim solely at a statement of costs. Indeed, there are few, if any, other control procedures which are formalised and operated by general contractors.

The aim of this chapter is to discover how and where effective control can be achieved and to investigate practical measures which will help in improving performance, minimising costs and maximising output, in terms, which are applicable to a construction site.

2.2 Analysis

There are a number of ways in which control can be defined. Cooke (11), presents the following :-

a) to check, regulate, verify or keep within limits;

b) to exercise restraint or direction upon the action of other people.

c) to analyse past and present performance in order to devise a standard plan for future action and

d) To review actual performance in comparison with predetermined standards and targets.

Control of construction work cannot be represented quite so simply. The processes to be regulated are extremely dynamic with large and numerous external influences. Standards are less defined and can often be based on an individual's experience. Most importantly in a manufacturing process, if the control highlights some discrepancy to the standard, the cause is likely to be far more easily traced and rectified. A range of possible solutions are presented to the site manager. It is therefore an important feature of a construction control system to provide guidelines for decision making.

A more appropriate description of the control process for building works might be: the regulation of available resources and factors of production to maximise output, minimise costs and maintain a rate of progress.

The major differences here are that the factors of production are seen to be variable not necessarily in size but in their balance over the production process which is a progressive element and not a fixed cycle.

To gain control, standards, such as cost, output rates, or progress are still needed. These can then be checked against

budget, targets, programme of works. But it is unlikely that any one standard will act as the sole control parameter.
One requirement of all control systems is feedback. There are two levels of feedback, the first being one which enables the control cycle to operate, the second feedback used for setting and checking standards.

To justify and support the definition of control in construction works it is necessary to examine some of its peculiarities.

2.3 Peculiarities of the Construction Work.
It is very common for an individual construction project to be as equally heavily committed in terms of investment (i.e. capital and labour) as many firms in other industries. Therefore there are no real reasons why the construction industry should be treated differently to manufacturing industries.

However there are very real differences between building sites, manufacturing and process plants as outlined below:-

2.3.1 Scope of work.
The range of work a general contractor might undertake is large, and must be so to cater for the needs of a variety of bodies who are likely to be one-off clients with precise and differing requirements. This could be:-

a) type of work.
b) type of contract

a) In reference to the type of work the fact that no two contracts are identical, and the size and complexity of each product is different, causes considerable organisation difficulties and a whole level of problems which are facing the construction contractor rather than manufacturer.

b) In reference to the type of contract building work, obtained by competitive tender or some form of negotiation. The competitive tender may be the basis of a serial tender and the negotiation could be for technical reasons or possibly a purely contractual arrangement. Furthermore, the contractor could be building for a developer / client or for himself as a developer. Therefore each form of contract will necessitate a different administrative back up and different types and levels of financial commitments.

2.3.2 Financial commitments

Unlike most products a building requires major capital expenditure throughout its production. A conventional product may require a substantial capital for the initial production run, the set up cost, but thereafter the unit cost is likely to be small. Furthermore, the market price will be set according to demand but at a level which will guarantee a unit profit. If there is a comparison to be made between building and manufacturing it would be that building equates more to the setting up of a production line or the first trial run of the line, rather than the subsequent working runs.

Construction companies achieve a low profit/turnover ratio. They

are not in a position to raise profit levels as competition within the industry is keen at present. Similarly, owing to the physical nature of the product, they are unable to increase stock turnover to any real extent. Each contract thus requires a high level of investment by the contractor and depending on the form of contract, profit may not be realised until the end of completion. This means that careful balancing and timing of work is required by the senior management to avoid a cashflow crisis. This is difficult enough, and often corporate financial decisions conflict with the ideal production solutions by limiting the resources available. Additionally the flow of work coming to a contractor, as the result of bidding for tenders, is variable and often insufficient. (e.g. an average tender success rate of one in seven or more for medium to large contractors.)

The most common method of obtaining work by contractors is competitive tendering, with a Bill of Quantities as a basis for tender. The contractor is asked to price work which is not only set out in an inappropriate form but does not clarify quality required. In fact full working drawings are not always available. The contractor is asked to cost a completed product about which he has little or no knowledge. He is however fully aware that it is likely to change in content and possibly nature.

Unlike manufacturing industries there is no prototype to evaluate.

2.3.3 Working environment.

Usually the manufacturer's work place does not change from year to year. A convenient place for tranport and availability of workforce and materials is chosen. The construction contractor is in no such position. The site manager is often remote from his senior management and often his administrative base. As a result, communication between senior management and site managers is often via a third party. This is not only tedious but can lead to ambiguity.

The second feature of location is that it will only be a temporary one for the construction contractor. Consequently full advantage of local amenities may not always be taken.

2.3.4 Special requirement.

Perhaps the largest difference between a building as a product and a manufacturing product is that its design is most commonly undertaken by a separate body to the manufacturer. Whilst manufacturers are given performance specifications and can design a product with a view to the practicalities of production, the construction contractor must fit his 'production runs' around the design and often to an externally set time scale. Furthermore the design function may be split between several specialist parties such as Architects, Structural Engineers, Services Engineers etc. whose interests may often conflict and even when combined are unlikely to fully appreciate the practical consequences of their proposals.

Nominated subcontractors and their specialised skills are another outside influence on the contractor's work. Although the site manager does not manage their operations, he must regulate their progress and the scheduling of their operations. Yet the nominated subcontractor's work is likely to be specialised beyond the capability of the general contractor and in the case of service subcontractors, may be a high proportion of the contract value.

Specialist subcontractors are also likely to have their own programme requirements which may conflict with the general contractor's, whereas the manufacturer's subcontractors will usually supply a finished product to be included by the manufacturer in his process.

The manufacturer is subject to laws relating to company administration, health and safety, terms of employment and regulations relating to specific processes or materials. The contractor is subject to all of these plus regulations regarding minimum building standards planning and land use law (not forgetting implications in legislation such as the Highways Act) and other forms of contract. Even under legislation to which the manufacturer is subject, the builder often has special requirements.

Finally adverse weather conditions particularly in the early stages of construction can cause delay and even damage. Working spaces are generally out of the control of the contractor. The

reverse is true for the manufacturer.

2.3.5 Organisation.

Since the site is remote from Head Office and the rest of the organisation the product decisions and executive decisions may conflict.

Comparing the site with the industrial workshop, however other differences can be seen. In all but the smallest of workshops the production supervisor is not required in any other capacity.

There will be separate managers concerned with matters such as personnel, health and safety and administrative matters maybe even public relations. The site manager is responsible for all of these functions for his site. There will be advice on matters of contract law from the quantity surveyor, and probably a site clerk or accountant but the site staff will usually be geared to production, leaving the manager to deal with administration. In short, there is generally a lack of co-ordinated management structure in the building site.

2.3.6 Team relationship.

The production team by nature is a casual one due to the temporary nature of building site work. The site supervisor must therefore, work with operatives about which he will know little. There is little chance for him to develop the same working relationship as a workshop supervisor would with his operatives. Another difficulty is that that the construction operatives work in gangs. It is rare that one man can be set to one task. The

site supervisor will, therefore, have to set the appropriate gang to the task as well as select the best gang composition. Certain trades will only be required for short periods within the construction sequence.

2.3.7 Nature of construction work.

Construction work is generally not simple assembly work; it involves the adaptation of materials into a different form or the amalgamation of units of materials to a complete element. The 'productive' element of the work is largely undertaken by skilled craftsmen with preparatory back-up work performed by unskilled labour. The degree of mechanisation in the production process is small. There is then a creative component of the work as the Ashridge team suggest.(10)

Materials used in construction are variable in quality and type and this means that a bank of commonly used materials cannot be developed. Consequently deliveries must co-incide with a programmed sequence.

The craftsman is required to exercise a judgement and to choose from several methods in order to turn the drawing into a reality. This may cause changes in the programme of work.

It must be emphasised that there is no provision for a trial run in building and construction work, despite the fact that some site operations are repeated. This poses considerable problems in accurately assessing resources required.

Similarly this applies to scheduling of operations. Certain

sequences cannot be altered. It is often the experience of the site manager which influences the final operation sequences.
It is apparent that there are rarely differences between manufacturing and construction industries. Outside influences have considerable bearing on decision making as do the number of variables.

It can be deduced that control of building works must be seen in terms of optimisation rather than maximisation.

2.4 Conclusion

It appears that the Ashridge team were correct in their assessment that a high degree of control is not applicable to a general contractor and his works. However, they were only correct to the extent that control from outside the industry cannot be applied.

Control as practised by the contractor, specifically by the site manager, is more related to an attitude of mind than physically restraining action. Control is implied, and can only be implied by careful planning and programming, co-ordination organisation and communication. To be in control, the manager must be aware of the areas he cannot influence, so that he can attend to the areas he can. His primary consideration to achieve the aims of control(output maximisation, cost minimization and maintainance of progress) should be to maintain or improve the flow of work. This means he must have freedom to act; must make maximum use of the expertise circulating around the site; must be aware of the type

of input required to make an operation flow; and he must know and be able to communicate his objectives.

In 1959 the Building Research Station concluded in a survey of building sites throughout Europe that:-
"... it would appear that the aspects of supervision Site Labour, Building materials, Incentive Payments (to operatives and staff), Planning and Programming, Plant and Equipment, and Sub-Contracting are important to efficient production - and very roughly in that order - than Estimating and Tendering, Accountancy and Cost Control, and Cost and Output Analysis."
This still applies.

C H A P T E R T H R E E

Business characteristic of the Construction Industry and management of information system

3.1 General introduction.

A frequent complaint of managers is that they are working longer and harder than ever before but with less success. This is suprising when over the last few years computer aided management tools have developed significantly .

The methods, procedures and techniques for performing business tasks that have been so readily accepted by management are supposed to reduce the burden of work not increase it. Unfortunately they are all too often adopted by business for the wrong reasons and therefore incorrectly. They become a substitute for the manager's appreciation of the structure and purpose of business. They develop into an inconsequent mass of disjointed subsystems that do little to provide an overall picture of reality.

The objective of this chapter is to establish the general structure and character of the management information system that will provide a basis of knowledge. To do this it is first necessary to determine the overall function of the business, that is to say, to outline the basic actions by which the business fulfills its purpose. This will set out the general activities for which information and knowledge is needed.

3.2 Systems - The Structure of Wholes.

Scientific thinking has been dominated by the view that scientific advancement can only be achieved by analysis and the logical manipulation of relationships.

In physics, chemistry and all branches of science the object of most investigations have been to divide every whole into its smallest elements. It does not follow, however, that by combining knowledge of each element, a knowledge of the whole results.

Analysis is necessary to push back the frontiers of science, but so is the ability to look at and understand wholes, that is to say to understand the systems where each entity is related to each other within a multi-dimensional framework.

A parallel to this scientific thinking can be seen in many institutional and social groups, none the least of which is the business organisation. The present day company has seen, within its organisation, an upsurge in specialisation. The disciplines of today's industry are endless:(accountant, solicitor, planner, systems analyst, training officer, personnel officer etc. etc.) Not that such specialisation is wrong, it is in fact inevitable.

This is the basic problem of management and will only be simplified if we possess an awareness of the basic characterisics of the whole. D.Katz and R.L.Kahn (12), identified nine characteristics that seem to define all open systems.

These are as follows :

1) Importation of energy.
2) Through-put
3) Output
4) Systems as cycles of events
5) Negative entropy
6) Information input,negative feedback and the coding process
7) Steady state and dynamic homeostasis
8) Differentiation
9) Equifinality.

Open systems require the importation of some form of energy to their environment. Within the industrial organisation this will be such things as material resources, knowledge and information. This will be transformed in the through-put stage into a product or service which will be exported back into the environment.

The giving of a product to the environment allows the further taking of energy and so establishes a continuous return for the product and using it to purchase further raw materials. Every giving system has a cyclic relationship with its environment, although not all cycles are so easily indentified as that in the industrial concern with its monetary link in the chain of events. Energy renewal may come directly from the organisational activity itself.

Any system that does not have this cyclic characteristic to enable it to renew its energy becomes non-productive.

What it termed a system (a whole) as well as being a combination of sub-systems (parts), is a sub system of a higher level of systems. For example - a construction company is a combination of several sub-systems (marketing, estimating, production) yet itself is just one part of an industrial complex.

From this it can be seen that a system (at any level) has a cyclic pattern formed by a combination of cycles of events. These cycles of events may be wholly part of a sub-system shared by several sub-systems or shared with a cycle of events forming part of a higher level system.

The input of information into a system is essential to stimulate action. This information should indicate the state of the environment and the systems own performance within the environment. One of the main forms of knowledge of an informative nature is negative feedback.This is the regulatory device which keeps the system on course and prevents it expending too much energy.

The coding process determines what inputs are capable of being absorbed: it is the sensitivity of the system to outside stimuli which allows only the useful and significant impulses to penetrate the system.

The entropic process is arrested by the existence of a pool of surplus energy which had been collected earlier by importing more energy from the environment than was expended. This enables the

system to survive and even to live for a period on borrowed time. The controlling factor that regulated this store of energy is described as dynamic homeostasis. This force monitors the outside environment anticipates change within the system and then deploys the energy in order to retain as far as possible a steady state. The basic principle is to preserve the character of the system. To do this more complex systems will tend to grow and expand in order to extend their boundaries and to acquire greater control over their immediate environment.

Systems tend towards differentiation and elaboration. This is obviously happening in industrial organisations as was stated previously.

The last characteristic of open systems is equifinality. There are several ways within a system of achieving a final state. These paths will be restricted as the system moves regulatory mechanisms of control.

These nine characteristics can be universally found in open systems. There are many characteristics that are peculiar to particular systems.

The key to understanding the system is, an appreciation of the cyclic relationship of a system to its environment and its tendency towards self-preservation.

3.3 The Disequilibrium in Growth.

When performance and targets are one and the same an organisation is in a steady state. It is more than likely that the resources will be greater than the performance level. This is to guard against the entropic process and it is the safety margin against insolvency. Should its aim for efficiency in an organisation increase its performance level to its resource level, it will gradually degenerate because of the effect of entropy and risk instant death from insolvency.

There are two main reasons why this happens:-

1) The company sets its targets far below the future probable potential of its resources and markets. It is prepared to stay at a steady state when it still has the opportunity to grow.

2) The company reaches the limit of its potential(either resource shortage or market saturation).

Growth implies that there is a performance chasing a potential and a potential chasing a target. If this state does not exist there can be no growth and no certainty of a future.

If a company, in its struggle for rapid growth, pushes its performance beyond or too close to its potential, its chances of anything but collapse are somewhat remote. Should its potential reach its target without its targets being further extended, future growth will take the company nearer a steady state.

To summarise so far, the factors to be controlled in order to ensure growth are targets, potential and performance. But all

companies possess these factors to some extent.
There must be a fourth factor that links the other three; i.e. growth, maturity and death.
This factor is also disequilibrium, or more precisely, the degree of disequilibrium. It has already been mentioned that a system has a cyclic relationship with its environment. It has input, through-put and output. But if potential (input and output) and performance (throughput) are all in equilibrium the opportunity for growth does not exist and termination is inevitable. There has to be a store of wealth to stimulate growth, stave off the entropic process, to retain liquidity and attract investment. This surplus is the disequilibrium, the difference between what is paid for the resources and received for the product.

It is important to mention at this point, that this store of wealth is not purely financial. Although finance is extremely important for the acquisition of the many factors of production, there are other important factors such as knowledge, technology, management ability, information, experience perception and innovation.
Today's entrepreneur has the advantage of information and facts collected by market research, scientists, economists, mathematicians, statisticians, etc., and has means by which to store and collate this information in the form of the computer. But even with this base of knowledge decisions still have to be made and no computer has yet been created or is ever likely to be created that will substitute for business acumen. What is

important is that this base of knowledge reduces the element of uncertainty by depicting patterns and indicating trends. The manager is made aware of the situation, it is then up to his experience and intuition to decide between the alternatives.
It is often considered that financial investment can aid industrial growth. This is not so, although it is universally important in companies that they possess the other essential ingredients required for growth. It does not however detract from the importance of retaining a positive disequilibrium.

3.4 Organisation.

The organisation is the highest level of any system. It is the nerve-centre that plans, controls and co-ordinates the system within the framework of a philosophy, thus creating an overall picture of reality.
Yet all too often it does not have a philosophy. The specialisation factualisation, processes and techniques surrounding the manager are becoming a substitute for a philosophy, rather than a tool by which to capitalise upon a goal.

To plan and control has become an end in itself, rather than a means to an end. There are departments to plan and control markets, production, labour, plant, materials, finance, costs, training and personnel. Each believe themselves to be of prime importance. This leads to traditional attitudes in defining departmental boundaries and formal channels of communication.
Nevertheless large complex organisations have to be broken down

into smaller manageable units. There are three main problems in doing this by forming the traditional department. That is, departments based upon clerical, administrative and professional disciplines.

a) Departments tend to cut across the cyclic pattern of the system. Instead of working towards a continuous cycle of events they become involved with small areas of separate major event patterns. Two disadvantages arise from this:-

i) It becomes extremely difficult to measure performance because the department is only performing a very small part of many cycles. Therefore, instead of performance being measured in terms of effectiveness, it is measured in terms of hours worked and the quantity of paper work produced.

ii) Systems rely on the cycle of events to regenerate energy. The organisation is part of the system and equally relies upon seeing the outcome of its labour to regenerate energy and stimulate further action. When the function of a department is disjointed it becomes difficult to

determine the product. It, therefore, looses a great deal of its stimulus and further work becomes a monotonous chore.

b) Departments tend to possess dynamically conservative attitudes. Where as more complex systems will tend to change with their environment in order to preserve the character of the system, departments see change as threatening their very existence. This is probably because they do not fully appreciate their relationship with the body of the company and because they measure their performance in different terms. Change that adds more work to the department will be more readily accepted than change that reduces work but makes it more effective.

c) Departments restrict the free flow of information and ideas, communication between members of different disciplines becomes difficult. They do not understand each others problems and very often do not even speak the same language. In such circumstances communication can only be achieved by adhering to a rigid procedure that very often will not be able to differentiate between relevant and irrelevant. Anything out of the ordinary will create confusion.

3.5 Conclusion

The survival and future prosperity of a company does not depend directly on its product or service but on its ability to collect and use information and knowledge in order to decide upon the

most advantageous course of action for its future effort. This information and knowledge should report, in the broadest sense on market needs, the company's and competitors' ability and resource availability. The company should have the ability to use this information to determine performance levels, potential and targets and to project their findings back to the environment and to the remainder of the company. The ability of the company revolves around its appreciation of the reality of their business function and the instigation of a system for collecting information that will help to give management a clear objective knowledge of the prevailing conditions both internally and externally.

The success of a company depends to a large extent upon its recognition of the structure and character of the business function, the information systems and the production cycle and their inter-relationship. If it can combine this awareness with a functional organisation and information structure its chances of survival and future prosperity are extremely good.

The problem is to find some form of organisational communication pattern that allows the complex organisation of a company to be split into smaller units but at the same time retain an overall picture of the whole. This can only be done by the integration and management of information within the organizational units and the cycles of events that make up the main sub-system.

C H A P T E R F O U R

METHODS OF COLLECTING INFORMATION

This chapter explains, in two sections, the objectives of carrying out a postal survey and the methods of collecting information for a conceptual module of flow of information.

4.1 Postal survey

4.1.1 General

The relevant bodies of building industry especially the Royal Institute of Chartered Surveyors had done many surveys on computerisation of quantity surveying practices and had kept track of it as far as possible. Quantity surveyors were described as 'traditional' and 'conservative'. It was estimated that only 15% of practices in this country was using computers in the past few years.

Even in recent years quantity surveyors had tended to consider computers as having potential only for Bill production. A number os such systems had been developed in the past two decades and some practices used computers successfully. However, many practices had been deterred by the expense of such systems, and other practices had tried but failed to implement the systems satisfactorily, Computerisation had undoubtedly made for cheaper production of Bills but savings had not been staggering. The fact that computerised bills required a degree of standardisation had also had a benficial on the overall efficiency of the practices.

There were many surveys in the past to reveal the impacts of the computer towards the PQS firms. However many of these surveys were conducted a number of years ago . With the introduction of the fourth generation of computer in the past few years a survey is considered to be necessary to find the new impacts of modern computer and the difficulties towards computerisation in the PQS firms.

4.1.2 Objectives

The objectives of this survey were as follows:

1) What is the population of computers?
2) What is the extent of computerisation?
3) What is the priorities of computerisation in the respect of the types of work listed?
4) What is the popular choice of computer system and its usage?

4.1.3 Method of approach

It had been decided that the method of postal survey of questionnaire should be adopted because this sort of survey was the best means and the time available to cover a large survey sample firms, on the understanding that there was a risk of very low response which rendered the survey the survey to be of little significance as far as the whole population of firms was concerned.

The questionnaire was set up mainly to obtain information from a range of selected firms in order to tackle the objectives stated above.

The target firms for this survey are those quantity surveying firms in private practice and within the British Isles to fall within the scope of this survey. The sample size of this survey was decided to be 200. The actual sample size in analysis would be determined by the response.

The response rate of a postal survey is normally ranging from 25% to 75%. The expected response rate was 50%. There was a total of 76 replies , This means a final response rate of this survey was 38% of the total sample firms. It was a little but lower than expected but it fell within the normal range.

4.1.4 Answers to questionnaire

The answers received from the 52 responding firm are summarized here. Some firms did not answer certain questions because of various reasons.

There are twenty replies without answers at all for the whole questionnaire in addition to the following summary of answers. It is found that all these firms did not employ computers in their offices.

Question 1- Type of work wholly or partly performed/ will be performed by computer.

1- Budget forcasting and cashflow
2- Estimating
3- Cost planning
4- Network analysis
5- Taking off quantities
6- Squaring dimensions
7- Abstracting and billing
8- Printing bill of quantities

9- Tendering and post tender work
10- Variation bills and price adjustment
11- Interim certificate
12- Final account
13- Schedule of rate
14- Non-technical work, payroll, word processing

This question was designed for the following reasons

a) To find out the use of computer for each type work listed at present and in the future.

b) To find out whether use of computer tends to increase or decrease in future.

Table 1- Summary of response to question 1.

	Present	Future
1- Budget forcasting and cashflow	7	14
2- Estimating	5	14
3- Cost planning	12	11
4- Network analysis	2	6
5- Taking off quantities	4	3
6- Squaring dimensions	5	4
7- Abstracting and billing	8	6
8- Printing bill of quantities	16	7
9- Tendering and post tender work	9	5
10- Variation bills and price adjustment	7	9
11- Interim certificate	7	7
12- Final account	4	8
13- Schedule of rate	3	8
14- Non-technical work, payroll, word processing	10	12
	99	114

Question 2- Which type of computer is/to be used?

1- Micro computer
2- Mini computer
3- Mainframe
4- Others

This question was designed to find out the preferred system in the industry.

Table 2- Summary of response to question 2.

	No of firms
Micro computer	27
Mini computer	11
Mainframe	4
Others	0
Not used	15
No reply	4
	61

This is 57 answers from 48 firms.

The micro computer system is as expected the most preferred system. There were 15 firms which did not use and would not use computer in the near future, thus 33 of 48 firms would employ computer in the near future.

Question 4- The computer system used/to be used is/to be

1- Purchased
2- Rented
3- Leased
4- Others

This question was designed to find out the mode of employment of computer. Most firms either purchased or leased their computers, that is 32 of 39 firms. Only 6 of 39 firms rented their computers. The results indicate that only a firm would rent an expensive main frame system.

Table 4- Summary of response to question 4.

	No of firms
Purchased	20
Rented	6
Leased	12
Others	1
Not used	15
No reply	4
	58

This is 54 answers from 48 firms.

Question 5- What is the range of the total annual turnover of the firm.

1- Under # 2 million
2- # 2 - # 4 million
3- # 4 - # 5 million
4- # 5 - # 7 million
5- # 7 - # 9 million
6- # 9 - #11 million
7- #11 - #15 million
8- #15 - #25 million
9- #25 - #50 million
10- Over #50 million

The range of turnover was carefully scaled to cater for the whole sample firms. It was found that the lowest and highest ranges should be further scaled down to yield a more precise results. Although the beginning of a range continues with the end of the last range, it does not create a problem because the chace of having exact turnover is virtually none.

Table 5- Summary of response to question 5.

	No of firms
Under # 2 million	10
# 2 - # 4 million	13
# 4 - # 5 million	8
# 5 - # 7 million	0
# 7 - # 9 million	4
# 9 - #11 million	3
#11 - #15 million	1
#15 - #25 million	2
#25 - #50 million	0
Over #50 million	8
No reply	3
	52

Question 6- What is the range of the age of the firm.

1- Under 10 years
2- 10 - 20 years
3- 21 - 30 years
4- 31 and over

This question was designed for classification of firms to put them in this four group for analysis.

Table 6- Summary of response to question 6.

	No of firms
1- Under 10 years	6
2- 10 - 20 years	13
3- 21 - 30 years	9
4- 31 and over	24
	52

4.1.5 Method of analysis

All answers will be used for analysis to give a general picture of reults of all the response sample firms. In order to have more understanding of the results similar analysis will be performed with respect to size and age of firms where it is necessary. the main purpose is to discover any similarities and differences of results between different sizes and ages of firms.

a) size

The respondents are divided into three groups according to the number of employees. These three are small, medium and large firms with respectively nil-four, five and thirty one and over employees.

b) age of firms.

The respondents are also divided into four groups according to

the number of established years. These four are very young, young, mature and old firms with respectively less than ten, ten-twenty, twwenty one to 30 and 31 and over years.

4.1.6 Test for significance

The analysed answers in this survey will be subjected to a series of significance tests if necessary in order to reach a more definite conclusion. A significance test means a 5% chance of having a wrong conclusion in a single test or an aggregate of equally divided 5% chance in a series of tests for a single conclusion as the case may be.

a) population of computer.

The proportion of firms using computers is used as an indicator of population of computers and can easily be found from the analysed answers in the following tables. From the previous works and reports it was said to be around 15%. The proportion found in this survey is to be tested against a significant difference from the said 15% using binominal test. However this proportion will not indicate very well the extent of computerisation in the PQS firms because it only reflects the proportion of the firms used or did not use the computer.

b) extent of computerisation.

The whole scope of work in quantity of surveying firm is outline to be 14 types in such a way that they would not excessively and unnecessarily separate the scope of work. they are the types of work listed in Question 1. The reasons for separating the work

are to obtain a better study and analysis of the results and to have more precise knowledge on computerisation in a PQS firm.

In order to have a more precise analysis of the population and extent of computerisation the term, level of computerisation is used to indicate how many types of listed work are wholly or partly performed by computers.

If a firm for instance uses computer to work on 5 types of listed work it will be said to have 5/14th level of computerisation. This means the level of computerisation will range from 0 for firms not usually using computers to 1 for firms using computers for all types of listed work. The actual extent of using computer of each type of listed work will differ from one firm to another. It is difficult to determine the exact commitment of a firm towards computerisation. The level of computerisation with respect to the type of listed work will most probably indicate to a lesser or greater degree the extent of commitment within a firm.

The level of computerisation of each firm is to be used to obtain a weighted mean in computing the extent of computerisation of the respondents. The computed figure will give a more reliable indication on the population and hence the extent of computerisation of the respondents as a whole.

The extent of computerisation with respect to each size and age group of firms will also be computed. It is hypothesized that the extent of computerisation is higher with a larger and older firm.

c) - Priority towards computerisation.

It is also hypothesised that a priority towards computerisation in respect of the type of listed work. This hypothesis is to be tested by using Chi-square test. If this hypothesis is true, the overall priority will be determined according to the number of firms using computers for each type of listed work. However the priority will be determined according to the number of firms using computers for each type of listed work. However the priority will only depend on individual decision and necessity of a firm. In addition the priority with respect to future computer used of each size of firms will be similarly determined and compared.

For firms with over a hundred employees it is assumed that these firms has had a maximum of 300 employees respectively.

Moreover for firms with less than 2 million pounds or over 50 millions pounds turnover a year it is assumed that these firms has had at least five hundred thousand pounds or a maximum of hundred million pounds turnover a year respectively.

d)- preference of computer system.

Chi-square test will be used to significantly confirm any preference of computer system employed by the sample firms.

4.1.7 Analysis of answers

In the following analysis the significance tests are given with the computation of extent of computerisation.

a) population

Table 7 - Replies form firms.

(Figures in brackets included replies without answers)

Size of firms (employee)	No of firms	%of total firms
0 - 4	18 (38)	34.6 (44)
5 - 30	22	42.3 (49)
31 and over	12	23.1 (7)
	52 (72)	100.0 (100)

In analysis of population of computer in PQS firms the replies without answers are included because it is known that they were small firms and did not employ computer. These are 20 firms. The number of firms is 72 altogether.

There were 26 firms employing computers in their offices.This is 36% of the total. The population of computer is expected to be around 15%.

The found population is 21% higher than expected.

Null hypothesis: Population of computer is 15%

Alternative hypothesis: Population of computer is greater than 15%

Sample size, N = 72

No of firm using computer, B = 26

Expected 15% of firms used computer

Therefore;

P = 0.15
Q = 0.85

and therefore,

NP = 10.8
NQ = 61.2

Since both NP and NQ are bigger than 10, used normal distribution approximation for binomial test

Since B > NP, therefore,

B'= 26 - 0.5 (for continuity correction from B)

Now, Z = (B' - NP)/ v (NPQ) = 4.852

For an upper-tail test at 5% level of significance, critical value of Z = 1.645

Therefore, null hypothesis is rejected

It is established that the found 36% is significantly higher than the expected 15%.

Table 8 - Level of computerisation and size of firms.

(Figures in brackets included replies without answers)

Size of firms (employee)	No of firms with computer	without computer	3/14 and more present	future
0 - 4	5	13	3	8
5 - 30	10	12	5	12
31 and over	11	1	7	10
	26	26 (46)	15	30

On further analysis of the population with respect to size of firms it is found that about 28% of small firms (5 of 18 firms), 45% of medium firms, (10 of 22 firms) and 92% of large firms 11 of 12) was employing computers. This shows that the overall 36% of population depends mainly on the size of firms.

Therefore, the distribution of the size of the response firms

should conform to that of the whole population of PQS firms so as to reflect the population of the computer. The former distribution is about 53% small firms, 31% medium firms and 16% large firms. The latter distribution is estimated to be 44% small firms,49% medium firms and 7% large firms. Although the two distributions does not match each other very well, there is some sort of compensation effect. The higher percentage of small response firms is compensated by the same in large response firms.

The conclusion is that 36% of population of computer should be very accurate estimation. Nevertheless, this does not reflect the extent to which a firm is computerised.

b) extent of computerisation

1-general

The extent of computerisation of all the seventy two firms is computed as:

$$\text{Extent of computerisation, } E = \frac{\sum_{i=0}^{14} L_i \cdot N_i}{\sum_{i=0}^{14} N_i}$$

Where L = Level of computerisation

N = No. of firms with L correspondingly

$$\text{Therfore, } E = \frac{U}{14 \times N}$$

Where U = Total no. of uses

N = Total no. of firms

Table 9- Use of computers

Type of work	No. of firms: Small firms Pre	Small firms Fut	Medium firms Pre	Medium firms Fut	Large firms Pre	Large firms Fut	All firms Pre	All firms Fut
1		4	4	10	3	7	7	21
2	1	5	2	10	2	4	5	19
3	2	5	5	11	5	7	12	23
4				4	2	4	2	8
5			1	3	3	4	4	7
6	1	1	1	4	3	4	5	9
7	2	3	3	7	3	4	8	14
8	4	6	5	10	7	7	16	23
9	2	5	3	5	4	4	9	14
10		4	2	7	5	5	7	16
11		1	3	8	4	5	7	14
12		2	2	7	2	3	4	12
13		2	1	5	2	4	3	11
14		4	3	9	7	9	10	22
	12	42	35	100	52	71	99	213

The extent of computerisation for all firms at present is calculated as;

Where U = 99 and N = 72 (replies without answers included)

Therefore;

$$E = 99 / (14 \times 72) = 10\%$$

This implies that the firms on an average used computers for about one and quarter type of listed work. Perhaps it does not make sense to say of a fraction of a type of listed work. But this only gives an idea of the computed pecentage in relation to all the 14 types of listed work. This is substantially low because many firms did not use the computer at all or used computers only for one or two listed work.

The extent of computerisation in the near future for all the firms is calculated as;

Where U = 213 and N = 52

Therefore ;

$$E = 213 / (14 \times 52) = 29\%$$

This is about 4 types of listed work in a firm. It is found to be three-fold increase compared with present and future employment. This implies that many firms were trying to employ computers in the future.

2) size of firms

Null hypothesis: No difference in extent of computerisation of each size of firms

Alternative hypothesis: Differnce in it

The extent of computerisation at present with respect to size of firms is computed separately.

Small firms: $E = 12 / (14 \times 38) = 2\%$

Medium firms: $E = 35 / (14 \times 22) = 11\%$

Large firms: $E = 52 / (14 \times 12) = 31\%$

Expected extent of computerisation taken to be the average of total percentage.

$n_i = (2+11+31)/3 = 14.67$

$$\text{therefore } X^2 = \frac{(N - n_i)^2}{n_i} = \frac{(2 - 14.67)^2+(11 - 14.67)^2+(31 - 14.67)^2}{14.67}$$

$$= 30.03$$

At 2 degrees of freedom and 5% of level of significance

critical Chi=square value = 5.99

Therefore, null hypothesis is rejected

It can easily be seen that there is a large gap between each size of firm. In fact, it is found that the extent of computerisation is significantly different from each other.

There was very little extent of computerisation in small firms. It is only about one third of a type of listed work to be performed by computers.The 11% for medium firms is not far from the average 10%. But for the large firms, it is greatly more than the average. The 31% of large firms implies that the large firms used computers for about 4 and third of the listed work.

The conclusion from this is that the larger firms were more computerised in other word they used computers to a greater extent.

3- age of firms

Table 10- Use of computers with respect to the age of the firm.

	No. of firms				
	Age of firms (Years)				
Type of work	< 10 Yrs	10 - 20 Yrs	21 - 30 Yrs	> 31 Yrs	Total
0	3	8	4	11	26
1	1	2		2	5
2	1		2	3	6
3	1	1	1	1	4
4		1		1	2
5				2	2
6			2	1	3
7		1		1	2
8					
9				1	1
10					
11				1	1
12					
13					
14					
	---	---	---	---	---
	6	13	9	24	52

The 20 replies without answers are excluded from hereon because the ages of their firms are not known.

The extent of computerisation with respect to age of firms is computed separately as before.

Null hypothesis: No difference in extent of computerisation of each age group of firms

Alternative hypothesis: Difference in it

The extent of computerisation at present with respect to age of firms is computed separately.

Very Young firms : $E = (1x1 + 1x2 + 1x3) / (14 \times 6) = 7\%$

Young firms: $E = (2x1 + 1x3 + 1x4 + 1x7) / (14 \times 13) = 9\%$

Mature firms: $E = (2x2 + 1x3 + 2x6) / (14 \times 9) = 15\%$

Old firms:

$$E = \frac{(2x1 + 3x2 + 1x3 + 1x4 + 2x5 + 1x6 + 1x7 + 1x9 + 1x11)}{(14 \times 24)} = 17\%$$

Expected extent of computerisation taken to be the average of total percentage.

$n_i = (7+9+15+17)/4 = 12$

$$\text{therefore } X^2 = \frac{(7 - 12)^2 + (9 - 12)^2 + (15 - 12)^2 + (17-12)^2}{12} = 5.66$$

At 3 degrees of freedom and 5% of level of significance

critical Chi=square value = 7.82

Therefore, null hypothesis is accepted.

There is a gradual increase from very young to old firms. However the increase between each group was small. In fact the extent of

computerisation of different age of firms is not significantly different from each other. This shows that computerisation is not very much related to age of firms.

There is a fact that some firms employed computers for the sake of gaining prestige, especially for a long established firm. The result of only a small gradual increase in extent of computerisation shows that this factor is not substantial with regard to computerisation.

4) priority towards computerisation

The prioritty of computerisation of the listed work can best be understood not only by comparing the number of firms using computers at present but that in the future for each listed work.

i) at present

Every listed work was performed by computers in one or other office and in the future as well.

Null hypothesis: No difference in number of computer use of each listed work.

Alternative hypothesis: Difference in it.

See table 9

$n_i = 99/14 = 7.07$

Therefor $X^2 = 186.91/707 = 26.43$

At 13 degrees of freedom and 5% of level of significance,

critical value of Chi-square = 22.36

Therefor, null hypothesis is rejected.

There is a significant difference in number of firms using computers for each listed work. This suggests that there is a priority towards computerisation.

The order was as follows:

1) Printing Bill
2) Cost planning
3) non technical work.
4) Tendering and post tender work.
5) Abstracting and billing
6) Cashflow(budget)forecasting
6) Variations and price adjustment
6) Interim certificate.
7) Estimating
7) Squaring
8) Taking off
8) Final account
9) Schedule of rate.
10) Network analysis.

The top two are printing Bill and Cost Planning. The most probably reason is that these are the main types of work which has already sophisticated sofware and would have a high standardisation for computer processing in a PQS firm. The last two are Schedule of Rate and Network analysis. The former is not a usual work in a PQS firm unless it mainly engages in maintenance work. The latter is the least common work in a PWS firm. No wonder it is at the bottom of the list.

ii) near future

The increase in computerisation was noted in the comments of answers to be exceptionally high. It is a three-fold increase. the medium firms accounted for about 57% of the increase; the small firms for 26% and the large firms for 17%. The reason is taken to be that the medium firms are more financially equipped and have a larger workload than the small firms. These lead to a

greater incentive towards computerisation. The large firms have already used computers for many listed works. There will not be as much room as the others towards computerisation.

Null hypothesis: No difference in number of increase in future computer use of each listed work.

Alternative hypothesis: Difference in it

see table 9

Total no of increase = (14+14+11+6+3+4+6+7+5+9+7+8+8+12) = 114

Expected number increase taken to be avarage of total = 114/14

Therefore X^2 = 19.35

At 13 degrees of freedom and 5% of level of significance,

critical Chi-square value = 22.36

Therefore, null hypothesis is accepted.

It is found that there was no significant difference in the number of increases. This implies that the firms did not give the mode of compilation of software for the listed work they intended to be computerised. This might imply that many of these firms merely had the intention to employ a computer but had no planning on how to do so.

iii) size of firms

The types of listed work with the greatest increase towards computerisation inb the future with respect to the size of firm were as follows:

Small firms: Cashflow(budget) forecasting

Variations and price adjustment

Non-technical work

Medium firms: Estimating.

Large firms: Cashflow (Budget) forecasting

5- computer system

Null hypothesis: No perference to type of computer system chosen

Alternative hypothesis: Preference existed in the same

see table 2

expected no of firms taken to be average of total = 42/3

Therefore, X^2 = 19.9

At 2 degrees of freedom and 5% level of significance,

critical Chi-square = 6.0

therefore, null hypothesis is rejected.

It is found that firms usually purchased a micro-computer system. Moreover some firms used more than one type of computer system.

4.2 Conceptual module

The purpose of this section of this chapter is to explain the method of collecting and collating information for the management information system and its' organisation structure that powers the system.

4.2.1 Method of approach

A module of general flow of information (Fig. 1) was constructed with the help of number of professionals in the field of

construction management. From which a management decision check list was deduced.

Three forms designed to help individuals, decision makers, to list their understanding of their decision making process in conjuction with the overall objectives of their company.

These forms were not used as a questionnaire. It would have been unrealistic to expect department heads to spend the large amount of time necessary to fill in the form correctly. It was used as a guide for collecting and recording information derived from interviews, discussions and the investigation of policy and procedural documents and forms.

The results from the investigation are presented in the next chapter.

4.2.2 Manamement decision check list

a) PROJECT SELECTION

1. Is new work needed?
2. What type of work is preferred - Contract Work?
   Speculative Projects?
   Both?
3. Decide upon probable future clients.
4. What type of speculative work is preferred and in which areas?
5. Can speculative work be fitted into existing or obtainable resources?
6. Is speculative work to proceed (technical and commercial feasibility)?

7. Is package deal to proceed (technical feasibility, profit yeild and resource utilisation)?

8. Is invitation to tender to be accepted (resource utilisation)?

b) Design

9. Decide upon detail design requirements in respect of:-

   a) Need

   b) Function

   c) People

      - Aesthetics
      - Ergonomics
      - Safety

   d) Sales

   e) Production

   f) Maintenance

   g) Cost

c) OUTLINE PLANNING AND COST ESTIMATING

10. Does project or any part of it warrant detailed pre-tender planning on an operational basis?

11. Decide on

   a) tender bid

   b) price

   c) sale value

12. Is work to proceed?

d) DETAILED PLANNING

13. Decide upon construction method.

14. Decide upon work programme.

15. Decide upon resource requirements:-

    a) Labour

    b) Plant

    c) Materials

    d) Sub-Contractors

    e) Details and Drawings etc.,

e) EXECUTION OF WORK

16. Selection of personnel

    a) Staff

    b) Operatives

17. Decide upon and put into effect wages scheme.

18. Decide upon and put into effect incentive scheme.

19. Decide upon suppliers and place orders.

20. Decide upon sub-contractors and place orders.

21. Decide upon plant and equipment (purchase, hire or transfer).

22. Decide when the work is digressing from programme and what, if any, corrective action to take.

23. Decide when actual cost is exceeding budget cost and what, if any, corrective action to take.

24. Determine the amount of interim valuations, variations and all contractual claims.

25. Determine the amount payable to :-

    a) Operatives

b) Sub-contractors

c) Suppliers, etc.,

26. Decide when standard of workmanship and materials are not in accordance with the specification and rectify the situation.

27. Determine resource utilisation and re-allocate around contracts as necessary.

f) COMPLETION

28. Determine amount of final account.

29. Determine amount of sub-contractors and suppliers accounts.

30. Decide if sales are going as planned and if not what action to take to rectify the situation.

31. Determine final profitability of contract.

4.2.3 Analysis form

The first sheet was designed to determine the relationship of a department to the remainder of the companyy and to see where the information generated and used in the department, fitted in relation to the overall structure.

a) ANALYSIS FORM

The purpose of this form is to determine the Management decisions that have a direct influence upon the effectiveness and profitability of the Company and to ascertain a system of information flow that will facilitate the making of these decisions with a clear objective knowledge of all the relavant facts.

NAME .....

DEPT. .....

- What do you consider to be the objectives of the Company?
- Briefy describe the role your Department plays in helping the Company to achieve its objectives.

4.2.4 Departmental information

The second sheet determines:-

- The key decisions made by a particular department.
- The information necessary to give a clear objective knowledge of the factors influencing the decision.
- The basic data necessary to generate this information.
- The feedback information necessary to judge the level of performance of the action that resulted from the decision.

a) KEY MANAGEMENT DECISIONS

State the key decisions made by your Department relating directly to the planning, control, utilisation or co-ordination of the Company's resources.

These should <u>not</u> include the day to day decisions necessary to run the office, such as deciding upon the stationery requirements of the Department, these are of course, very necessary decisions to make, but do little to improve the Company's competitive position.

A key decision is more likely to be, for example:-

1. The amount of a tender.
2. The type of mechanical plant be used on a project.
3. The amount of an interim valuation.
4. The sequence of operations.
5. The subcontractors and suppliers to be used on a project.

b) PRIMARY INFORMATION

List against each decision the type of information you consider necessary for a clear objective knowledge to be gained of all the factors which may influence your decision. This should include information that can be generated within your own department or obtained from other departments or external parties.

Example:-

1. Cost of direct work.
2. Cost of sub-contract work.
3. Overhead Costs.
4. Capital expenditure.
5. Rate of Return.
6. Competitors bids.
7. Contract particulars, etc.,

c) BASIC DATA

In column 2 there will be types of information that could be or are at present generated in your department. Against each such item list the basic data you would require to produce this information.

Example:-

1. Capital outlay.
2. Contract period.
3. Sequence of activities.
4. Value of activities.
5. Discount factor, etc.,

d) CONTROL INFORMATION

Against each decision in column 1 list the information that you consider necessary to judge the level of performance of the action that has resulted from your decision.

Example:-

1. Amount of tender - 1. Tender results.

4.2.5 Transit and archived information

The third sheet records the service information, that is to say, the information generated in one department but used in another.

a) Service information and advice

Your Department may produce and service other Departments with information and advice that is of no direct benefit to its own effectiveness. If this type of information has not been included on the previous sheet, it should be listed below.

b) BASIC DATA

Against each item list the basic data you require to produce this information.

c) DEPARTMENT SERVICED

Against each item in column 1 state the department serviced with the information or advice.

4.2.6 Samples of interviews

"..... that there is a belief that all disciplines within a category (planners, surveyors, buyers, plant specialists etc.) perform the same function within a company a therefore should be closely related within the organisation. This is not so, a pre-tender planner performs a different function to a contract planner , similarly a quantity surveyor involved with tendering will study cash flows, legal implications etc. while a quantity surveyor during the contract will be concerned with valuations and variations."

"....the enquiries were split into different categories when received by the company. These categories ranging from tenders requiring the full pre-tender planning and estimating function to those to be assessed on more traditional bill of quantities procedure and those to be returned. the allocation of the enquiries to the different categories depended upon opinion rather than factual information. The carefully and factually based selection of enquiries at pre-tender stage would have reduced the amount of abortive work and allow more effort to be expended on preparing tenders for work that suited the company;s ability. A degree of selection could be made prior to this by the client if they were informed of the type of work the company was best capable of undertaking."

"Determining competitors ability is a difficult task especially at the enquiry stage. Very few clients will even publish a list of the companies tendering for a project for fear of price

fixing. This is a rather short sighted attitude. Once a firm begins to prepare a tender it quickly learns, via trade connections who it is competing with. This is however too late a stagew in the proceedings for a company to return the enquiry should it realise that it has little echance of gaining the contract. Fortunately the publication of tender results is more wide spread and this gives a firm the opportunity to coolect the information necessary to formulate a bidding strategy. This can only be used at the end of the estimating procedure on future work and not as a means of selecting tenders in the light of competitor's ability. A firm should attract the work it isbest capable of performing and ensure that ots performance is geared to satisfy a need of the market that its competitors have not over exploited. This cannot be done unless a firm is aware of its current performance ability and that of its competitors."

"Cost control is a method of directing future effort in the light of past performance. Within the construction industry it has long term and short term function. The long term function is that of assessing overall company performance by lookiing at the current and projected cost figures for individual contracts. The importance of this was stated in the last sub section. the company investigated had a monthly cost statement prepared that was ideal for this purpose, but it appeared that too much emphasis was placed on the short term (that is to say, a particular contract) rather than the long term relevance of this document. The short term function is that of controlling the work

on individual contracts by comparing budgets with actual costs. For this a weekly cost statement was prepared that determined the cost of each operation on a contract. This appeared to be rather pointless as many of the oeprations werre one-off operations on a one-off project."

"Short term cost control should be considerably more flexible, thus allowing the planning engineer to investigate the repetitive operations and plant and labour performance, where there are alternative courses of action. This will leave him more time for calculating future resources requirements, carrying out cost/time studies on future work and investiagting working methods. That is to say, looking ahead rather than over the shoulder all the time."

"After all, cost control is only meaningful when the budget is realistic. Very ofteen operations that look efficient could in fact be drastically improved."

"To obtain a realistic estimate of cost a reasonable degree of planning has to be undertaken to determine working methods, resource requirements and timing and to compare resource requirements with availability. In other words, it is necessaqry to take an overall look at the project requirements in relation to the company's commitments. To achieve this it is necessary to break the project down into definable and reasonably independent operations."

"The traditional tendering procedure requires the submission of a priced bill of quantities with or after the submission of the tender. Most bills are of the traditional standard method format. The bill items give a very poor picture of the project sequence and overall resource requirements, therefore it is difficult to obtain a realistic estimate using the bill of quantities. This virtually means that a large part of the estimating function is carried out twice. Once to obtain a realistic estimate of resource requirements and once to determine the cost of bill items based on standard labour and plant constants and resource prices. The bill of quantities then bueing adjusted in some way to suit the actual planned cost estimate."

"It is difficult to see the reason for an independent purchasing department when its function is split directly between two main sections of the company, Estimating and Resource Allocation and Production. The purchasing manager and a group of purchasing staff could work with the estimating section, determine material prices and deliveries and arrange bulk purchasing. Each production team would include a buyer who would be directly responsible to the construction manager. The purchasing manager would advise regarding bulk purchasing and also furnish the buyer with pre contract quotatations. The buyer would then gain the advantage of easy communication with the rest of the production team and local suppliers and would be able to play a greater part in determining future material requirements and chasing deliveries. This ridiculous situation arises in the

present system where the production team has to inform the purchasing department the maximum price to be paid for materials."

"... the company's information system was rigidly defined down to the last detail. The reason put forward by most department heads as to why such a rigid system was necessary was the lack of competent personnel with the ability to perform their function in the company wihtout the assistance of a rigidly defined system."

C H A P T E R F I V E

GENERAL FLOW OF INFORMATION WITHIN THE PROCESS OF PROJECT MANAGEMENT

5.1 General

Communications within the construction industry have not been particularly successful in the past.

It has been the site manager who has experienced the most significant problems. Two reasons for this can be identified as

a) inadequate information leading to confusion and uncertainties which have caused him to make inappropriate judgements and

b) inadequate feedback mechanism for the site manager to convey his decision making processes back to the rest of the project management team.

Before the introduction of microcomputers to the Construction Industry there seemed to be very little going on that had any particular bearing on it.

The three national bodies: The National Computer Centre, British Computer Centre and the Computing Services Association did not have any program aimed at the Construction Industry. The CICA (Construction Industry Computing Association) exists to provide advice and information on various applications and appears to be

the only major body concerned with this industry.

A system of data co-ordination and coding which could be applied to the whole industry was their major concern. A sub-committee was established under Mr. Alex Gordon OBE FRIBA but the task proved more complex than first appeared.

5.2 Objectives.

This chapter constructs a conceptual model of the flow of information within the whole process of project management. Particular reference will be made to information and documents generated for the production cycle of a project.

5.3 Review.

In 1982 in the first stage of this research (13) the author examined and identified the activities and functions involved on the construction site through case studies of 5 small-medium sized firms. A model was developed. However, since information required for production on site is mainly generated in the early stages of the contract management it was suggested that an overall flow of information is required to examine the most essential common variables. This can be used for the requirements of a minimum computerised documentation and feed-back basis which in turn would be the basis for a computerised integrated management system.

The pieces of information were collected and tested by conducting inteviews, discussions, and collating investigations of policy, procedural documents, forms, surveys and questionnaires.

Consequently, in order to identify the overall flow of information required it was decided to determine the relationship between the department with the rest of the company and to see where the information was generated and fit it into the overall structure and then determine:-

a) the key decisions made by one particular department;
b) information necessary to give a clear objective knowledge of the factors influencing the decision;
c) the basic data necessary to generate this information; and
d) The feedback of information necessary to judge the level of performance of the action that resulted from the decision, and also record the service information. That is to say, the information generated in one department but used in another.

5.4 Flow of information within a project.

Management function objectives are determined by the contractual process and by the influence of the overall industrial environment.

5.4.1 Pre-Contract appraisal

Pre-Contract appraisal is the first objective in the construction

process, and it is achieved in two separate, but similar stages.

a) Pre-tender stage

b) Pre-tender/pre-contract stage

At pre-tender stage a hypothetical model is drawn up once the client's brief is received. The client then has the opportunity to compare costs.

If the tender submitted has been successful the nature of the work is re-examined and if required further analysis and evaluation is then carried out at the Pre-tender/pre-contract stage.

5.4.2 Post-Contract production

Both this and the next stage are in progress at the same time. At this stage the actual project is realised according to client's requirements.

5.4.3 Post-Contract financial monitoring. The work in progress and the work completed are monitored in financial terms and actual costs are compared with the budget.

5.5 Flow charts.

The elements of this flow chart are described and detailed in the following diagrams.

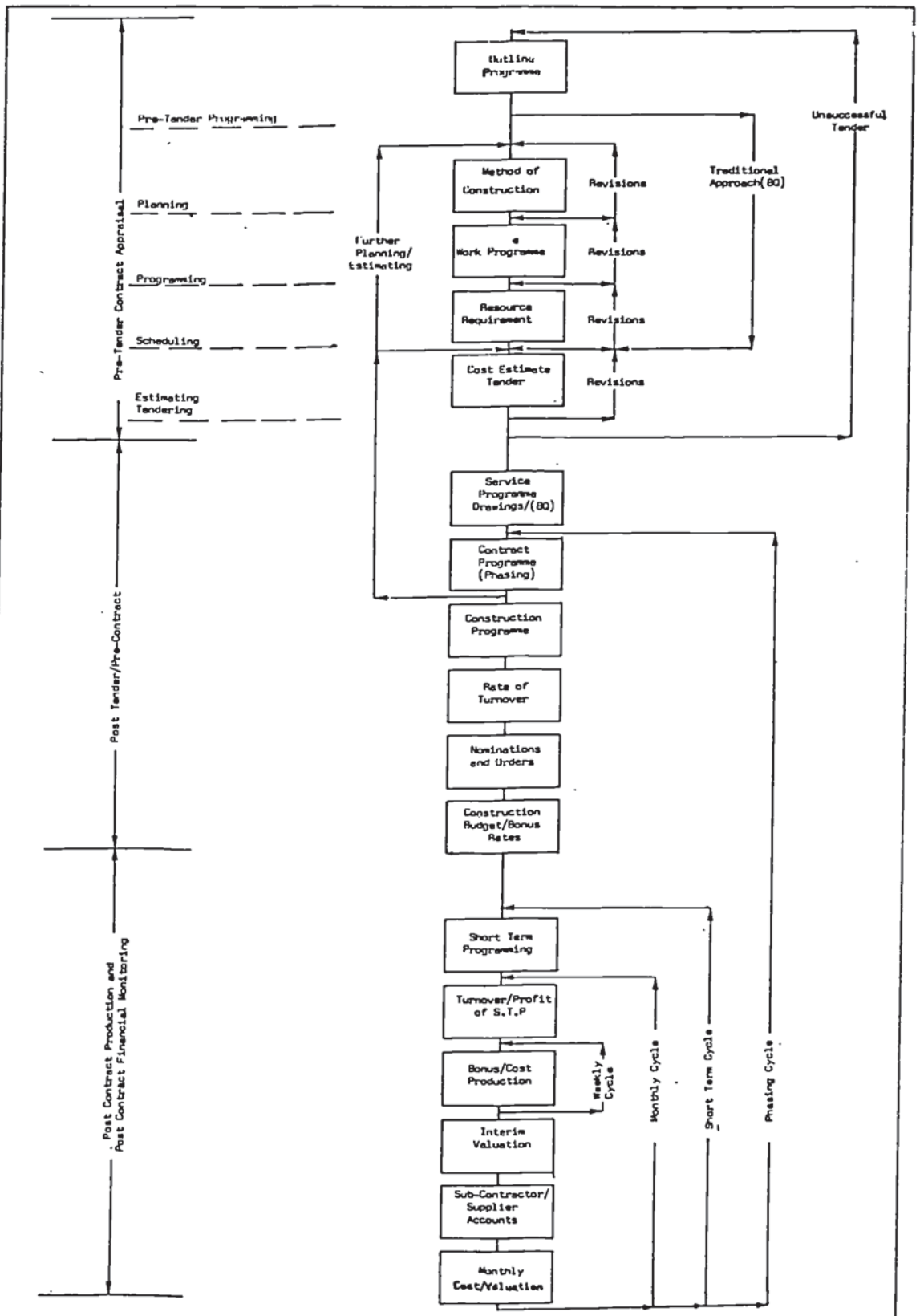

Figure 1. General flow of information for a project

5.5.1 Pre-Tender programming

At pre-tender programming stage, after receiving the clients brief of the contract, a project manager and quantity surveyor has to examine the location conditions and particulars of the site and resources availablity in the area.

Upon the information available and the company experience of such a job, an outline of the work is determined.

The formation and the interrelationship of the activities described are shown in the following diagram.

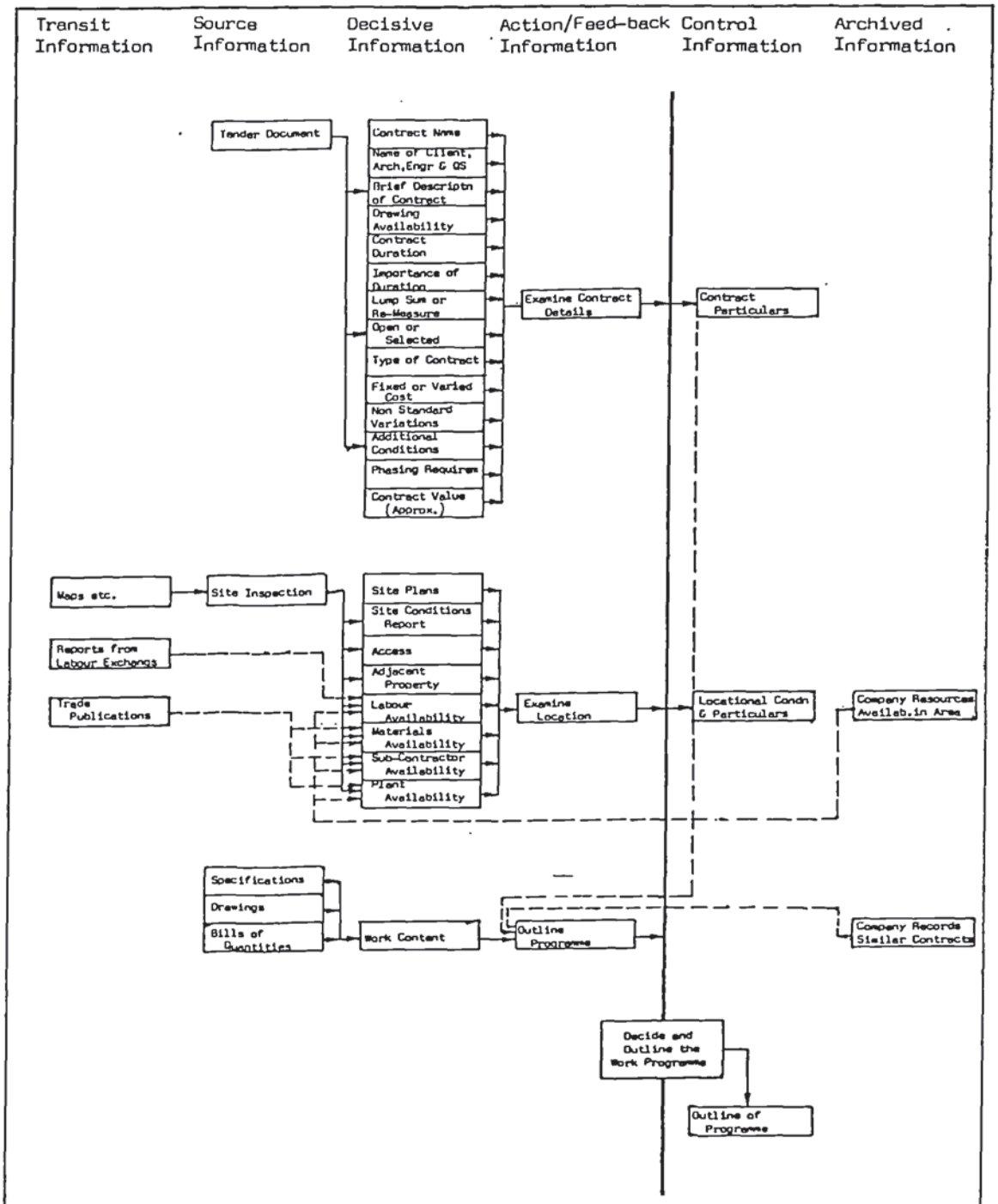

Figure 2. Pre-Tender programming

5.5.2 Planning

The complexity and the nature of the contract and the documents received determine the degree of planning needed at this stage of the contract. If the job is of the more traditional type or the Bill of Quantity approach then the documents are sent to the estimating department to be priced otherwise the planning department carries out the following tasks:

Upon receiving the outline of the programme a variety of construction methods are examined and judgement is based on past experience and knowledge of new technology.

Duration, cost and quality of the alternative methods determines the decisions.

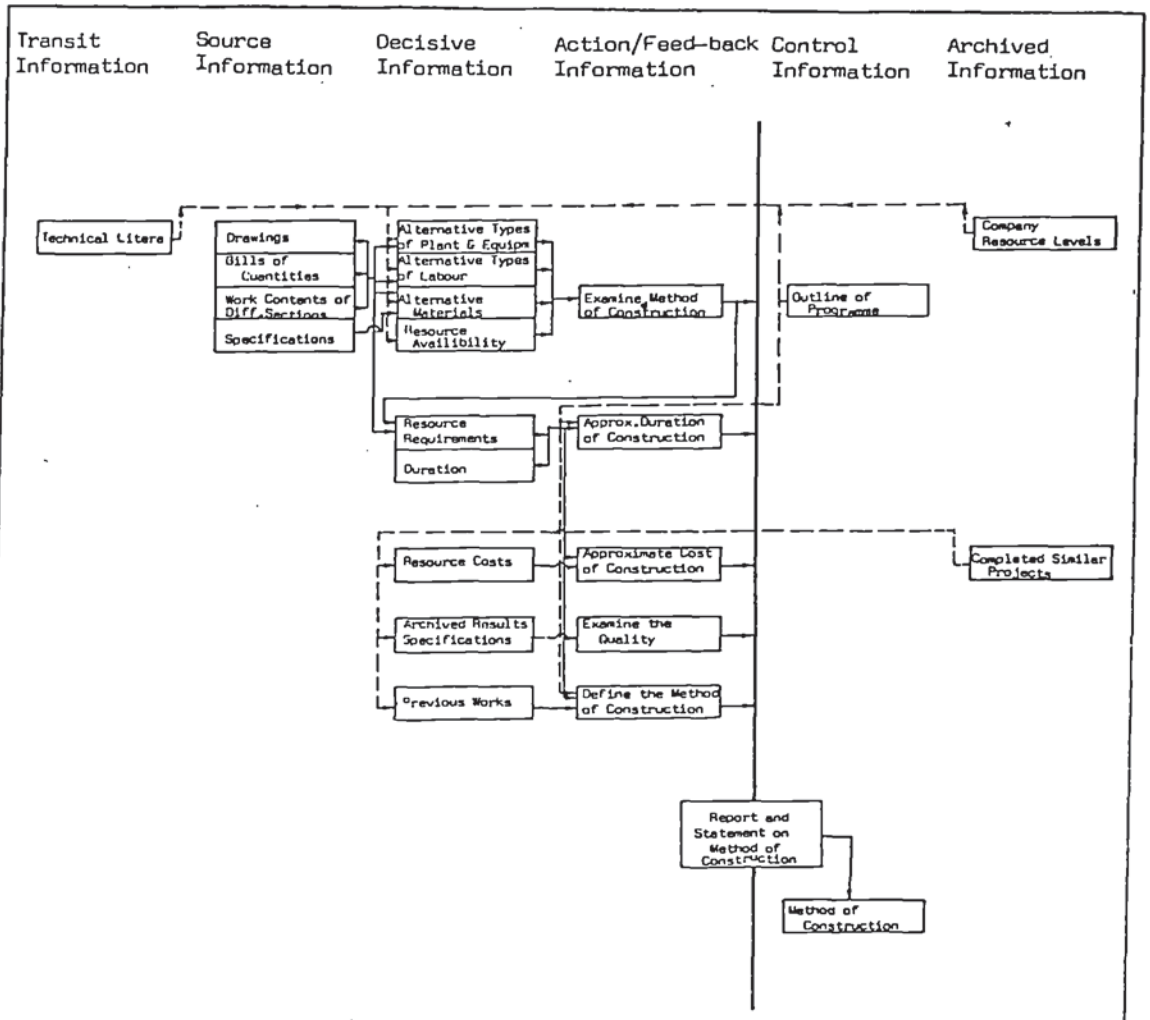

Figure 3. Planning

5.5.3 Programming

From the method of construction statement the sequences of work in terms of operations are derived in examining the limitations and complexity of work. Analysis of the operatives output or work studies will determine the duration of each project.

The overall project duration is arrived at after examining alternative sequences, their duration and the constraint which has been taken into consideration.

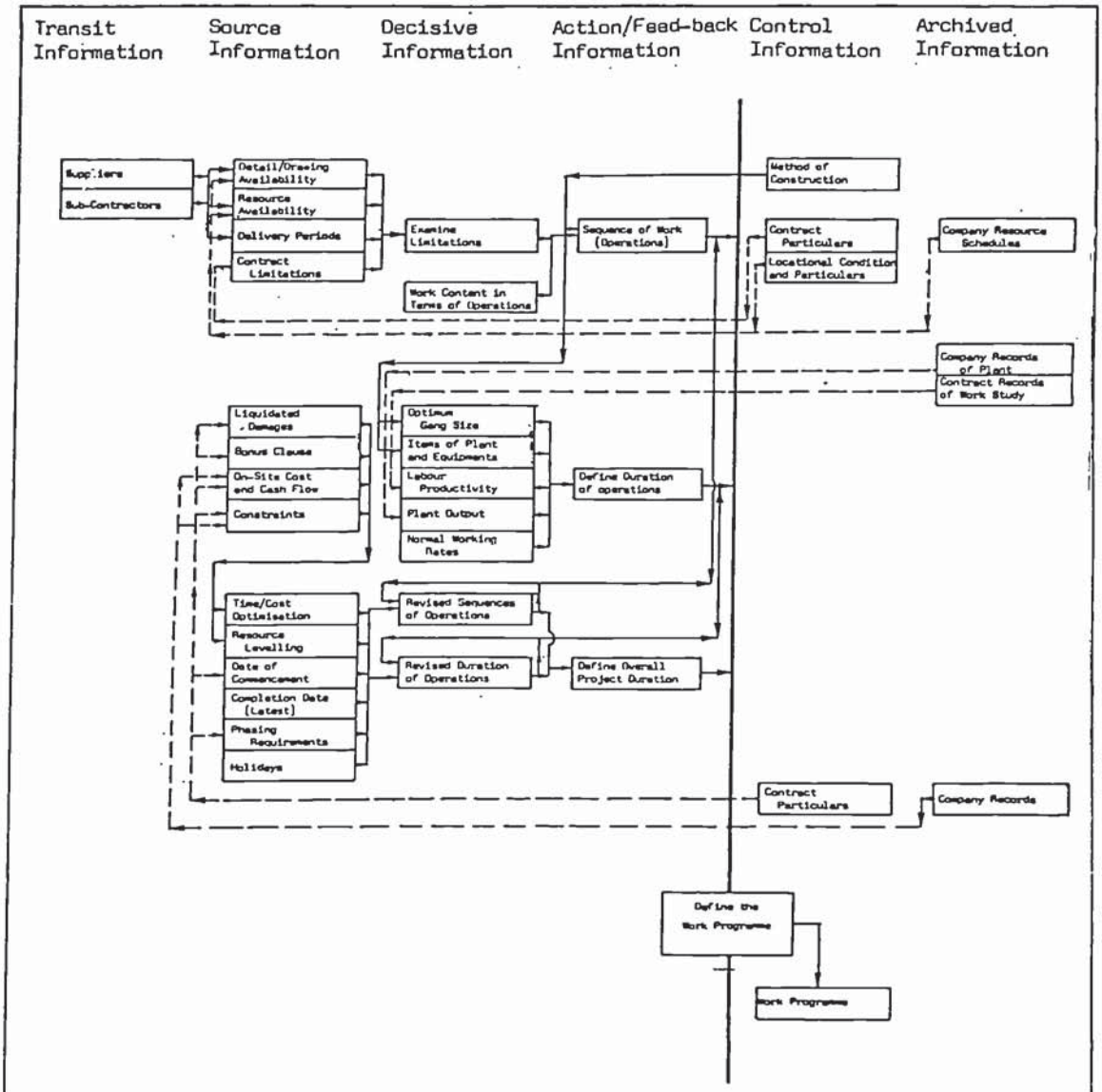

Figure 4. Programming

5.5.4 Resource Scheduling

To determine the resource schedule the work programme must be examined in conjunction with the archived records.

This involves examination of plant, labour requirements and schedules. Staff, materials, and temporary workers should be considered alongside supplier and sub-contractors' attendance and requirements, site welfare and accommodation.

If the resources requirements are unrealistic then either the work programme can be revised or the sequences retried.

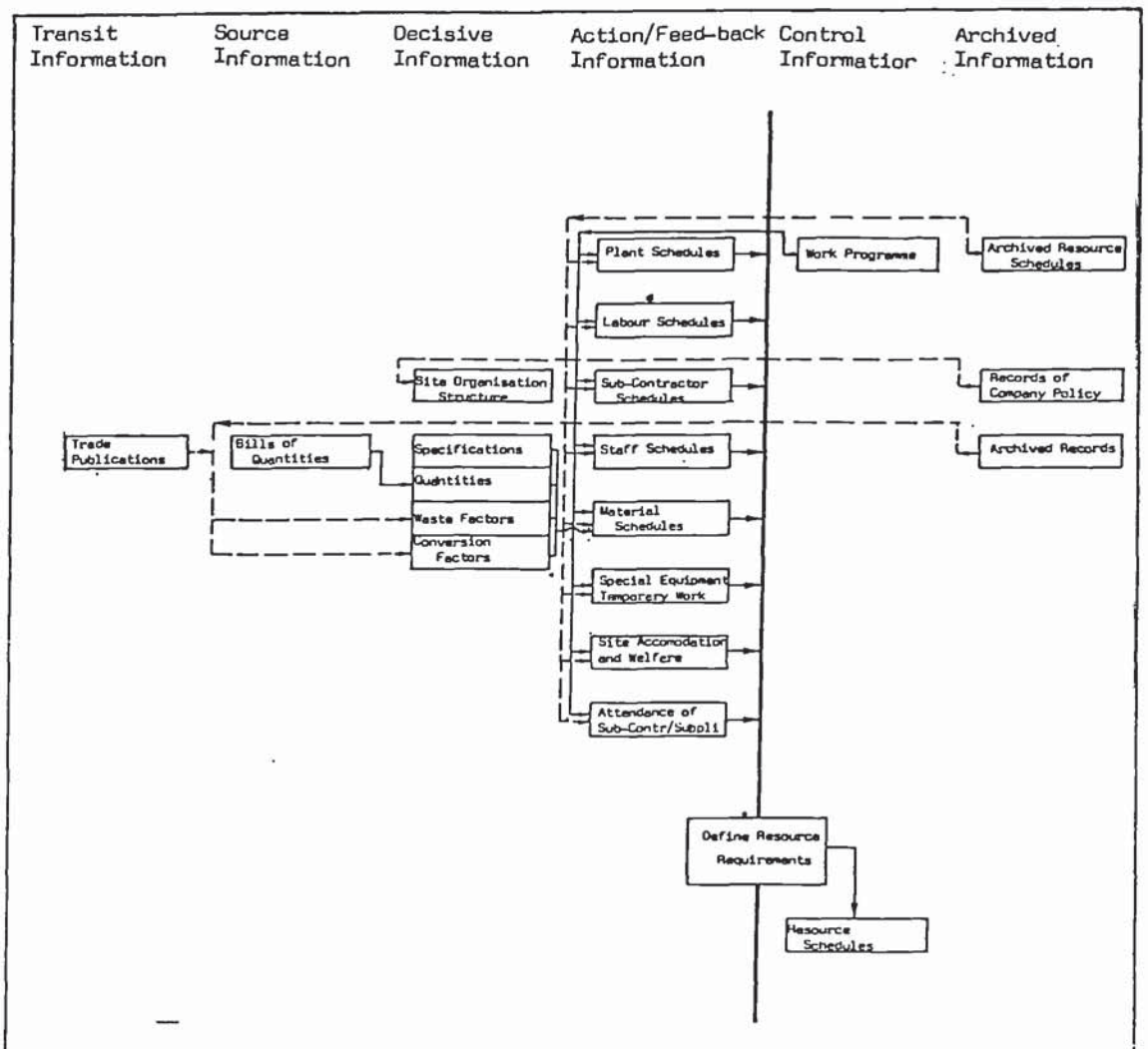

Figure 5. Resource scheduling

5.5.5 Cost Estimating and Tendering

To determine the amount of tender bid for a contract the following information is vitally important.

The resource requirements and the contract particulars, statement or revised statement of the method of construction, work programme or revised work programme, company's board policy and planning, actual turnover, record and patterns of similar jobs previously done.

The functions of this information are to determine the cost of direct work which is derived from examination of the work content, and working methods on which labour, plant and material are dependent.

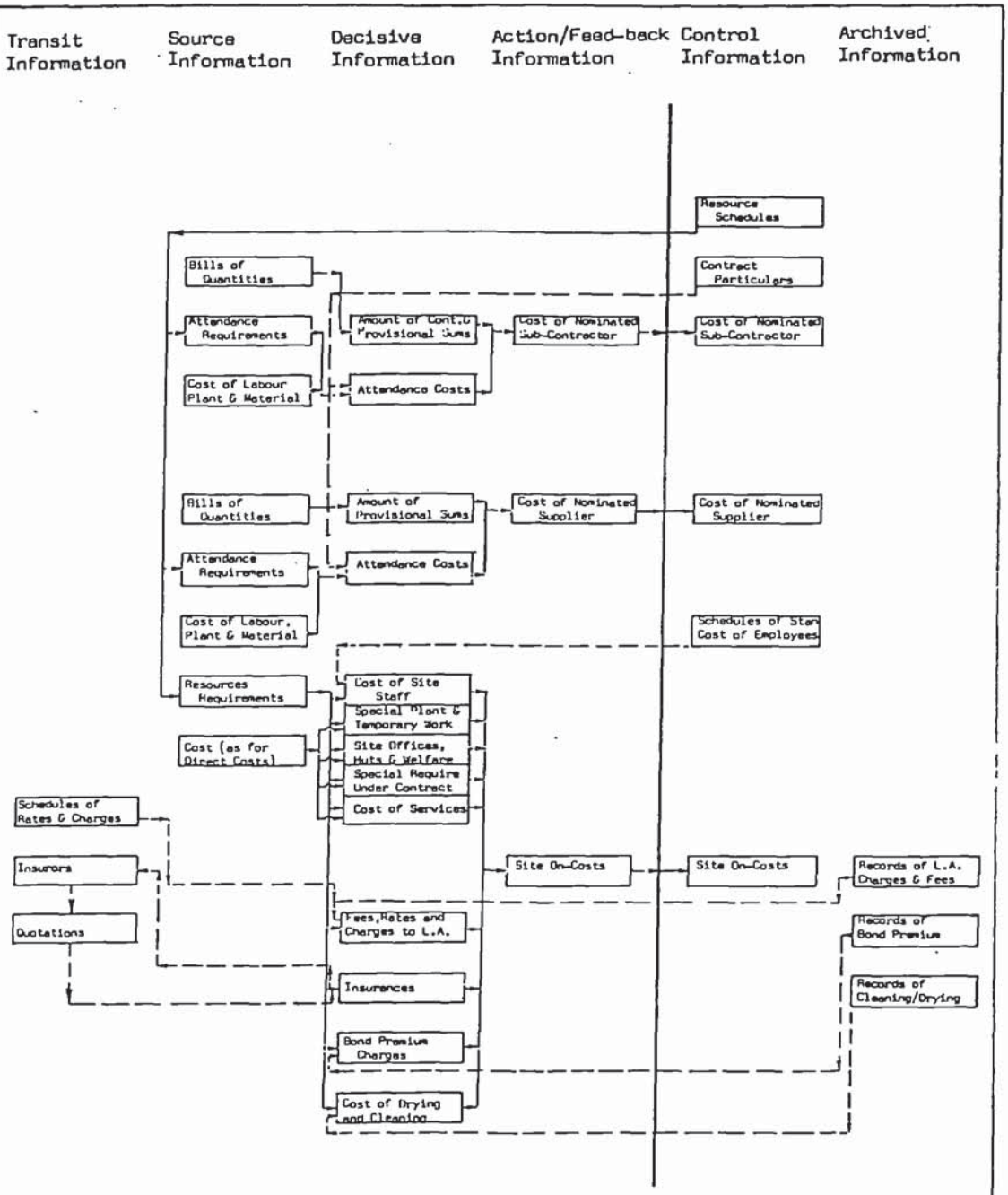

Figure 6. Cost Estimating and Tendering (direct cost)

The following costs must also be taken into account: nominated Sub-Contractors, suppliers, site and Head Office on-costs, and finance charges.

Contingencies and provisional sums are to be included to determine the mark-up value for the optimum tender bid.

Current government policies and resulting economic trends must not be overlooked.

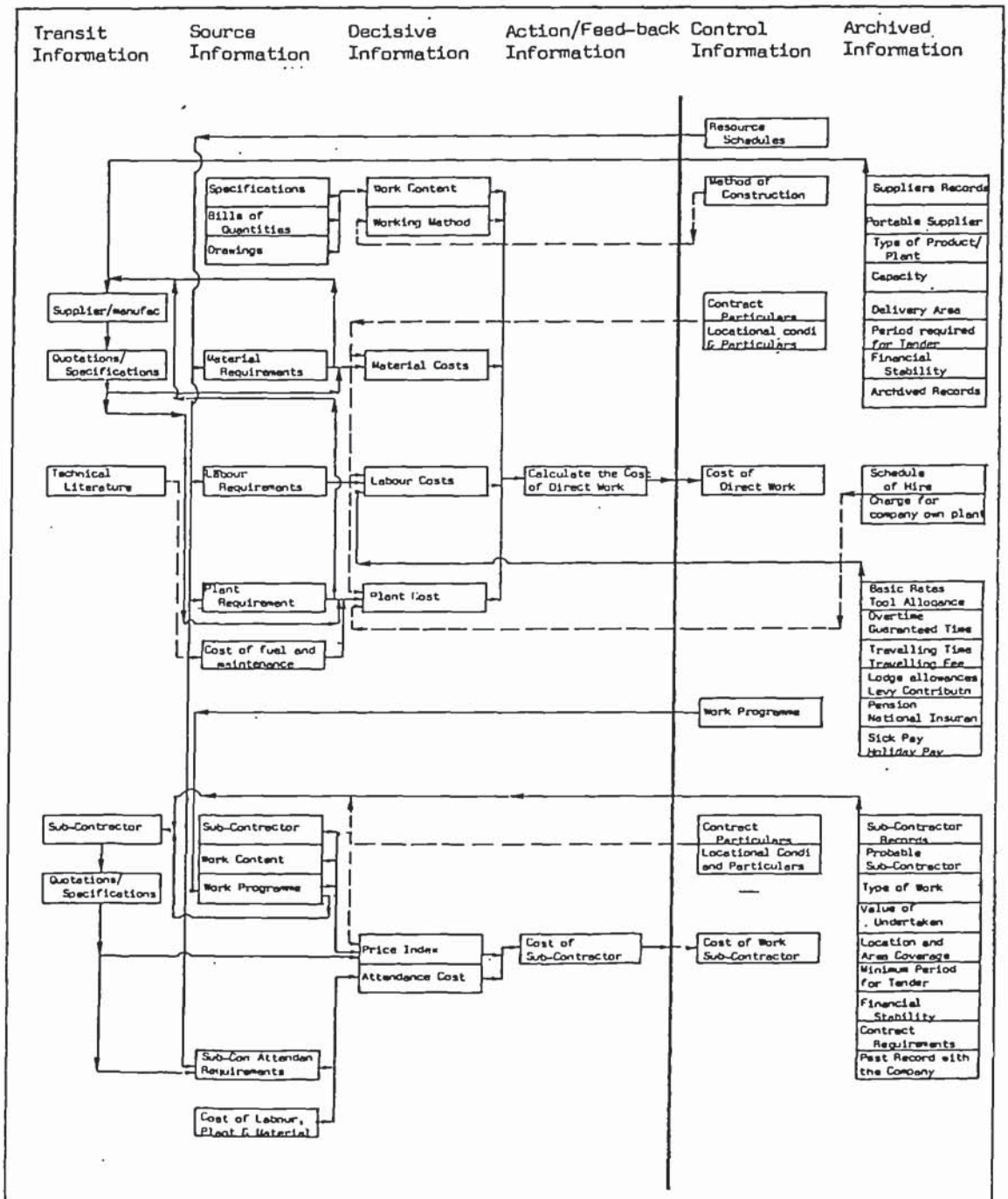

Figure 7. Cost Estimating and Tendering

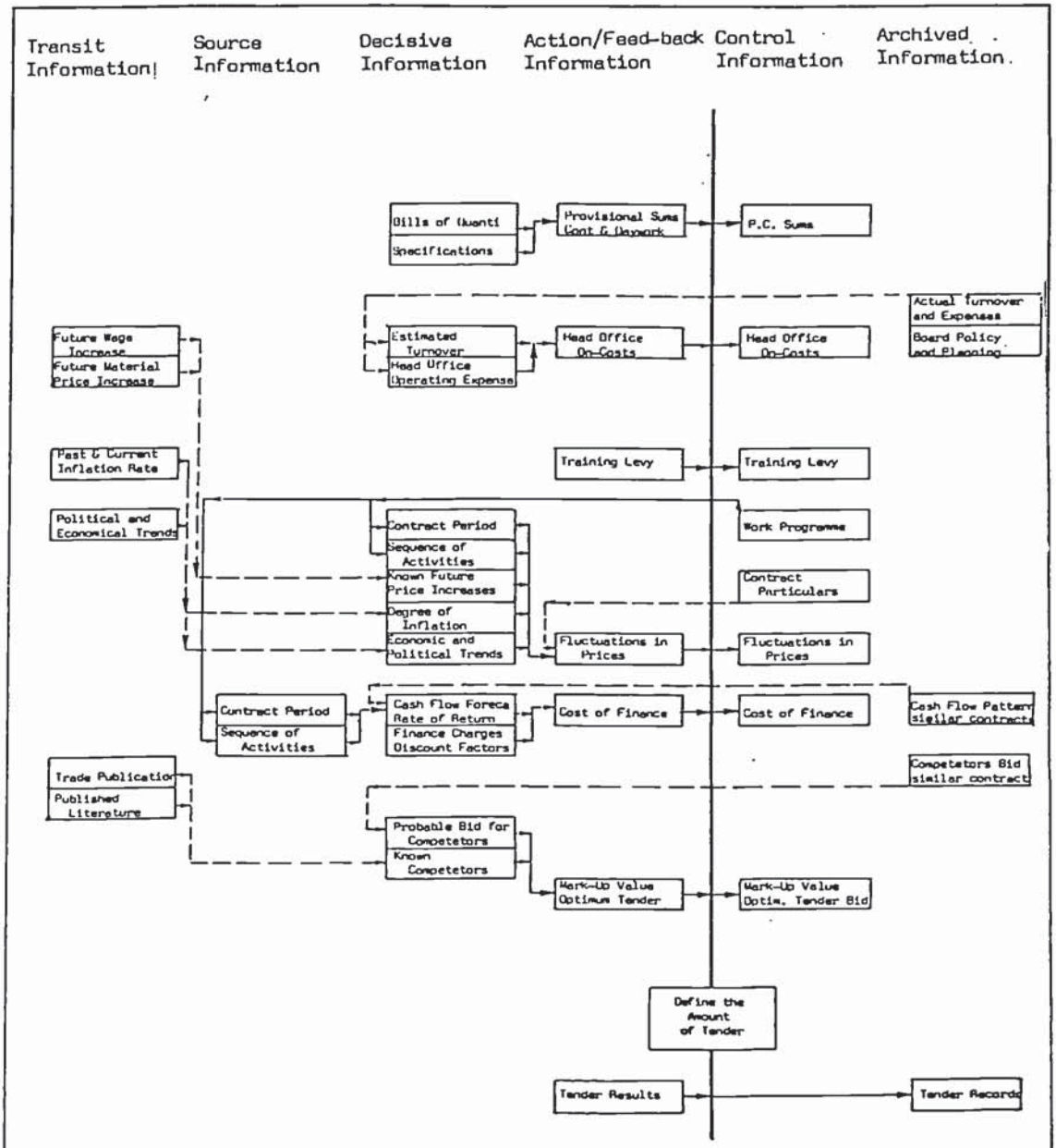

Figure 8. Cost Estimating and Tendering

If a tender has been unsuccessful then the tender document is archived with the company records for future reference. Otherwise the working drawings of the methods of construction are produced followed by preparation and formation of Bills of Quantities using the drawings and tender information.
At this stage decisions regarding further planning in order to determine construction plans and budget can be made.

5.5.6 Contract Programme

It is helpful in judging the contract programme and phasing requirements if the following information is to hand:-

- sequences of work
- date of handover
- start and finishing date of major operations.

5.5.7 Construction Programme

The next step of the project management is to define the construction programme from the contract programme available. (different phases of a contract).
To achieve the construction programme the following functions should be carried out in conjunction with the information required from outside bodies i.e. supplier, sub-contractor, architect and engineer and nomination release dates.
In achieving the above, the sequences and duration of each Sub-Contractor required must be determined by sequences of each operation and duration of each operation.
Consequently the Labour, Plant and Material useage programmes and

charts can be drawn up and from this and the estimate of cost build-up of Labour, Plant, and Material the weekly rate of turnover can be derived.

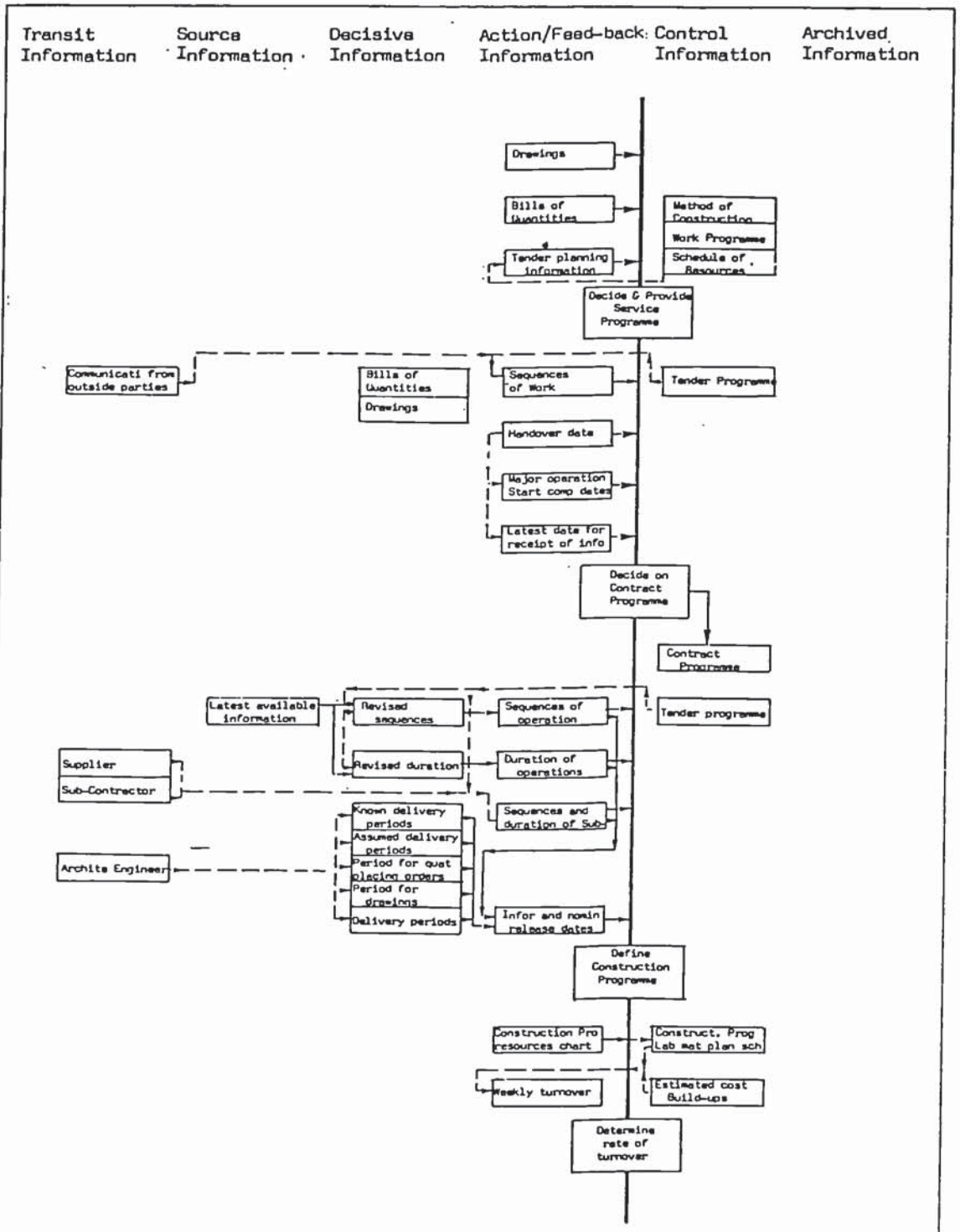

Figure 9. Contract/Construction programme and Turnover.

Preliminary preparations to placing the orders and nomination of sub-contractors and suppliers include assessment of plant, material and sub-contractor requisition, available internal resources and their costs.
Decisions can then be made as to whether further planning and subsequent estimating is required.
The order can then be placed.

5.5.8 Construction Budget

The operatives bonus rate and the construction budget must be finalised before the construction of the project can begin. The way this is achieved is by determining the list of operations in each trade, the target hours for resources and the cost of each operation within trades and total target costs.
Allowance for fluctuation in prices of materials over the target period must also be made.

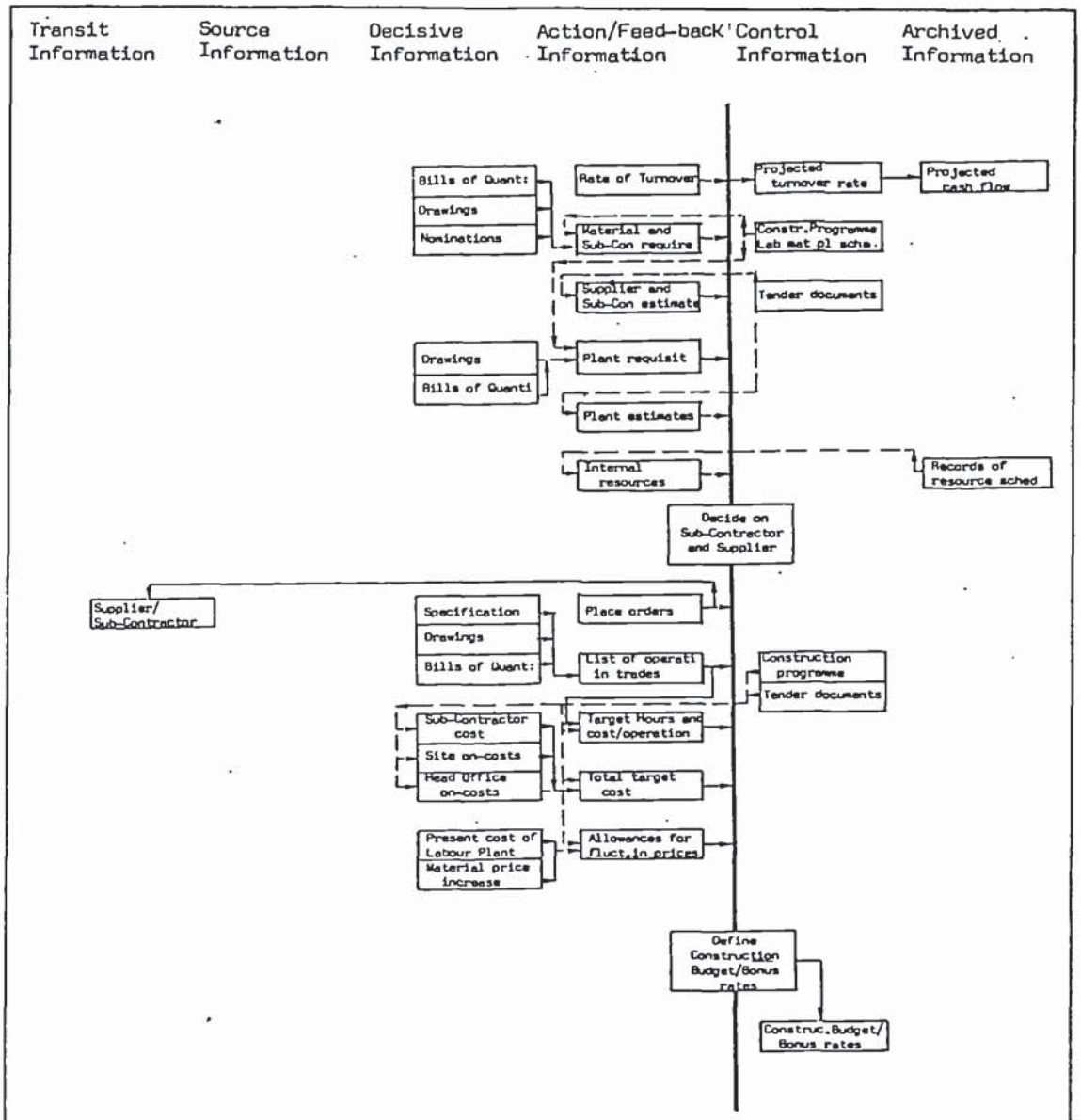

Figure 10. Nomination, Orders and Construction budget.

5.5.9 Post-Contract Production

The construction site management functions are divided into six stages and they are as follows:

To draw up a short term programme, the following areas are usually considered:

From the construction programme and resource schedule the construction operation, its location, and the required labour, materials and plant are defined.

Sub-Contractors requirements and any additional special contract requirements are also considered.

From the above, the resource requirement and costs can be decided which in turn determines the rate of turnover for the period of the programme.

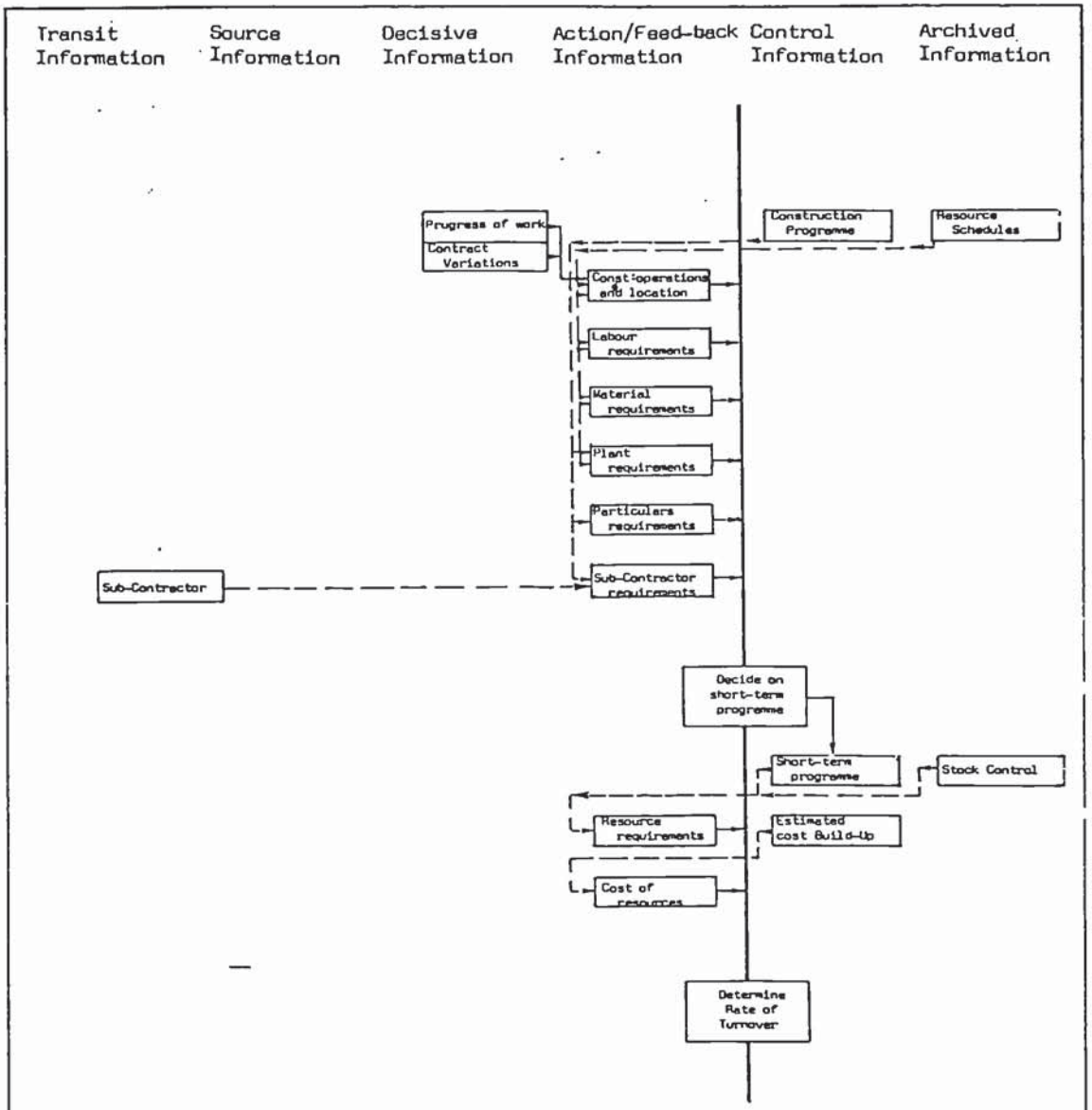

Figure 11. Short term programme and rate of turnover.

One of the major weekly pre-occupations of the site manager is to calculate the cost of production and operatives bonus. These include calculating the bonus, defining the gross labour rate, and deriving plant and labour costs. Comparisons between the tender gross labour rates and budget costs are also made.

From the Bills of Quantities records of progress of work, the monthly amount of interim valuation is determined by examining the material orders and delivery records, tender documents and valuations, the supplier and Sub-contractor accounts can be settled. To do this the order of work, tender value and progress of work can be assessed or measured in reference to the Sub-contractor particulars.

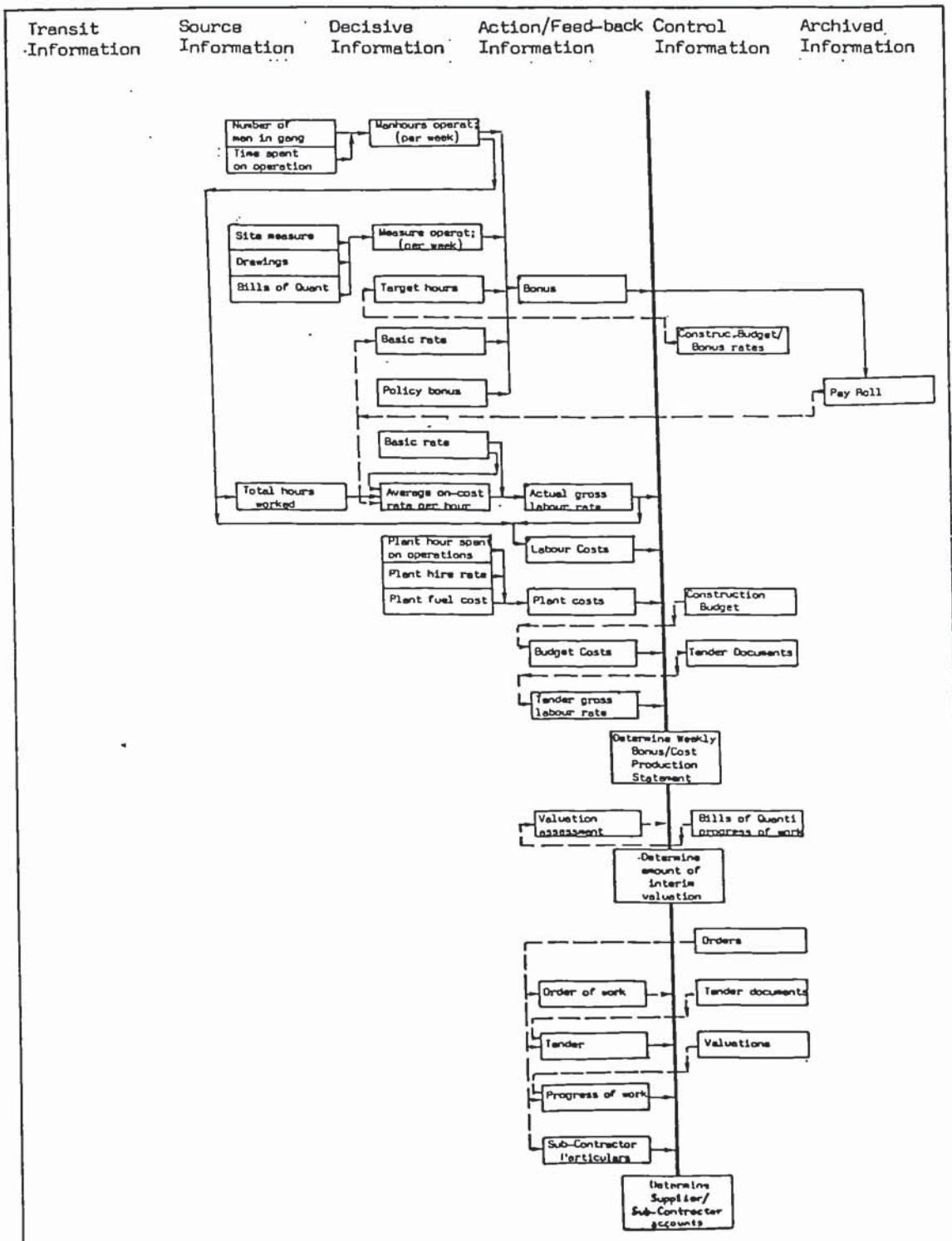

Figure 12. Weekly bonus/cost of production, interim valuation, supplier and sub-contractor accounts.

To determine the monthly cost/valuation statement.

The statement of expenditure is issued. This is derived from labour, plant, and material costs. Also site and Head Office on-costs in addition to sub-contractor and finance costs should be included.

An up-to-date construction budget is extracted from examination of weekly bonus/construction cost statement and construction budget, which can then forecast the final cost from examination of valuation, up-to-date construction budget, actual construction costs to date and the total construction budget.

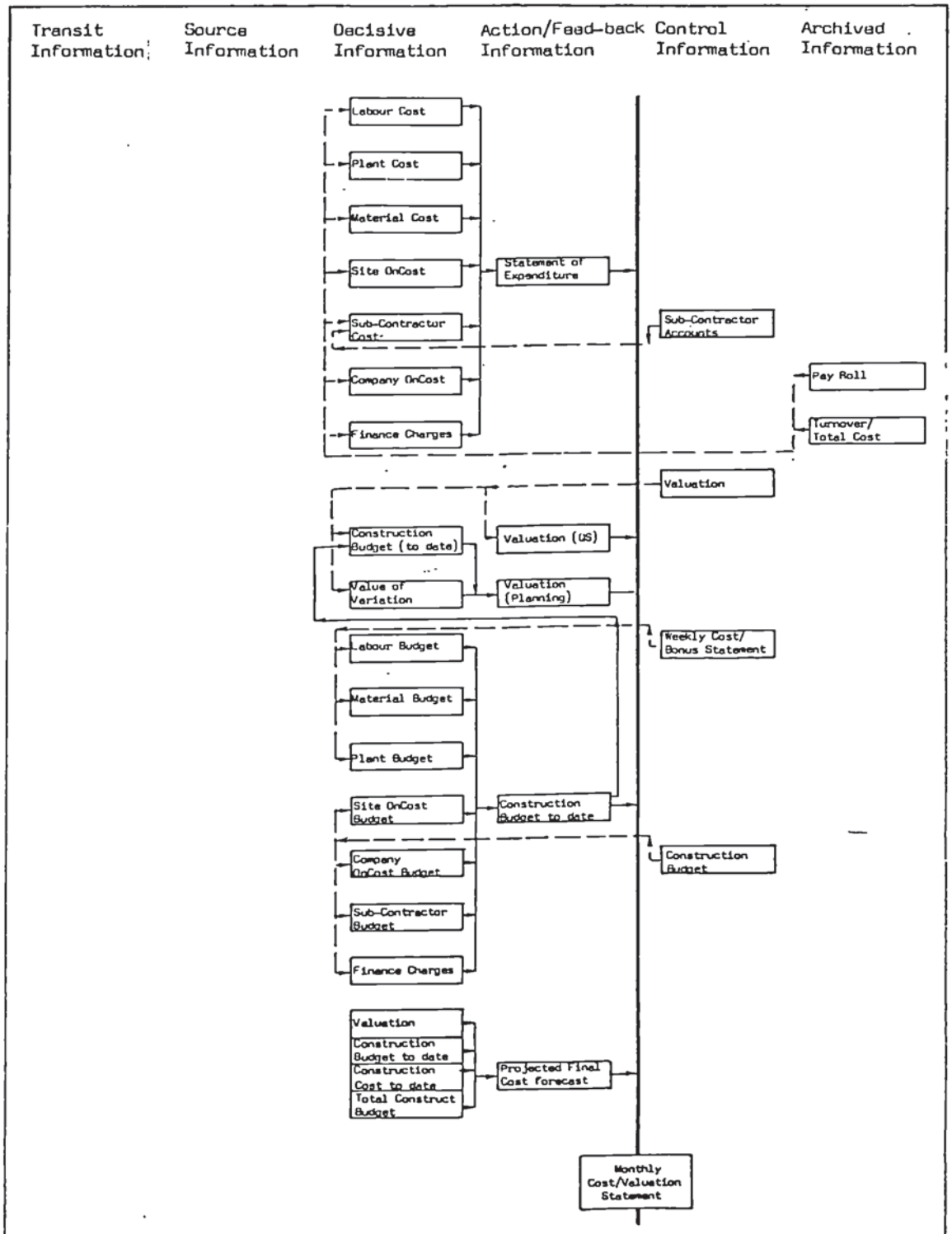

Figure 13. Monthly cost valuation statement.

C H A P T E R S I X

MINIMUM CRITERIA INFORMATION FOR AN INTEGRATED M.I.S.

6.1 Introduction

There is a lot of uncertainty in the contruction business. The quality of information may be good but the channels of communication may be poor, or vice versa. It is interesting to point out that since there are so many options open when deciding upon a suitable method for the communication process so many people follow the established routes without seriously considering ways of improving the system.

To run a construction site efficiently a contract must have adequate information from the design team to carry out the construction process. The efficiency with which the technical information is used depends on the site manager's organisation and the communications within it. Most site managers tend to spend some time on clarifying the information received.

Uncertainty due to unclear objectives is because of clients, architects, engineers and contractors who have different objectives even though they are all involved in the construction process. Daltry (14) identifies six categories which are :-

a) conflicting information which is largely due to poor co-ordination.

b) incorrect information.

c) unavailability of certain pieces of information on site.
d) lack of definitive detail.
e) lack of certain information and
f) poor presentation.

In the construction industry the client is committed to buying the product even before it has been built and so the client is able to exercise control over the quality during production. This creates another uncertainty as to the quality of standards which will be acceptable.

6.2 Objectives.

This chapter analyses the flow of information for the whole process of project management constructed and detailed in the previous chapter in relation to the production cycle. The intention is to isolate dominant factors which can then form the basis of full integration. With the help of the micro computer better communication and the elimination of uncertainties facing site management can result from the integrated system.

6.3 Analysis

Examination of the detailed flow of information at the post-contract production stage i.e. on site, reveals that the information required for the control of a project is passed to the site manager in the form of the construction programme, resource schedules, estimate of costs, construction budget/ bonus rates, tender documents i.e. drawing, Bills of Quantities and Specification.

However, during the actual production stage itself, and indeed in the post-contract financial analysis stage, some of the following information is fed back to the planning and estimating team for future contracts: short term program, payroll, weekly bonus/ cost production statements, interim valuation subcontractors/ supplier payments/ accounts and cost valuation analysis statement.

The primary purpose of this exchange and creation of control information through a project is to achieve an end product on the site. Therefore it must be assessed on the basis of some objective criteria, which would normally be a function, quality, time, cost and quantity.

This criteria can be categorised into two distinct variables:

a) Description

b) Quantity

1) DESCRIPTION :- which defines functions, quality, and additionally specification, resources, and location.

2) QUANTITY: - describes the entity of the elements of a volume or a shape to be acheived by the function. Also from this quantity the time required to construct is assessed taking into account the operatives output limitation. This will then define the cost of achieving the function. If it cannot be measured, assessment is based on experience and records of similar previous jobs. In general the quantity is arrived at either by the process of measurement or assessment as a result of previous experience.

For a given function throughout a project and between various projects the description will remain constant and consequently can be standardised, hence the Building and Civil Engineering Standard Methods of Measurements (SMM5/6 & CESMM).
It is important to determine whether or not quantity is a dominant factor in decision making for control management throughout the various stages of the project.

6.3.1 Production Stage

In order to determine weekly bonus and cost production statements it is important to measure the progress of work to define the following costs: labour, plant, budget, and gross labour rate and bonus payroll progress.

The progress of work over a period of weeks determines the amount of interim valuation. The sub-contractor and supplier accounts are settled from the measurement of the progress of work and materials delivered.

6.3.2 Pre-tender Stage

The following analyses are common to both the pre-tender contract appraisal and the post-tender pre-contract stage.
To decide upon the method of construction, quantities and measurements are taken from Bills of Quantities and drawings in order to discover the work content of each different section of the project. These quantities are used to calculate the duration of the alternative methods of construction and also defines the cost and the quality of the alternative methods.

In the programming stage of the contract or project the work content of each operation determines the sequence of work and also permits the finding of the duration of the operation in terms of the output rate of operatives. This becomes a predominant factor in determining the duration of the overall project. However the limitation of the operatives output has to be taken into account.
Subsequently material schedules are derived from the quantities which have been measured and documented in the Bill Of Quantities in respect to the project programme mentioned above.
The rest of the resource schedules required such as plant and labour are the result of a project programme and measurement done in the earlier stages. i.e. planning and programming.

The calculation for the cost of direct work, sub-contractor, supplier, on-site and Head Office costs is derived from the Bill of Quantities and resource schedules.

6.3.3 Post-tender/pre-contract Stage.
At this stage working drawings are prepared and measurements are taken off to produce the Bill of Quantities and tender documents for the post-contract control purposes.
To determine the rate of turnover the weekly estimated construction progress and its cost is used.
For the nomination of the sub-contractor, the placing of orders with the supplier and the requisition of the plant, the quantities and measurements, are derived either from the Bill of Quantities or the construction programme and tender documents.

The comparison of the total target cost and the actual direct cost of construction should determine the bonus and construction budget.

6.4 Conclusion

The analysis indicates clearly that quantity is a dominant factor where description or the code can represent the function of an operation.

This is in contrast to the information requirements put forward by Britten (15). He concludes that the information needed throughout a project are three fold:-

1) description or specification of project defined by resources, times and locations.
2) specification of the work, in terms of resources and locations.
3) details of all resources and materials.

As the handling and storing of this information is relatively simple for the micro computer it can be concluded that the basis for an integrated information management system within the construction industry should be a computerised measurement technique aided by libraries of descriptions.

C H A P T E R S E V E N

THE MINIMUM REQUIREMENTS OF AN INTEGRATED SYSTEM

7.1 Introduction

From the comprehensive surveys of software carried out for the earlier research (13) it became apparent that almost all aspects of the project management process have been computerised as stand-alone packages.

These stand-alone systems, mainly adapted for microcomputer from mainframe, and micro computers are for all areas of project management such as production of Bills of Quantities, cost planning, estimating, resource scheduling, planning, programming , cost control systems etc.

Over the last few years a number of integrated packages have been introduced to the construction industry for project management such as Hornet Project Management /Multisoft contract management. These are mainly aimed at Head Offices to assist the project management controlling a number of projects in production stages as well as tendering etc. However these systems leave the site manager with all the problems at the most crucial stage of a project management process.

During the last decade there has been growing demand in the construction industry for a more effective communication and

documentation. This has been for the purposes of estimating and tendering and the construction site manager. The reason for the demand has been the changes in construction technology and practices, with the recent dimension of the advances made in computer technology.

The traditional approach has been through the vehicle of the Bills of Quantities (BQ) which expresses design solutions in terms of a number of small quantified items of finished work. The items are measured and described in accordance with the Standard Method of Measurement (SMM) from drawings and specifications.

The Bills of Quantities have no doubt succeeded as a means of obtaining competitive tenders, but its limitations have been well documented and still attract a great deal of discussion.

There are three main criticisms of the traditional approach: (16)

a) the BQ is rarely able to fully describe and accurately represent the quantity and quality of the works to be carried out as required by the construction site management, largely because of insufficient information at the tender stage;

b) as a cost model it assumes that the production cost of construction work is directly proportional to its finished quantity. It ignores the effect of resource management on

costs and it is particularly inappropriate for preparation of valuations or variations where they do not involve changes in quantities of work;

c) as a means for data communication it does neither facilitate on-site physical and financial control of construction work nor the feedback of data to the estimator.

Various attempts have been made by researchers for alternative procedures. The SMMs have been revised to reflect the changes that have occurred. Skoyle's (17) operational and activity bills were particularly suitable for administration and financial control. These attempts have so far had little impact.

The following approach does not necessitate a re-structuring of contractual procedures, design processes and the technique of cost planning. It is envisaged that the following system will enable a construction company to monitor and control its performance effectively and at the same time provide a basis for the retrieval of site costs data.

Furthermore this system will allow the construction companies to accurately model construction costs and therefore produce a more realistic estimate of a project, and of the cost implications of any changes, in the circumstances under which work is carried out.

7.2 Objectives

It has been known that the Bills of Quantities documentation built around unit rates has forced estimators to prepare their estimate to suit. However, the data generated is not suitable for site management or cost control because it does not express costs in the way in which they are incurred on site, neither does it reflect resource utilisation or managerial decisions. Often it is necessary to set up a cost control system.

The objective is to establish the minimum requirements of a computerised system of documentation and communication which will be suitable for estimating and cost control and provide relevant information for site management. Also it is to provide the foundation and means of developing and upgrading the system to achieve full integration within the whole process of project management.

7.3 Integrated System

7.3.1 Introduction

A system for taking off measurements, billing and estimating was developed and re-structured under MSDOS/PCDOS Micro-soft Basic and front-end 8086 assembler/standard communication protocol for a company based in Birmingham.

This computerised take-off system follows closely the traditional dimension format or manual method but eliminates routines such as cut and shuffle, squaring and scale rule, and abstracting.

7.3.2 Configuration of System.

The system is comprised of either:

1) digitiser unit.
2) two-ribbon microphone mounted on A0 size architect drawing board
3) sonic pen.

or:

1) digitiser unit/2 integral spot microphones which can be placed on A1 size drawing board
2) sonic pen.

The sonic pen which is connected by a wire to the digitiser unit generates sparks when pressed on the drawing board.
A specific range of frequency 60KHz generated by the spark is picked up by the activated (synchronised) microphones. This is transmitted through RS232 ports to the digitiser and is then converted to co-ordinates. Finally through the second port co-ordinates are transmitted at 9600 bits/second to the host suite of programs on the microcomputer.

This system has been translated into European languages and is commercially available for building and Civil Engineering contractors on a variety of popular 16 bit microcomputers such as Apricot, IBM and IBM compatible ranges etc.

7.3.3 Software Configuration

The system was originally designed for take-off in traditional dim format. Since quantities derived from the measurement are the basis of management throughout all stages of the construction

project, the system was restructured and designed to achieve overall integration in communication with the documentation of a project.

The main operation of this system is to allow take-off of measurement using the sonic digitiser or keyboard.

Once the digitiser take-off has been selected the system displays a traditional taking off Dim. Paper formated screen on top of which details of working file such as client, job names etc. are already displayed. Relevant descriptions, drawing number and scale are displayed also Dim. (Dimension) paper taking off is standard for measurements of quantities and only involve measurements of the fundamental units of the SMM's system. The user can operate the system by choosing a function from a menu chart mounted on the drawing board.

Apart from numerics and calculator functions i.e. addition, subtraction, multiplier, the system allows the user to add and subtract subtotals to/from running totals and hold subtotals in a memory.

The main functions of the sonic digitiser are measuring length or cumulative length from sequential point co-ordinates and calculating the area of an enclosed shape irrespective of shape and sides. Two specific locations on the menu chart instruct the digitiser to generate sparks in stream mode and this is used to measure irregular and curvature lengths and areas.

The calculation of irregular areas is based on Varignon's theory which is defined by W.E. Williams and A.Waltham (18).

Theorem: "For forces acting at a point, the moment about any point of the resultant is the sum of moments about that point of the separate forces."

They defined the moment of a system of forces acting through different points represented by their co-ordinates to be the sum of the moments of the separate forces.

On the other hand the sum of the moments of the separate forces is equivalent to twice the size of the enclosed area between the points of acting forces where the magnitude of such are represented by the length or difference between sequential points.

In order to calculate area of an irregular shape, it is sometimes useful to have an expression available in terms of the co-ordinates of the points of the shape. the following shows how such an expression is obtained.

The co-ordinates of P will be taken to be (x0,y0) and the x and y components of F will be denoted by:-

$X=F \cos Q$ and $Y=F \sin Q$

Where Q is the angle between the position x-direction and the positive sense of F. The point Z denotes the point of intersection of the line of action of F with the x-axis.

Assuming that the $0 < Q < 180$ and Z is to the right of O, the

equation of the line of action of F is

$$\frac{x-x0}{y-y0} = \text{Cot } Q$$

So that the x-coordinate of Z is x0-y0Cot Q.

For the configuration shown, the moment M is positive and given by $M = F.OZ.\text{Sin } Q = F.(x0-y0\text{Cot } Q).\text{Sin } Q$

$= Y.x0Y-Y0.x$

The right hand side of above equation can be interpreted as the sum of the moments about O of the Cartesian components of F.

Therefore the moment of the resultant of forces (F1,....,Fn), with components of magnitude (X1,....,Xn) and (Y1,....,Yn) parallel to the x- and y-axis, can be shown as

$$(Y1+Y2+....+Yn).x0 - (X1+X2+....+Xn).y0$$

$$= (x0.Y1 - y0.X1)+....+(x0.Yn - y0.Xn)$$

the right hand side is the sum of the moments of the separate forces, therefore the following can be deduced

$$\text{Area} = [((Xn.Ym)-(Yn.Xm))/2]+$$

$$(XmY1-YmX1)/2$$

Apart from the production of Bill of Quantities this system allows the user through two different sets of menus to allocate cost against each item code numbers either as a total unit rate or build-up of costs in terms of labour, plant and sub-contractors. Provisional sum/contingencies are represented as a lump sum and a percentage of uplifts which will be applied to all elements of the same item code number.

Some other functions are listed below:-

- reviewing build-up of all costs of the working file
- allocating cost only against item code numbers which have not been priced.
- printing estimates with application of an overall uplift percentages applied to all elements, labour, plant etc. of the working file.
- printing estimates with individual item code number uplift percentages entered at the time of allocating cost to elements.
- printing net estimates of cost without the application of any uplifts at all.

This output/printout is either a draft mode which will print breakdown of cost build-up for individual item code number, or final mode print which is a priced Bill of Quantities with totals carried to summary and collection. This will show the individual pages total carried to summary. (See Appendix A)

An additional sheet of printout will display the overall total of cost build-up of each element within the working file.

7.4 Conclusion

In the following discussions the use of system is analysed on the site and in the whole organisation.

7.4.1 Using the system on the construction site.

The system detailed above basically should provide all the control information required by the site manager at the production stage. For all the decision-making acitivities involving the site manager the primary or control information

comprises of: tender documents, contruction programme and budgets and material orders/deliveries.

This control information is used for short-term programming and budgeting, determination of costs either for the short term period or on a weekly basis and interim valuation.

a) Control information

i) Tender document analysis

Using a microcomputer to store details of the tender build-up and any amendments by the Quantity Surveyor, the tender analysis poses little problem. By listing the work content of each activity on a locational basis, the scheduling tasks for the site management are made easier.

The form of the locational analysis will vary from firm to firm and may be either operational or SMM form. The site manager's major consideration is to have access to accurate information eg. quantities, materials and target hours for each operation, location by location.

ii) Construction programme

In conjunction with the master programme there should be a schedule of activity for each real activity, the total of which should equal the tender sum. The site management should be able to link each item in the data file to the relevant activity.

The activity specifications can be built up by manual analysis of the estimate. If a system is properly integrated, the computer can print out the various operations in such a way so that only

activity numbers need to be added for an automatic preparation of specifications.
Additionally it should be possible for a schedule of amendments issue with a revised drawing to be processed automatically and the programme amended accordingly.

iii) Construction budget
Budget forecasts are required primarily by the accountant for cash flow calculations. The site manager can also use them to check progress rates. i.e. if all the measured work is not accounted for then either the work has not been correctly valued, the estimate is out of date or the work is behind schedule.

iv) Material orders and delivery programme
A well organised delivery programme based on accurate Bills of Quantities, fully amended, eliminates problems of material shortages and facilitates planned store keeping.

b) Use of control information

i) Primary use
Planning can be viewed as a two stage exercise. Stage One involves the preparation of a master programme illustrating the relationship between the various activities and items available. Each activity on such a programme may contain a number of sub-activities and have a duration of several weeks.
The second stage is the preparation of a weekly or daily schedule of work to be done.
The preparation of a weekly schedule or program requires a

properly detailed, up-to-date activity specification showing the work content and the operations to be performed in each location and the time available is essential for the preparation of a weekly schedule or programme. If the quantities are in SMM form further analysis may be required for planning or bonusing. If they are in operational form target hours should be available for bonus purposes.

Existing staff levels represent the actual labour resources available. If extra resources are needed sources, that are required are target outputs. If resources required exceed resources available then additional costs in the form of overtime or inducements must be incurred if the programme is to be maintained.

If resources required are less than those available the difference represents unused resources. The sum of these two form a measure of unrealised profit.

ii) Processing and reporting

The computer's ability to record, store and summarise small items of information with speed and accuracy provides a basis for a fully integrated system.

As each item of information is uniquely referenced and identified, it is easier to store the original data and recalculate the answer where necessary instead of storing derived data. All the original basic items can be stored for access by various departments when required.

The item used by the professional quantity surveyor in taking off

from drawings is the located quantity of work within a given area as described before.

A Bill of Quantities computer program could be used to extend the dimensions, collect together all similar items and print the finished bill.

For the purpose of estimating and control the contractor is largely interested in the plant, material and labour content described by the bill items which are required to complete the project. Hence the basic item used by the contractor is the located operation or work piece, i.e. the labour, plant and material content of a given operation contained within that location.

1) Required information

To ensure that nothing has been overlooked reports of site amendments and drawings received are required as a check list. To calculate and allocate expenditure correctly documents in the form of time sheets, plant returns, allocation sheets and material received sheets are required.

A computer based system should be able to prepare a pre-printed form listing activities before the start of an activity according to programme with the target and actual unit cost to be achieved. The site manager should only need to add starting and completion date, percentage completion on current activities and whether work will be completed on current or target rates. Where computerised Bills of Quantities are also being used the surveyor may also have to complete a form listing the items to be measured.

2) Construction cost.

If all the time sheets, plant returns and material received sheets show the location and activity, then the costs can be allocated to the same headings as the estimate and it should be possible to compare the estimated and actual cost of carrying out the construction of a specific part of a building or project.
Ideally the hours spent on an operation and the material used should be costed to the proper work item code and location. If this is not possible the operations can be summarised under account headings known to the site management which are also used for allocation of hours and materials used. These account headings may be activities, trades or sections.

3) Construction Budget

It is vital to ensure that the sum of the target volumes equals the bill figure and that all costs are accounted for.
One way of ensuring that this is done is to allocate the whole of the costs incurred in the period to those accounts on which work has been done.

In terms of calculating wages the overall number of hours allocated is totalled and divided into an overall wage bill. The hours spent on each account are then multiplied by the hourly rate obtained. The total of the labour costs allocated to each account should then equal the wage bill. This exercise can be applied to plant although in this case the number of different hourly rates will be much greater.

With regard to materials, the materials checker should have a list of account numbers and descriptions which can normally be entered on the actual orders. The delivery notes can then be coded on receipt. If stock on site is reported with the progress report the computer can be programmed to multiply the material received by the price, allowing for site stocks, and allocate the material cost in accordance with the account numbers. It should be possible to obtain a listing that can be used for checking invoices.

The clerical administration does not change significantly except that the site clerk will have access to a list of the actual amount of material and the target hours. This means that he can check whether consumption is excessive and carry out bonus calculations more efficiently than can be done at present.

4) Amendments

If a drawing needs to be amended, the quantity surveyor could correct his take-off by replacing the existing located quantities with the new figures, or by adding the increased quantity to that already recorded for those particular locations.

The same procedure can be followed when agreeing measured quantities on site. The amendments may be dealt with day by day as they take place, but it is more likely that the surveyor would issue an amendment file at the end of each month detailing any amendments to the Bill of Quantities that have taken place during the course of the month.

Once this is received by the site surveyor he should check that the original bill rates still apply and correct these where necessary before processing. This ensures that the updated bill clearly defines the value of the work to be done. To do this the contractor's surveyor will need to translate the bill amendments into operational form, check that the original conditions still apply and replace the quantities already recorded for each located operation with the revised quantity. A print-out of revisions will be required.

When processing this file the contractor's surveyor can bring his own Bill of Quantities up-to-date and also bring the estimate of cost up-to-date for the Site Manager. The manager can use this information to correct his figures for the work to be done, the time allowance in the program and the target cost for the work to be done in the following period.

The procedure on site should be exactly the same as for drawings measured in the office. The various unit quantities are referenced to their locations and so are unique. The statement of the agreed quantities for the work done within a given location makes it possible for the computer to locate the figure originally recorded, to delete and replace the figure in the record with the new agreed quantity.

5) Interim valuation

Before an income forecast can be prepared it is necessary for the surveyor to allocate each item in the Bill of Quantities to its

relevant activity in the network program or bar chart. This can be done directly by splitting the quantity of work shown against each item in the bill among the relevant activities or by translating the bill into operational form and then collecting the value and cost of each of the located operations relevant to each activity together so as to form an activity specification.

It is advisable for the various located quantities to be allocated to their activities to form a bill activity specification. Bill items which are comprehensive and include more than one activity can be split into reasonable proportions between the activities concerned.
If a table is prepared listing activity value and the cost periods in which each activity will be carried out then a computer program can be used to calculate the income per month.
If a time analysis program only has been carried out without resource limitation then both earliest and latest start dates may be given. In this case the surveyor will need to allocate the value of that particular activity into two separate tables:
the earliest and the latest the work can be done.

The probable income will lie somewhere between these two limits. From these figures the surveyor can prepare a certificate forecast showing the probable value of the work done at any time.

This is useful in checking that expenditure rate is not subject to sudden change which would indicate unbalanced resource

requirements.

7.4.2 Use of the System in the whole organisation

a) Detailed information

As already stated an integrated management system differs from the systems normally used in the industry in that it takes advantage of the ability of the computer to store information and process it quickly. The manager is able to use the information and make more accurate decisions based on up-to date facts.

b) Sources of Information.

The manager of a construction company or department will receive information from a number of different sources identifiable as three main groups:- instructions and advice from design teams and clients, reports and returns from site, reports from head office departments and government statistics.

i) Clients instructions and information from design teams.

The first suggestion of a contract may be the receipt of drawings and specification with or without a Bill of Quantities and accompanied by a request for an estimate or tender for carrying out the work described. If the tender is acceptable to both parties then further working drawings and instructions can be issued from time to time during the course of the contract. The work shown on the later or working drawings may be remeasured and a new final price negotiated. Alternatively variations from the contract as originally described may be measured and the price varied accordingly. Delays do occur however and the manager often

only knows the final value of the contract some months after completion. The completion of design work before actual construction is desirable but as last minute amendments are inevitable any system developed should take into account client's requirements accordingly.

ii) Reports from construction site

Reports from a building site may consist of time sheets, delivery notes and a handwritten note from an operative. Most Head Offices will be accustomed to receiving weekly the following documents

- Wage sheets showing gross and net wages due
- Materials received sheets
- Plant returns for own and hired plant
- Weekly measure of work done
- Sub-contractors measure
- Requests for plant: materials required or surplus
- Progress reports

This information may be partly processed on site or it may be received in its raw state. Sites may be required to report a piece of information once or the same fact a number of times in several different ways. For instance the area of a brick wall may be measured once for the material order, again for a bonus measure of work done, again for quantities for interim certificates, again for the final agreed measure and all over again when the wall is plastered. All these different measurements may not be done by the same person, nor give the same answer.

iii) Head Office reports

Working from the analysis of the original estimate and the returns from site, head office departments will derive certain conclusions which when suitably summarised, will form the basis of Head Office reports. Reporting procedures will of course vary from firm to firm but most will report at least monthly.

iv) Further reports will detail:

- Tender inquiries received, tenders submitted, tenders accepted.
- Final accounts agreed, final accounts paid.
- Credit balance i.e. cash in bank plus money due less bills outstanding.
- Probable material supply and labour problems.

Generally location costs are allocated by the senior "taker-off" but it is possible that they could be agreed by the contractor.

The computer adds up all the similar items on the take-off file to produce a bill in the normal form or with quantities located to levels.

Any amendment to the drawings can be dealt with by deleting the original take-off file or part of a file and adding the revised items or part items. The Bill of Quantities and planned work contents can then be corrected or up-dated immediately or at the next review.

This allows the surveyor to analyse a proposed revision without destroying the original file, and so to advise the designer of the probable effect on cost. Where the construction programme

uses the same information the probable effect on construction time can be also simulated in the same way. The simulation of major changes may involve a major review of construction methods which consequently incurrs time and costs.

If the system is used in conjunction with co-ordinated design and construction programmes a considerable improvement in optimising design and improving information flow is possible.

c) Estimating

A locational bill can be prepared for the use of the estimator where a coding system has been agreed between the contractor, quantity surveyor and the design team since most of the computer routines being used by quantity surveyors incorporate some system of locational coding.

The estimator can create operational codes for costing purposes and from this can price operations and build-up new rates necessary for unusual operations. The computer carries out the essential calculations and prints out a fully-priced locational operational bill, sorted into trades, and needing only the addition of overheads, prelims and profit to complete the tender.

d) Planning and programming.

Once the tender documents have been received by the planners they will start by obtaining from the client's representative a set of up-to-date working drawings from which they will take off quantities again taking into account the limitation of their own

material plant and labour contents. These are used for planning programming.

In addition if the professional quantity surveyor has been measuring revisions on the data file the planner should be able to obtain an up-to-date bill, sorted to locations, with the relevant working drawings.

Providing the tender has been prepared in line with the requirements of the integrated system, this updated bill will contain on file details of material, plant and labour content of each operation in each area.

The planner, with the use of an arrow diagram and a list of labour content operations, can identify the located operations in each activity.

The work content or specification of each activity can be added together by the computer and listed. Once the work content is available activity durations can be calculated according to the resource limitations and a schedule of work and resources can be drawn up.

e) Feedback Information.

Due to the nature of the industry with its independent firms effective feedback to the design team in order to make changes is not always forthcoming. This is not to say that more integrated firms are significantly more successful.

The procedure outlined earlier would enable the designer to

simulate the effect of the various limited alternatives on the contract and even arrange for alternative designs to be priced and programmed by the quantity surveyor and planner. In this way he can test alternatives before tenders are invited.

C H A P T E R E I G H T

METHODS OF ACHIEVING INTEGRATION OF STAND-ALONE SYSTEMS.

8.1 Introduction

Of all the management techniques production control is one of the easiest in theory but the most difficult in practice.Many firms have production control procedures but few of them have effective control of production. The reasons for this paradox are numerous.

The blame is often placed on over complex, unreliable and outdated information. The most common cause is misunderstanding by some managers of the basic concept of production control. They expect perfection when by its very nature production control can only provide a compromise solution to conflicting demands.

Keeping a check on the execution of the production plan is a far cry from the old routine of progress chasing. Effective progressing means revealing potential delays at an early stage and foreseeing them before they occur rather than waiting until everything is behind plan before any action is taken.

The plans and programs can be successfully implemented providing all the necessary information and instructions are distributed at the right time and rate to insure that all the resources needed like materials, plant and labour are made available. This means having a coherent system of paperwork and documention. There are many effective systems to facilitate reproducing copies of both static and variable information. These can be useful aids

providing their limitation is recognised. They are not in themselves systems of production control because they neither plan nor progress but they can be an aid to both planning and progressing as well as helping to give clear production instructions and production control does not need a complex system. In most cases it is a waste of time to strive for perfection. A simple scheme covering the main requirements is often more effective than a complicated system catering for all eventualities. Although good production control depends on reliable data it also depends on the effectiveness of the people operating the procedures.

8.2 Objectives.

From the evidence of Chapter Five and discussions on the use of the system in the previous chapter it is clear that a detailed breakdown of measurement is an essential document for the site management and forms the basis of achieving the overall integration for project management control. Most of the stand-alone packages within the Construction Industry at some stage are involved in measurement and consequently needs to refer back to the Bill of Quantities.

The aim of the chapter is to show how the integration of stand-alone packages can be achieved.

8.3 Options available.

The need for an integrated system between the various members of the construction team for the purpose of construction site

project control is of paramount importance. There are a number of options available.

8.3.1 In-house development.

This only really applies to those large companies with adequate resources, since the development of this system requires specialists in a variety of professions and ample time for development.

Considering that such a company will have a complex organisation pattern and a range of special contracts, any such suite of programs developed will be unsuitable for the majority of construction firms which are small-medium size.

8.3.2 Adoption of a full integrated system.

The second option is to purchase and adopt an integrated package for the company but as has already been explained it is unlikely that such a package will be suitable. However even if such a system is purchased additional difficulties will occur. These are as follows:

1) In most cases the communication system will need to be re-structured to accommodate the package if it is to be used effectively.
2) For the system to function properly, a total re-training program, will need to be implemented. This requires time and incurs high costs.

3) It is difficult if not impossible to modify an integrated package for future expansion which would suit the company.

8.3.3 Gradual integration.

It is possible to adopt an integrated system in stages. This means having the ability to integrate a further adopted system allowing for expansion when and where required.

After the initial adaptation of the system and the training of certain sections, the move towards full integration is considerably eased. The company has the opportunity to "shop around" for the best available packages to suit the company's organisation, and since they are stand-alone packages and are usually offered with support and proper documentation, less time is required for training in the new system.

8.4 Outline of systems

During the course of this research, with the help of five software-houses/practices the following methods were identified as being those most suitable for the requirements of achieving integration.

a) System A.

This system is a standard take-off system using a digitiser which has been detailed previously in Chapter Six, running under MSDOS/PCDOS.

b) System B.

This is an estimating and job costing system which has been developed by leading quantity surveyor partners and a software

development company.
The system runs under MSDOS/PCDOS on major microcomputers and is commercially available under a licence agreement. This system held extensive libraries with resources, allocated units and cost rates which can either be created, updated or re-organised. The main concept of this package is to arrange estimates/costs into structured objects/blocks.

c) System C
This system is designed by a division of a major company for assessment of heat loss calculation in arriving at the size of radiators and heating systems required for buildings and offices. The system is designed in GWBASIC interpreter running under MSDOS operating system.

d) System D.
Comprised of a suite of programs, this system is designed for the production of an elemental Bill of Quantities, post-contract financial management by a team of chartered surveyors and a software house. It is based on a comprehensive SMM6 library derived from Fletcher and Moore standard phraseology. The final B/Q and abstract can be printed in a variety of formats with tender cost analysis in BCIS elements. The system also allows the user to print a cost breakdown in NEDO categories for post-contract and interim valuation purposes. Additionally it can be used for final account settlement and variation bills with the original contract rates.

The system is running under MSDOS/PCDOS operating system and available in the Apricot range.

e) System E.

Designed and realised by a software house this system is a suite of estimating and contract management software for the Construction Industry. It holds an integrated pricing library of over 15,000 items based on Laxton's data. The library contains both new and refurbishment works. The user is allowed to modify the supplied rates for labour and materials and alter the profitability of the contract either globally or by trade and/or elements of a job. The system offers the following:

- setting out estimates
- calculation of construction costs
- calculation of prime cost (direct cost), labour, plant, materials, on-site costs etc.
- production of interim valuation/analytical valuation
- production of progress schedule
- production of claims accounts and variations
- production of material schedules

The system is running under MSDOS/PCDOS mainly on IBM hard disc and IBM, Apricot compatible micros.

f) System F.

This system is devised and developed by a software house in consultation with the quantity surveying profession for the production of Bills of Quantities from Architect drawings using

microcomputer equipment. It was in fact originally designed for use on the molecular multicomputer SM200 range but it has been revised and planned for transfer onto other major micro computers running under MSDOS/PCDOS/CPM operating systems.

The system leads the user through a number of menus where options defined the build-up of the standard phrased Bill of Quantities. The advantage of this system is in its multi-user capabilities where a number of "takers-off" can enter data for the same bill. It is based on a series of comprehensive phrased libraries compiled by chartered quantity surveyors. These are SMM's, principles of measurement (international) and rehabilitation work.

8.5 The methods used.

The following are outlines of methods whereby integration was achieved.

a) Essential routings from two independent systems (A and B) were added together to create a new unique package which has some features in common with both systems. This is viable where both systems are capable of running under one operating system.
There was a need to use the breakdown measurement of a "take-off" for a cost planning suite of programs with an extensive library of descriptions and prices. Therefore a routine was identified and isolated from the take-off program and merged as a sub-routine within the cost plan program. By doing this the integrity of the main program was preserved. Also it provided the means of using a

sonic digitiser with additional facilities which previously had been used as an independent system.

b) Integration was achieved by an interface program which reads and interprets the data generated by system A into a different format which satisfies the needs and requirements of system C. Consequently if all data required by system C is not generated by the original system the remaining data can be adequately translated and generated by the interface program itself. For example there was need for measurements and pricing facilities to assess the heat-loss within a building and arrive at a set of calculations for the heating system installation.

The method of integration between the take-off system and heat-loss package was achieved accordingly.

c) The integration was achieved by modification and standardisation of the data files of systems A and D. A bill production and valuation package required detailed measurement for production of an operational Bill of Quantities. The standard take-off data file package which holds the descriptions was modified in the format of the required system to allow the description to be drawn from system D for the take-off stage and a proper breakdown of a measurement was recorded for future analysis and the bill production.

d) Alternatively, the creation of an intermediate data file which both modified systems (A and E) can read and generate their own

general data files. Additionally a certain operation is required through which both systems can update the intermediate data file. An estimating and contract valuation management system was integrated with the standard take-off and bill production package through this option whereby both systems kept their own integrity and identity. An agreed intermediate date-file with the particular needs of the systems in mind was generated and through the options of both systems this file could be read and updated when specific tasks are completed by the individual systems.

e) Integration was also achieved by combining methods two and four [(b) and (c)] between systems A and F. A menu driven complex bill production and post-contract financial monitoring system was interfaced to the standard take off system with the use of stand-alone interface programs and intermediate data-file. The latter was generated by the two stand-alone interfacing programs which monitors the movement between systems A and B.

8.6 Conclusion.

Several conclusions can be drawn in terms of assessing advantages and disadvantages of these methods of integration.

Firstly, the integrity and consistency of the individual systems can be preserved since the remainder of the original system is capable of behaving as it was formerly designed and structured.

Secondly, the use of intermediate programs/data files causes less disruption and data loss if at any stage of operation faults occur. The systems hold the original set of data and the intermediate one can be recreated.

The time taken to achieve the modified system is a fraction of the time it would take to contemplate writing/ editing and testing the new system.

One of the minor set backs could be, that in the case of a problem occurring in the integrated system it may not always be immediately clear where the problem originated.

Finally it allows the software houses/practices to diversify into a new market area without much effort, since modifying a working system with these techniques is far easier than contemplating writing a new package.

This in turn shows a good investment in the long term, and opens a new market for individual stand-alone systems to search and identify where their system is capable of integration and to provide a comprehensive service to the construction industry. Particularly with the aim of assisting the site manager.

C H A P T E R N I N E

APPLICATION SYSTEMS FOR THE CONSTRUCTION SITE.

9.1 Introduction

Probably the most important application of micro computers on the construction site is the documentation. Many firms believe that clear concise information is of paramount importance, as is the need for a vast quantity of information which is often lacking in quality and clarity.

However, the fact is that if and when a microcomputer is installed on the site for purposes other than documentation then this becomes automatically a necessity, either to complement financial management aspects or other aspects of project management. Financial management itself is complemented by records of progress and amendment of the work. Therefore planning is complemented by financial and resource management where resource management itself is acheived by proper documentation, control and financial management.

Since construction firms have to make progress, measure the progress, define profit or loss, and finally make decisions on how to control the project, the needs for financial and progress management are undoubtedly high.

The needs cannot be purely for the purpose of profit making but also to encourage efficiency with less paper work for a higher rate of productivity and less manpower/resources wastage due to

bad planning and control.

One of the most important needs of site management was to find a quick and reliable answer for the problems which they are faced with daily, owing to the uncertain nature of the Construction Industry. The need exists for financial management and constant planning and progress updating since the present system allows only to do so when the time is almost too late to rectify any inefficiencies.

During the course of research a number of stand-alone systems with specific requirements for the site management were developed and implemented on a variety of microcomputers.
These are as follows:

9.2 Tender Bill and Valuation package.
This system was designed and implemented (1983) on CBM8032 microcomputer for a small-medium size contractor. It comprised of the following characteristics.
At the stage of tendering after the take-off has been done manually, the relevant information SMM's or CESMM decription, Internal Rate, Contract rate and quantities are entered onto the Bill of Quantities.

After completion of the Bill the quantity surveyor checks the priced Bill and print outs generated by the system with the Contract rate and Internal rate to assess the profits budget and actual cost of estimate. Any item can be inserted or deleted until the bill is completed. Any further addition to the bill is

marked or flagged as variation to the Bill of Quantities for valuation and variation pricing.

The same priced Bill of Quantities is used at the time of issuing interim certificate and cost/budget analysis and control. This is achieved by using one of the command keys to enter quantities of work measured and approved by the visiting Q.S. The system only outputs the items of priced Bill of Quantities where the quantity has been entered as completed work. The variation between the internal rate and contract rate determines the level of profit made on individual items.

9.2.1 Outline of Tender bill program

The main functions of this package are Entering, Editing, Amending and Printing the Tender Bill of Quantities, performing and printing interim valuation from the completed Bill.

Finally there is an addition of items of variation after the Bill has been completed. Each bill item comprises a code, level, heading, level 2 full or abbreviated descriptions, tender quantity, unit and its rate. The two level headings are added together to form the full title. The Bill code comprises work section letter, bill page number and item reference D12G. SMM5, SMM6, and CESMM road and bridges work sections are allowed and the appropriate heading will be printed. Non-standard methods of measurement can be used and should be specified. When it is used the heading facility should be used to denote sections' names. (See Appendix B)

9.3 Sub-Contractor payment and cost evaluation:-

This system was designed and implemented for the problem of sub-contractor payments for work on a number of sites/cost centres. Monthly valuations of work are fed in for the calculation of VAT, Tax, CITB and retention etc.

Analysis of sub-contractor payments and amounts of tax due or withheld can be either monthly or at the end of the year. This system holds cumulative payment certificates for individual sub-contractors on each job or contract as well as being a data base for holding information on each sub-contractor.

On the basis of work completed by the sub-contractor on each contract, this system issues the certification of payment of VAT, calculation and tax return. (See Appendix C)

9.4 Weekly cost and time recording package.

The principal operation of this package is to keep records of cost escalations of individual Jobs/Cost Centres within an organisation, with reference to man hours and/or fees spent on these contracts.

The package also generates a number of reports on all or a selection of contracts. Reports are generated on cost to date of jobs, work in progress, fees received, fees recovered, budget summary sheet and Fees/WIP summary comparison. (See Appendix D).

9.5 NEDO formular price adjusting and valuation.

This was designed for the contractor which enables him to carry out all increased cost calculations in accordance with NEDO category indices issued each month.

These indices are stored on file and then accessed through the main program. Gross values of categories within each work group are entered, from this information the increases are calculated. Entering a new contract, the system prompts for necessary information regarding base month date, project name etc.
General, fix-only and specialist outgoings are dealt with in turn, system generates reports when calculation are completed, summary of gross to date total for month and increase/ decrease for each category.
(See Appendix E).

C H A P T E R T E N

MAN-MACHINE INTERFACE

10.1 Introduction

When ever someone uses a machine, of any type, an interface is set up between that person and the machine. What ever the type of machine it is, the person using it needs to be able to observe its performance and control it. It is this communication with the machine that can make it very easy or very difficult to use.

This communication is known as the Man-Machine Interface (MMI), which is the general term used in the study of the use of any type of machine by a human operator, and is a major branch of ergonomics. When the machine is a computer and the user communicates via an interactive device such as a VDU or voice input, then the interface is known as the human-computer interface (HCI). (HCI also stands for human-computer interaction). However, the term user-machine interface (UMI_ is often used, as it may not always be recognized that the interface is to a computer.

One of the most striking changes in computing in recent years has been the spread of the use of computers to many aspects of people's everyday and working life. This has been made possible by concious attemps on the part of the computer specialists to make their products accessible to people who are not computer professionals. Some examples of this include the use of

spreadsheets systems for business accounting and statistics, word processors for textual document preparation.

10.2 Integrated system

It is an understatement to say that the study of HCI principles is a large area, and it is still in its infancy in spite of an already very extensive literature. It has brought into computer science, experts in applied ergonomics and psychology, who now play a major role in advancing the understanding of what constitutes good design.

Any deep analysis of the 'human computer interaction' is beyond the scope of this research, but the factors considerd for designing the system are, briefly, described.

These factors are;

- simple to use

  User already has a model about how they perform their tasks. This model was used as the real UCM underpinning the interactive computer system. There are grounds for believing that the system has become easier to learn to use than if it required totally new concepts, unrelated to those previously held.

- self-explanatory in concept so as not to distract the user from the main task.

Also the user must be able to make quick decisions on the basis of any prompts and messages provided by the system.

If users are forced to behave in a manner that is unfamiliar or in circumstances that are uncomfortable, this will undoubtedly affect their ability to perform their tasks. This in turn may impair their speed of re-action or their rational decision-making capability or both, and overall system performance will suffer as a consequence.

The system was designed with other users in mind, and not just for use by one group within construction industry.

Users are always the starting point for a good HCI. It was necessary to carefully consider all that is known about the tasks performed by the construction management team (end users) for the system. It was, also, considered that some users may even be complete beginners to the whole tasks performed by the system.

General consideration was given, that people are good at the following:

a) They have the ability to function very effectively as monitors. That is they can be used to monitor the behaviour of a system, looking for abnormal situations as well as the normal progress of a system in operation.

b) They have the ability to locate and recognise patterns either in terms of diaplay or in terms of behaviour. They are also capable of doing several of these tasks in

parallel.

c) They have great versatility in handling many different input and output symbols. They are, however, relatively slow information processors.

d) They have the ability to adapt to a situation that involves risk and uncertainty and can effectively guide a computer-based system where decisions have to be made quicky and intuitively on data that itself may be subject to error.

It was also considered that computers tend to excel in the following tasks:

a) Computers are good as tasks requiring large amounts of memory capacity. It is better to rely on the computer's memory and its ability to quickly and accurately display its memory contents. Users can then concentrate on the things that they are good at, like making decisions.

b) Computers are good and fast at making deductions where the information and rules are complete. However, they are usually at a loss when either there is data missing or some of the rules for deduction are incomplete. People, on the other hand, have great ingenuity and can exercise judgement in situations of missing data or rules.

c) Computers are very good at high-speed and repetitive

monitoring of data and can filter this data to display it in summary form. People are less efficient at both of these, but good at monitoring and acting as adaptive controllers based on this type of data.

The cycle of design and implementaion consisted of:

- task analysis
- user conceptual model
- system design
- prototyping
- evaluation

C H A P T E R E L E V E N

CONCLUSION.

General analysis.

The research set out to identify the role and application of the microcomputers on the construction site and to develop appropriate software. The major consideration was to facilitate the decision making processes of site management by firstly identifying the areas where computers could effectively be used, secondly, investigating the requirement for an integrated system by avoiding double data entry and finally, developing software for these areas where possible.

Chapter Two sets out to analyse the controls needed in the management of a project with particular reference to the unique needs of the construction industry within the context of site management.

It was first established that a high degree of control from outside the industry cannot be applied. Control by the site manager can only be implied by careful planning and programming, co-ordination, organisation and communication. The manager's main consideration is to maintain or improve the flow of work which implies that he must be able to make maximum use of expertise on site, and fully understand and be able to communicate his objectives.

The subsequent chapter explored this further by analysing the various problems facing managers within the overall system and

determining to what extent the organisation would benefit from an integrated management information system.

It was discovered that information and knowledge and its effective use determined the success of a company and not solely its product or service. By recognising the interrelationship between structure and characteristic of the business function, the information systems and the production cycle and combining this with a functional organisation and information structure the organisation is likely to survive. Thus the problem was identified as finding some form of organisational communication pattern which allows the breakdown of a company into small units but still retains an overall picture of the whole company.

Chapter Four demonstrated the methods of collecting information on the impact of computerisation within the PQS firms, where information is generated for a project.

It is found that the population of computer is 36%, this is significantly higher than the expected, reported and hypothesized, population of 15%. This result very likely indicates an increase in uses of computer by the PQS firms. This shows that quantity surveying is becoming more and more computer orientated. However, there is still a long way to go towards full computerisation of the whole scope of work in a PQS firm.

The overall extent of computerisation of the respondents to questionnaire was about 10%. This implies that computers are used

to perform on the average only about one and a quarter type of listed work in a PQS firm. On the group analysis with respect to size of firms it is found that the extent of computerisation for small, medium and large firms were respectively 5, 11, and 31%. This gives a strong view that larger firms are more inclined towards computerisation, the percentage of large firms being more than 6 fold that of the small firm. Moreover the extent of computerisation for the very young , youong, mature and old firms with respect to age of firms were respectively 7, 9, 15, and 17%. Although there is a gradual increase in percentage from very young to old firms, it does not indicate a great difference as it is for different sizes of firms. It could be safe, followed by significant tests, to say that there is not strong relation between computerisation and age of firms but such relation exists for size of firms. The larger the firms, the greater extent of computerisation.

It is found that there was priority towards computerisation with respect to the listed work after the significance test. In order of such priority of the respondents is as follows;

1) Printing bill
2) Cost planning
3) Non-technical work
4) Tendering and post-tender work.
5) Abstracting and billing
6) Cashflow forecasting
6) Variation and price adjustment
6) Interim certificate
7) Estimating
7) Squaring
8) Taking off
9) Final account
9) Schedule of rate.
10) Network analysis.

It is not surprising to find that the Printing Bill, Cost Planning and Non-technical work are at top of the list because they are the main type of work involved in a PQS firm with network analysis at the bottom because it is not common in PQS firm even in cost planning stage. It would follow that there might be a greater demand in software for Printing Bill, Cost Planning and non-technical work. In addition every listed work is just as likely to be computerised in the near future. This is rather a contradiction to the presence of priority in the previous paragraph. Nevertheless, it shows that with more sophisticated computer techniques, firms are considering computerisation of all the listed work for it is becoming more and more feasible.

The purchase of a micro-computer is mostly preferred because it is not expensive and can meet the requirements of a PQS firm. There are some firms used more than one type of computer system. Integration and management of information within the organisational units and the cycles of events that make up the main sub-system is suggested as the means of achieving the objective of this research.

The first stage in developing this is through the construction of a conceptual model of the flow of information within the whole process of project management by examining the type of information and documents which are generated for the production cycle of a project. This was achieved by determining the

relationship of the department with the rest of the company in order to identity the types of information generated and their place in the overall structure. The method employed was in the form of a range of communication techniques directed at construction companies eg. questionnaires, interviews and discussions.
The next stage was to analyse the flow of information with respect to the site manager's requirements and indicate the minimum criteria required for achieving the integration of procedures in order to avoid double data entry.

The analysis showed that it is quantity which is the dominant factor where description or code can represent the function of an operation. This being so it can be concluded that the basis for an integrated information management system within the construction industry should be a computerised measurement and detailed take-off technique aided by libraries of description.

The Bill of Quantities, as it stands now, provides information which is not always in the form useful for feedback from the site when estimated and actual costs are compared. The trade by trade bill is often replaced by an operation or elemental bill to give more than just a description of the completed works. The standard Bill reduces the apparent importance of the time aspect in the utilisation of resources and cash, and makes meaningful feedback difficult to obtain. To overcome this an estimate must be tied to activities that are definable in time, location and work content. Every effort should be made by the estimator to pin point and

record the factual reasons for costs having varied from the estimated mean under differing conditions. This cannot be done effectively if the plan of work on which the bill is priced is not carried through to the post-contract stage. In many cases the pre-tender programme is disgarded when work begins on site. This is caused mainly by lack of time and working drawings.

The results of co-operation between planners and estimators will enable realistic estimates to be produced and encourage the collection and use of feedback.

Efficient estimating can be accomplished only with access to the expertise of other departments of the company concerned with the operation and control of contracts. It would appear logical, therefore, that the setting up of a feedback system must be considered if the estimator's skill and judgement are to be employed to their fullest extent in the interest of gaining tenders successfully.

The first step in doing this is to assess the availability of feedback within the company and examine how this information can be made more presentable to the estimator. The information must then be brought together from all the different sources, through various lines of communication to a central system by way of a systematic framework arranged to meet the particular needs of the company.

The amount of information recorded will vary with the size of the

company and it must be remembered that, to succeed, it will have to be updated at regular intervals. Information provided by a single file or, at the other end of scale, a computer, is only as reliable as the information fed into it.

There exists a realistic way of producing data of particular use to the estimator in providing him with variances from his original estimate, if the costing system incorporates the use of estimating rates.

Misunderstandings may occur, however, when figures are prepared by one department to be used by another, due to lack of uniformity in standards of measurements and accounting. The ideal costing system for feedback purposes is one in which the work is analysed and pre-measured on site each week and costed daily as it is carried out.

Chapter Seven details the development of such a system and discusses the use of it.

Construction Computer Software Industry (CCSI), is one of the fastest growing Industries which has been firmly established during the last few years with introduction of the new generation of Micro Computers into the Construction Industry.

Until a few years ago CCSI had a heavy emphasis laid on most software used in the Constuction Industry of being related either to accounts, payroll or complex social and legal needs of the industry. Meanwhile the management aspects and problems have

been overlooked and in many cases totally ignored.
This may have been because of the followings:

1) There were fewer qualified people in CCSI.
2) There was no overseas pressure to imply the move to problems and improve this area.
3) Absence of set standards, or lack of defined procedures by the industry.
4) Characteristics and nature of small businesses and firms which have evolved by the fragmented nature of the Construction Industry.
5) Absence of an encouraging and growing market for computerisation since the market was dominated by large main frame and rather expensive mini computers. This meant the following:
    a) The cost of hardware could not be justified by the majority of small firms.
    b) Lack of general knowledge and awarenss of computers.

Cheap, dedicated and portable micro computers have captured the attention of many industries including the Construction Industry and as result of cheap computing the awareness of computerisation has greately improved.

Today's computer users within the Construction Industry have been demanding more sophisticated, less keyboard data entry software, in all different disciplines involved, from simple bill production to cost planning and estimating.

As a result of these requirements and high level of expectation because of awareness of computerisation, a new dilemma is facing the CCSI, as follows:

1) Software/hardware compatibility
2) Tailoring to specific needs of individuals
3) Overcoming the problems and barriers of Operating Systems and Languages inadequacy
4) Competition from overseas
5) Satisfying the needs and demands of market for cheaper and more sophisticated software

In view of the above listings there is fear that the software houses of CCSI may be faced with:

1) Too many similaraties in some disciplines, or easy options
2) Rigid structuring and lack of proper specifications and system analysis
3) Less research and developement, and more keyboard hacking and debugging of rigid software
4) No requirements for the future because of the rapid technological changes in the computer industry

Subsequently Chapter Eight outlines the methods of achieving integration of stand-alone packages within the whole of the construction industry in a logical sequence and the research demonstrates the advantages and disadvantages of the methods.

Although there is no need for a pre-defined and standard

structured data bank apart from what is required by individual stand-alone software, as was demonstrated, it was possible to integrate these systems through the inter-face data files or programs.

The most tedious and time consuming task facing the site manager is the determination of weekly production costs, calculation and preparation of interim certificates and valuation of variations occurring during the production stage, and finally the settlement and preparation of supplier and sub-contractors' accounts. During the course of research these areas where microcomputers could be of most help were identified and packages designed and implemented for a number of contractors as detailed in Chapter Nine.

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A P P E N D I X A

OUTLINE OF TAKE-OFF/BILL OF QUANTITIES/
ESTIMATING PACKAGE.

The software comprises of 6 packages which at run time mode are chained to each other by the operating system (MSDOS Microsoft 2 plus or equivalent operating system).

First Program:-

This initials the digitiser by reading a data file which contains:

1) control codes for screen handling routines (usually ESCAPE sequence) i.e. clear screen, cursor, positioning etc.

2) control codes for printer such as underlining, bold print etc.

3) client identification

The system prompts regarding description levels, identification and if error is generated either by reading the initialisation data file or absence of it, this program generates the file with default values which could be altered by the next program.

Second program:-

This displays an option menu available to users. The operator will have the option of :-

-changing the working file prefix. A working file can be accessed by four alpha numeric code which is assigned as the working file prefix and up to 4 digit number defining the file number. Additional 2 letters in front of the prefix can define the destination disk drive of the storage media which could be altered independently of the prefix.

-changing printer control codes. All changes will be recorded on the initialisation file.

The rest of the options are related to the choice of programs which can be executed.i.e. measurement, output print, cost estimating.

Third program:-

This allows the operator to open a file which is either already created or creates a new one, and also allows the user to take-

off measurement without recording the data on the disk.

If a new file is to be created the system prompts for the usual queries such as client and job names etc. which are recorded as file header for identification of data files.

Once a file has been opened the system displays menu of options which can be accessed only if an item code number has been entered. This item's code number can be up to 10 alphanumeric characters.

If the first letter of the item code number is alphacharacter and ranges between A-Z and the system has not found the code number within the working file (i.e. new item code number) then it searches through the relevant library for the same code number. eg. where the code is C100 the library would be LIB3 since C is the second letter after A.

Therefore the item code numbers which do not exist in the library or libraries are absent and code numbers which are purely numeric or at least the first character is numeric are recorded on a working file as rogue items.

The rogue items usually carry the previous item's descriptions. When descriptions are not appropriate or repeated, one of the options allows the user to edit the text of individual levels of description. There are provisions for 10 levels of description to be put against each item code number and each level of description itself can accommodate nearly a full screen of text.

The text editor operates in much the same way as many standard word processors, and therefore comprises of features such as delete/insert characters or lines, find and find/replace a character or word within a text or each level of description. Further features incorporated such as repeating the last command, find and replace, home positioning, cursor and cursor movement, help screen and saving or quitting the edited text. Libraries can be developed with the help of text editor in a working file. The standard libraries of SMM6 and CESMM have been created and normally requires four levels of decriptions for categories or section of standard methods of measurements.

The other options of menu in this program relate to entering the Drawing Number and scale of measurement. Once the scale has been entered, the system prompts for further adjustments and compensation which can be done to X and Y scales due to stretch or shrinkage of working drawings or the blue prints obtained.

Fourth program:-

This holds a number of options such as printing the measurement, taken either for individual code items or for the whole content of the working file in a different format:

1) printout in the format of a dimension paper take-off either on paper or dumped or spooled into a disk formatted file which could be word processed and printed.

2) printout in the format of traditional Bills of Quantities either in draft mode with code items displayed or as Final Bill with summaries and collections. In this format only the totals are represented against descriptions.

Apart from these options this program allows the user to re-order or reshuffle the order of items to be sorted in ascending code item no. This is appropriate where there are a number of rogue items which have to be sorted in the right order for summaries and the final bill print out. One of the options in a utility program allows the user to renumber any item code to a non-existing code within the working file and therefore the option of resorting code items is an essential part of this program.

Fifth program:-

This program allows the user through two different sets of menus to allocate cost against each item code numbers either as a total unit rate or build-up of costs in terms of labour, plant or sub-contractors. Provisional sum/contingencies are represented as a lump sum and a percentage of uplifts which will be applied to all elements of the same item code number.

The first menu gives options such as:

- Reviewing build-up of all costs of the working file
- Allocating cost only against item code numbers which have not been priced

The final option of the first menu is to print an estimated cost of the working file. This can be done through the second menu with options such as:-

- printing estimates with application of an overall uplift percentages applied to all elements, labour, plant etc. of the working file.
- printing estimates with individual item code number uplift percentages entered at the time of allocating cost to elements.
- printing net estimates of cost without the application of any uplifts at all.

This output/printout is either in draft mode which will print breakdown of cost build-up for individual item code number, or final mode print which is a priced Bill of Quantities with totals carried to summary and collection. This will show the individual pages total carried to summary.

An additional sheet of printout will display the overall total of cost build-up of each element within the working file.

Sixth program:-

This is mainly to allow the user with the knowledge of the structure of data file to manipulate the item code number within the working file. This could be done through option of menu of the program to check and alter item code number, forward and backward pointers etc.

BRICKWORK AND BLOCKWORK

FACING BRICKWORK IN LOAD-BEARING SUPERSTRUCTURE

Facing bricks; reference A730; 215 x 103 x 65 mm bricks; in gauged mortar reference Y611 - group 3

Skins of hollow walls

20402 half brick thick; facing and bucket handle pointing one side as work proceeds; stretcher bond — 56 m2

BLOCKWORK IN LOAD BEARING SUPERSTRUCTURE

Concrete blocks; lightweight insulation, BS 6073 part 1; 440 x 215 mm; solid compressive strength 7 N/mm2; in gauged mortar reference Y611 - group 3

Skins of hollow walls

20804 100 mm thick — 48 m2

Concrete blocks; solid dense reference A341; BS 6073 part 1; 440 x 215 mm; solid compressive strength 7 N/mm2; in gauged mortar reference Y611 - group 3

Skins of hollow walls

0804 100 mm thick — 98 m2

DAMP-PROOF COURSES

Visqueen 1200 gauge polythene; 150 mm laps; (no allowance in measurement for laps)

On vertical surfaces

1604 over 225 mm wide — 2 m2

SUB STRUCTURE WORKS

EXCAVATION AND EARTHWORKS

SITE PREPARATION

A	Excavate topsoil average 150mm deep	70	m2
B	Deposit in temporary spoil heaps average distance of 50m from excavation	70	m2

SUPER-STRUCTURE WORKS

BRICKWORK AND BLOCKWORK

BLOCKWORK

C	Precast concrete light aggregate blocks to BS6073 to walls and partitions 100mm thick	42	m2

ROOFING

SLATE OR TILE ROOFING

D	508 x 254mm Stonewold Interlocking Blue Tiles	70	m2

WOODWORK

SECOND FIXINGS

E	19 x 100mm wrot softwood skirting, once splayed	29	m

SUB STRUCTURE WORKS

EXCAVATION AND EARTHWORKS

SITE PREPARATION

Excavate topsoil average 150mm deep

			70	m2	1.77	123 90
Labour	0.54	37.80				
Material	0.00	0.00				
Plant	1.04	72.80				
S/C	0.00	0.00				
Unit Price	1.58	110.60				
Lump Sum	0.00	0.00				
% Uplift	0.00	13.30				

EXCAVATION AND EARTHWORKS

DISPOSAL OF EXCAVATED MATERIAL

Deposit in temporary spoil heaps average distance of 50m from excavation

			70	m2	2.59	181 30
Labour	0.00	0.00				
Material	0.00	0.00				
Plant	2.31	161.70				
S/C	0.00	0.00				
Unit Price	2.31	161.70				
Lump Sum	0.00	0.00				
% Uplift	0.00	19.60				

SUPER-STRUCTURE WORKS

BRICKWORK AND BLOCKWORK

BLOCKWORK

Precast concrete light aggregate blocks to BS6073 to walls and partitions 100mm thick

			42	m2	12.84	539 28
Labour	4.83	202.86				
Material	5.59	234.78				
Plant	1.04	43.68				
S/C	0.00	0.00				
Unit Price	11.46	481.32				
Lump Sum	0.00	0.00				
% Uplift	0.00	57.96				

/ 1 To Collection 844 48

COLLECTION.

SUPER-STRUCTURE WORKS

Page no. 1	844 48
Page no. 2	1058 11
Total to Summary	1902 59

Overall % applied 12.00

Report on 10/12/198

DEMON

		Total to Summary	1902.59
Total % Uplift	204.01	0.00	204.01
Total Labour	264.79	6.00	280.68
Total Material	282.07	7.50	303.22
Total Plant	267.48	4.00	278.18
Total S/C	836.50	0.00	836.50
Total Lump Sum	0.00	0.00	0.00

			ROOFING SLATE OR TILE		
			ROOFING		
			508 x 254mm Stonewold		
			Interlocking Blue Tiles		
	17.690		Angle CAB (Deg.)		
	144.511		Angle ABC (Deg.)		
	17.799		Angle BCA (Deg.)		
	3.736		Side A-B (m).		
	3.714		Side B-C (m).		
	7.096		Side C-A (m).		
	14.546		Perimeter. (m)		
		4.027			
	17.500		Deg.		
	8.085		Roof Length. (m)		
	7.916		Roof Width. (m)		
		66.692			
			gross area		
AD					
	1.010				
x					
	2.880				
		2.909			
			porch		
		69.601			
		=========		70	m2

e 1:20
Number 100

			WOODWORK SECOND FIXINGS		
			19 x 100mm wrot softwood		
			skirting, once splayed		
	0.076				
	1.484				
	4.763				
	1.192				
	1.238				
	2.608				
	0.644				
	3.052				
	1.482				
	0.122				
		16.611			
DD					
	0.948				
			doorway		
AD					
	0.082				
	0.737				
	3.091				
	0.735				
	1.039				
	3.805				
	4.670				
	0.586				
	0.097				
		14.842			
DD					
	0.628				
	0.979				

A P P E N D I X B

OUTLINE OF TENDER/VALUATION BILL PROGRAMS.

The package comprises six programs.

First Program.

This program gives access to options such as:-

- printing the tender bill either with tender rates or with the cost control rate. Obviously the difference will show the profit margin.
- entering quantities of work completed for valuation purposes.
- printing valuation either with tender or with cost control rates for determination of production cost control and bonus rates.

Other options such as amending existing bills of quantites by either entering variation items or editing/altering descriptions and quantities or rates, and finally entering a new Tender Bill.

The main function of this program is to allow the user to create a new Tender Bill. The program reads and displays all the Tender Bills reference numbers which are created and a reference is kept on a data file. If the entered file name does not exist the reference file system will prompt for the Bill number or reference and also displays options regarding the method of measurement which is to be used i.e. SMM's and CESMM, Road and Bridges and non-standard or rogue methods of measurement.

Other requirements of the system are: job title and retention percentage before the files are created for the job.

The bill file holds the method of measurement, valuation number, number of items within the bill, job title and retention percentage. An additional index file is created for each bill for purposes of sorting items in alphabetical and ascending order.

The next stage is to display the tender bill in its final format on screen with headings such as code no. description, quantities, unit, rate and total price.

Second program.

This program allows the user to find and amend, delete or insert items. The cursor control keys can be used to scroll the screen up or down to browse through the items of the tender bill. A line of menus permanently displayed at the bottom line of the screen show options or commands available.

When the cursor is positioned on an item code reference, the user has the option of inserting and amending a new item in the cursor location or delete the item by pressing either I A or D. If option I or A is pressed a new screen is displayed with the current heading and section letter and tender bill page and the user must enter the item reference and second level of description. Alternatively, the user can re-define a new section head and description as well as entering quantities, units and rates.

A quick jump is possible by choosing key command Q. The system will prompt for the page number. If a legal page number has been entered the screen display will change and the the cursor will be positioned on the first item of the page requested. When the session is ended by pressing key command E the system will ask if the bill has been completed. However on completion of a bill, further amendment is not allowed by this program.

Third program.

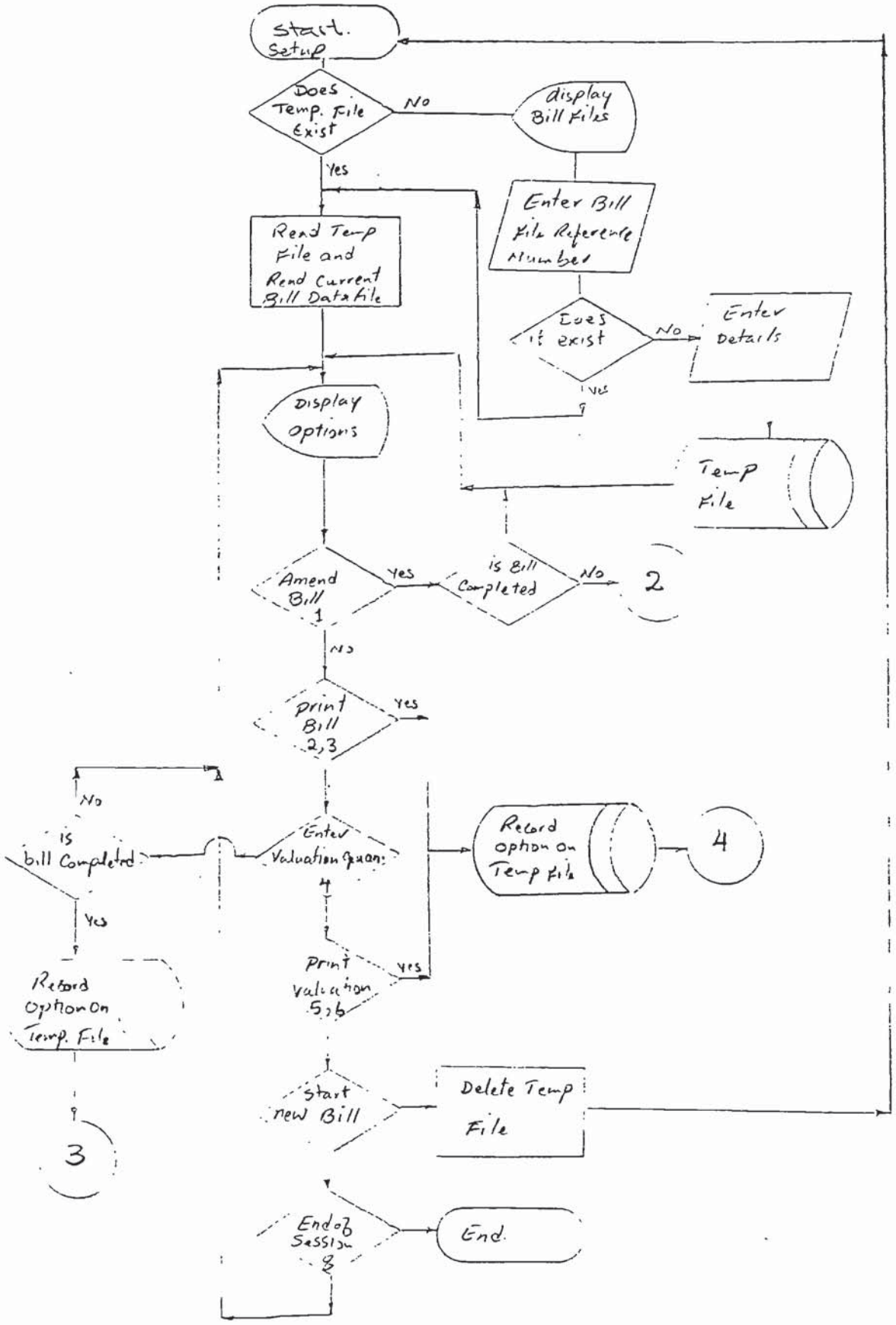
Access to this program is denied unless the tender bill has been completed. This program displays: tender bill the same as the previous program, the only difference being that tender quantities are replaced by the valuation quantities or work completed.

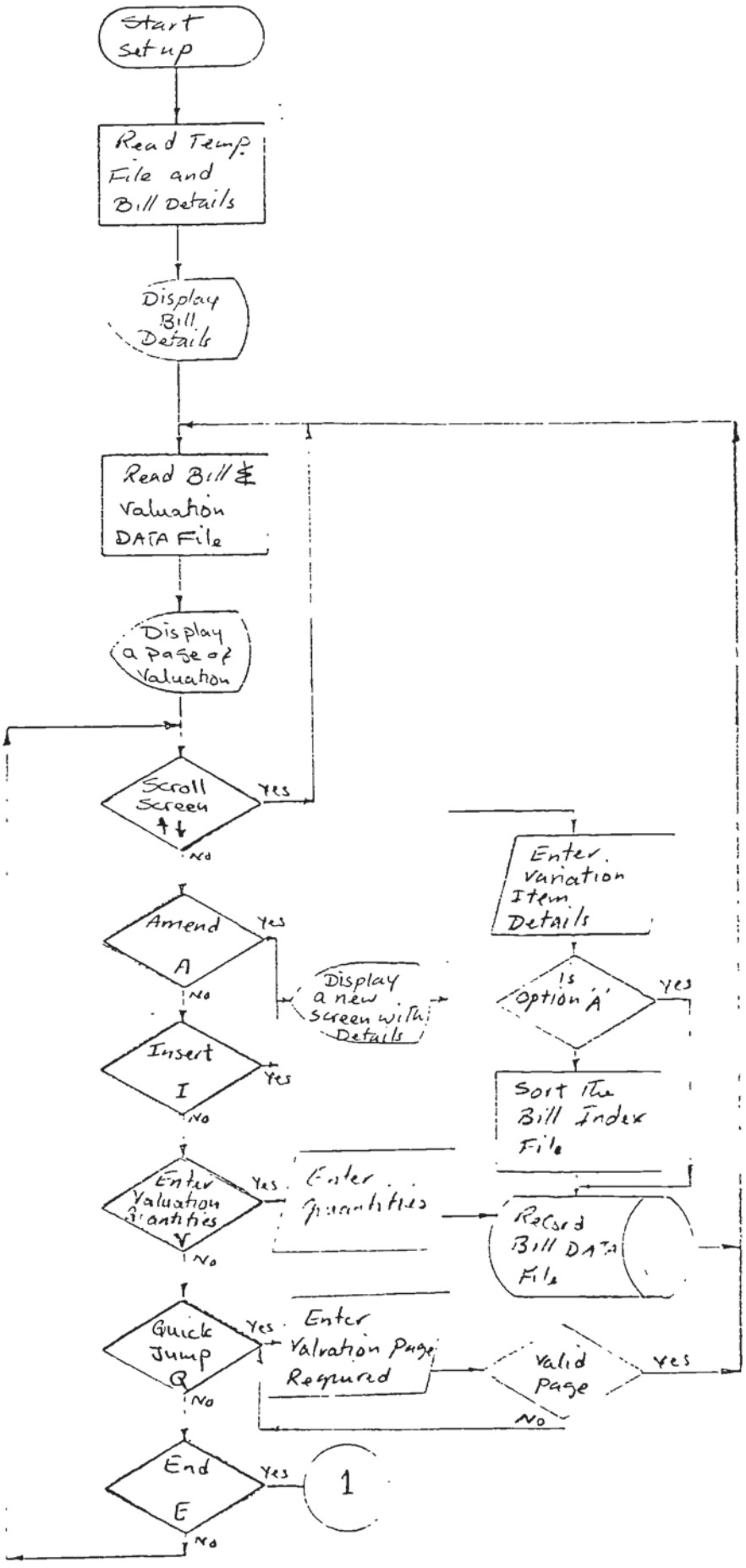
Similar command keys are displayed at the bottom of the screen with some exception. Any further insert is flagged as variation to the completed tender bill and deletion of items is not allowed. This option is replaced with 'key command V' for entering valuation quantities.

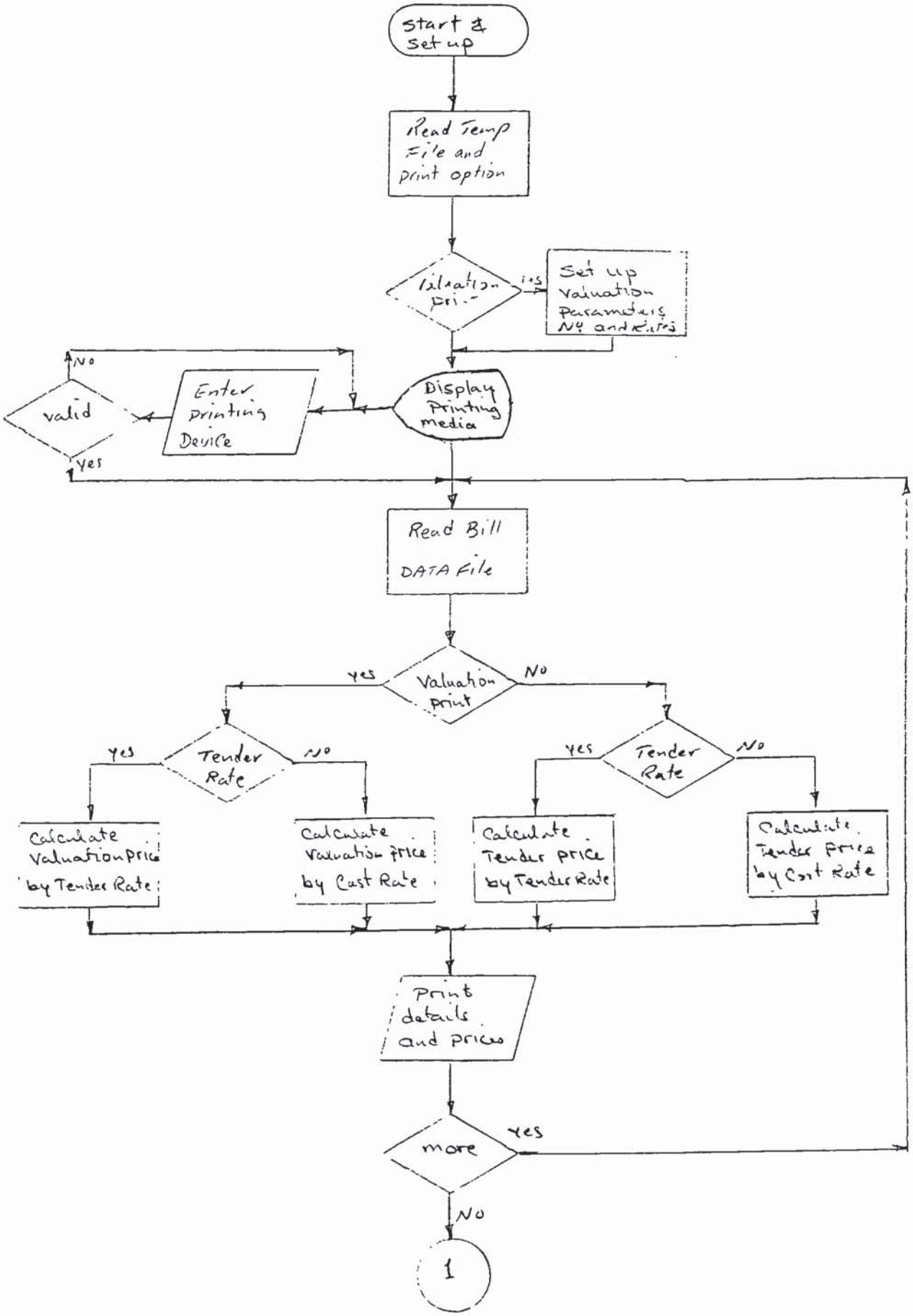
Fourth program.

This is the printing option which allows the user to get a hardcopy of either, tender bill with tender rates or cost control rates, or print of valuation of items which a quantity has been entered.

Provisions are given where a number of tender bills are to be appended or choice of printing on screen or various printers.


Start. Setup
Does Temp. File Exist
No
display Bill Files
Yes
Enter Bill File Reference Number
Read Temp File and Read Current Bill Data File
Does it exist
No
Enter Details
Yes
Display Options
Temp File
Amend Bill 1
Yes
is Bill Completed
No
2
No
Print Bill 2,3
Yes
No
Is bill Completed
Enter Valuation Details
Record option on Temp File
4
Yes
Record Option on Temp. File
Print Valuation 5,6
Yes
3
Start new Bill
Delete Temp File
End of Session 8
End.


Start
Set up
Read Temp. File and Bill Details
Display Bill Details
Read Bill & Valuation DATA File
Display a page of Valuation
Scroll Screen
Yes
No
Amend
A
Yes
No
Display a new screen with Details
Enter Variation Item Details
Is Option 'A'
Yes
Sort the Bill Index File
Insert
I
Yes
No
Enter Valuation Quantities
V
Yes
No
Enter Quantities
Record Bill DATA File
Quick Jump
Q
Yes
No
Enter Valvation Page Required
Valid Page
Yes
No
End
E
Yes
No
1


Start & set up
Read Temp File and print option
Valuation pri-
is
Set up Valuation Parameters No and Rates
No
valid
Yes
Enter printing Device
Display Printing media
Read Bill DATA File
Yes
Valuation print
No
Yes
Tender Rate
No
Yes
Tender Rate
No
Calculate Valuation price by Tender Rate
Calculate valuation price by Cost Rate
Calculate Tender price by Tender Rate
Calculate Tender price by Cost Rate
Print details and prices
more
Yes
No
1

```
00080  GOTO 100
00090  REM SAVE"@0:value",8:VERIFY"0:value",8:STOP
00095  END
00100  REM "Hamid Hasndadi Valuation   'VALUE'
          Version 1.1 26th May 1983 (H.H)"
00105  REM "Copyright Hamid Hasndadi, 48
          Meadowsweet Ave. Kingsnorton   "
00108  DIM S$(50),SN$(50),I$(500),IX(500)
00110  HM$=CHR$(19):
       CD$=HM$:
       FOR I=1 TO 24:
          CD$=CD$+"{cursor down}":
       NEXT
00124  CR$="":
       FOR I=1 TO 79:
          CR$=CR$+"{cursor right}":
       NEXT
00126  CU$="":
       FOR I=1 TO 24:
          CU$=CU$+"{cursor up}":
       NEXT
00128  CL$="":
       FOR I=1 TO 79:
          CL$=CL$+"{cursor left}":
       NEXT
00130  SP$="":
       FOR I=1 TO 79:
          SP$=SP$+" ":
       NEXT
00132  ST$="":
       FOR I=1 TO 10:
          ST$=ST$+"*":
       NEXT
00130  PM$="{rvs on}Hamid Hasndadi     48
          Meadowsweet Ave.  "
00134  PM$=PM$+"Birmingham 38
          021-451-2048{rvs off}"
00135  REM PM$="{rvs on}Section{rvs off} = 'end'
          {rvs on}or{rvs off} 'END' ( ){rvs on}to
          finish{rvs off}"
00136  REM PM$=PM$+"   {rvs on}All Input{rvs off}
          'xxxx'  {rvs on}to abort{rvs off}"
00138  Z1$="{rvs on}Section No:{rvs off}
              {rvs on}Page No:{rvs off}
            {rvs on}Item Ref:{rvs off}
00140  M$=CHR$(13)+CHR$(10):
       BK$=CHR$(13):
       I$=CHR$(95):
       PL=48:
       PN=0
00142  MR=0:
       MM$(4)="randb":
       MM$(1)="smm5":
       MM$(2)="smm6":
       MM$(3)="cesmm"
```

```
00422  PRINT "{clear.screen}{rvs.on}Job
          Reference{rvs.off} ";BN$;"  :
          {rvs.on}";JT$
00423  PRINT LEFT$(CD$,24);PM$;:
       POKE 225,22
00425  POKE 224,1:
       PRINT HM$;
00428  IF MM<>5 THEN
          GOSUB 53000
00440  REM ***************************
       A=1:
       IF VAL(VN$)=0 THEN
          A=1:
00460  O$(1)="1   Amend Tender Bill
00470  O$(2)="2   Print Tender Bill     (Tender
          Rates)
00475  O$(3)="3   Print Tender Bill     (Cost
          Control Rates)
00480  O$(4)="4   Input Valuation Quantities
00490  O$(5)="5   Print Valuation Bill (Tender
          Rates)
00492  O$(6)="6   Print Valuation Bill (Cost
          Control Rates)
00493  O$(7)="7   Start New Contract
00495  O$(8)="8   End   Of Program
00500  PRINT "{clear.screen)";:
       GOSUB 62000
00505  PRINT "      Option Table{2cursor.down)"
00510  FOR I=A TO 8:
          PRINT O$(I):
       NEXT
00520  PRINT "Which Option  ?
          ";LEFT$(SP$,20);LEFT$(CL$,20);
00530  GOSUB 60000:
       PRINT
00540  OP=VAL(IN$):
       IF OP>A-1 AND OP<9 THEN 00553
00545  PRINT SP$:
       PRINT "{cursor.up)";
00550  PRINT "Error in Option ";IN$;HM$;:
       GOTO 00505
00553  IF OP=1 AND CC$="y" THEN
          PRINT "{rvs.on}Bill
             Completed.{rvs.off}";:
          GOTO 00550
00555  IF OP=4 AND CC$="n" THEN
          PRINT "{rvs.on}Bill NOT completed
             yet.{rvs.off}";:
          GOTO 00550
00560  ON OP GOTO 00995,02000,02000,03000,04000,04
          000,00561,00570
00561  OPEN 15,8,15:
       PRINT #15,"s0:temp":
       CLOSE 15
00562  PRINT HM$,MM$;"{clear.screen)":
```

```
09000  STOP
09900  DATA "a42 ","",*,"Note all dimensions in
          descriptions are in    "
09910  DATA "         millimetres unless otherwise
          stated.",*,"",""
09920  DATA "a42 ","SECTION 1",*,"*Single storey
          Stores building drawing"
09930  DATA " Nr. 608/435A",*,"",""
20000  REM
20020  PRINT "{clear.screen}option 3"
20030  INPUT "Code          *{3cursor.left}";Z$
20035  IF Z$="*" THEN 20090
20040  F=0:
       FOR J=1 TO I:
          IF Z$=C$(J) THEN
             F=J:
             J=I
20050  NEXT
20060  IF F=0 THEN
          PRINT "{cursor.down}Code ";Z$(K);" not
             in bill - please check{4cursor.up}":
          GOTO 20030
20065  PRINT "{cursor.down}";SP$;"{2cursor.up}"
20070  INPUT "Quantity     *{3cursor.left}";Q$(F)
20080  GOTO 20020
20090  FOR J=1 TO I:
          IF Q$(J)="" THEN 20110
20100     PRINT C$(J),Q$(J)
20110  NEXT
20120  GOTO 00705
50000  PRINT "{clear.screen}{rvs.on}MicroAid
          Limited{rvs.off}";TAB(60);"{rvs.on}Valua
          tion Routine{rvs.off}"
50010  PRINT "{cursor.down}The main functions of
          the MicroAid Valuation program are to:
50020  PRINT "{2cursor.down}     Input / Edit /
          Print a Tender Bill of Quantities,
50030  PRINT "{cursor.down}     Perform interim
          valuations,
50040  PRINT "{cursor.down}     Print Valuations,
50060  PRINT "{2cursor.down}Each Bill Item
          comprises a code, ";
50065  PRINT "level 1 heading, level 2 heading
50070  PRINT "abreviated description, tender
          quantity, unit and rate.
50080  PRINT "{cursor.down}The code should
          comprise Work Section Letter, ";
50085  PRINT "bill page number and
50090  PRINT "item reference e.g. D12g
50100  PRINT "{cursor.down}SMM5, SMM6 and CESMM1 ";
50105  PRINT "Work Sections are allowed and the
          appropriate
50110  PRINT "headings will be printed."
50120  PRINT "Press spacebar when ready"
50130  GET A$:
```

```
00530  PRINT "{rvs.on}quantity
          {rvs.off}";TQ$
00540  PRINT "{rvs.on}rate              {rvs.off}";R$
00545  PRINT "{rvs.on}cost rate
          {rvs.off}";RZ$
00550  PRINT "{3cursor.down}{rvs.on}Main Heading
          {rvs.off}":
       PRINT "  "Hi$;M$;"  ";H2$
00570  PRINT "{3cursor.down}{rvs.on}Main entry
          {rvs.off}":
       PRINT "  ";Ai$;M$;"  ";A2$;M$;"  ";A3$
00595  POKE 158,0
00600  PRINT LEFT$(CD$,22);"{rvs.on}Amend this
          item{rvs.off}   y=yes n=no ^=next
          _=last d=delete";
00610  GET Q$:
       IF Q$="d" OR Q$="y" OR Q$="n" OR Q$="^" OR
            Q$="_" THEN 00700
00650  FOR I=1 TO 80:
       NEXT
00660  PRINT LEFT$(CD$,22);"Amend this item ?";
00670  FOR I=1 TO 80:
       NEXT
00680  GOTO 00600
00700  IF Q$="y" THEN 00710
00701  IF AM>0 THEN
          GOSUB 01600
00702  IF Q$="^" THEN
          II=II+1:
          R=I%(II):
          RE=R:
          GOTO 00706
00703  IF Q$="_" THEN
          II=II-1:
          GOTO 00706
00704  IF Q$="d" THEN
          I$(II)="delete"
00705  PRINT "{clear.screen}":
       GOTO 00428
00706  IF II=0 THEN
          II=1
00707  IF II>NI THEN
          II=NI
00708  R=I%(II):
       RE=R:
       GOTO 00500
00710  PRINT LEFT$(CD$,1);TAB(41);"{rvs.on}New
          Code       {rvs.off} ? ";:
       GOSUB 60000
00714  PRINT :
       IF IN$<>"" THEN
          C$=IN$:
          I$(II)=C$
00716  PRINT LEFT$(CD$,2);TAB(41);"{rvs.on}New
          Unit       {rvs.off} ? ";:
```

```
01520  R=R+1:
       RECORD £1,(R):
       INPUT £1,A3$
01530  RETURN
01540  PG$=MID$(C$,4,3)
01545  IF LEFT$(PG$,1)="*" THEN
          PG$=MID$(PG$,2):
          GOTO 01545
01550  PG=VAL(PG$):
       IF PG=PA THEN 01320
01555  RETURN
01600  REM SAVE AMENDED ITEM
01610  RECORD £1,(R),1:
       PRINT £1,C$
01620  RECORD £1,(R),11:
       PRINT £1,U$
01630  RECORD £1,(R),18:
       PRINT £1,TQ$
01640  RECORD £1,(R),31:
       PRINT £1,R$
01650  RECORD £1,(R),44:
       PRINT £1,VQ$
01655  RECORD £1,(R),58:
       PRINT £1,R2$
01660  RETURN
01700  PRINT "{2cursor.down}Last Valuation was
          Valuation ";VN$
01710  VN=VAL(VN$)+1
01720  PRINT LEFT$(CD$,5);
01730  PRINT "This is valuation number ";VN;"
          OK ? ";SP$
01735  PRINT LEFT$(CD$,5);LEFT$(CR$,44);
01740  GOSUB 60000:
       PRINT :
       IF IN$="" THEN 01720
01750  IF IN$="y" THEN 01800
01760  IF IN$<>"n" THEN 01720
01770  PRINT LEFT$(CD$,7);"You must be amending
          valuation number";VN-1;" ?";SP$
01780  PRINT LEFT$(CD$,7);LEFT$(CR$,44);:
       GOSUB 60000:
       PRINT :
       IF IN$="" THEN 01770
01790  IF IN$="y" THEN 01840
01795  IF IN$<>"n" THEN 01770
01798  PRINT "{clear.screen}":
       GOTO 01700
01800  VN$=MID$(STR$(VN),2)
01810  OPEN 2,8,2,"@1:"+F$+",u,w"
01820  PRINT £2,MM
01822  PRINT £2,VN$
01824  PRINT £2,NI
01826  PRINT £2,BT$
01828  PRINT £2,RT$
01830  CLOSE 2
```

```
           GOTO 02840
02720   IF AG$="e" THEN 02230
02730   IF AG$="d" AND NI>2 THEN
           ZM=22-LK(D6):
           GOTO 03340
02740   POKE 34810-(D5*80),62:
        GOTO 02670
02745   IF D6=NI THEN 02650
02750   D5=D5-LK(D6):
        D6=D6+1:
        IF D6>NI THEN
           PRINT CHR$(7);:
           GOTO 07000
02760   IF D6=I THEN
           JT=I:
           GG=0:
           ZM=6:
           PRINT CHR$(7);:
           GOTO 01180
02770   GOTO 02670
02780   D6=D6-1:
        D5=D5+LK(D6):
        IF D6<=0 OR D5>ZM OR D5>22 THEN 02800
02790   GOTO 02670
02800   JT=I-20:
        GG=0:
        ZM=0:
        IF JT<2 THEN
           PRINT CHR$(7):
           PRINT "{clear.screen}":
           GOTO 01180
02810   REM
02820   PRINT CHR$(7):
        PRINT "{clear.screen}"
02830   GOTO 01170
02840   I=D6
02850   GOTO 01200
02860   PRINT "{2cursor.home}{clear.screen}{rvs.on}
           Job Reference  {rvs.off}
           ";BN$;TAB(25);BT$;
02870   PRINT ;TAB(62);"{rvs.on}Amend Tender
           Bill{rvs.off}"
02880   POKE 224,1
02890   PRINT LEFT$(CD$,24);
02900   PRINT "{rvs.on}cursur=scroll       q=quick
             a=amend       e=end";
02910   PRINT "      d=delete        i=insert";
02920   POKE 225,23:
        PRINT HM$
02930   RETURN
02940   REM REDUCTION FROM TOTAL SUM
02950   A$=LEFT$(C$,2):
        IF LEFT$(A$,1)="*" THEN
           A$=RIGHT$(A$,1)
02960   DE=S:
```

```
02890  PRINT LEFT$(CD$,24);
02900  PRINT "(rvs.on)cursur=scroll      q=quick
          a=amend       e=end";
02910  PRINT "      v=valuation        i=insert";
02920  POKE 225,23:
       PRINT HM$
02930  RETURN
02940  REM REDUCTION FROM TOTAL SUM
02950  A$=LEFT$(C$,2):
       IF LEFT$(A$,1)="*" THEN
          A$=RIGHT$(A$,1)
02960  DE=S:
       GOSUB 02500
02970  IF U$="  Sum" OR U$=" Item" OR U$=" SUM"
            OR U$=" ITEM" THEN 02990
02980  GOTO 03000
02990  T(S)=T(S)-VAL(R1$):
       S=DE:
       GOTO 03010
03000  T(S)=T(S)-(VAL(R1$)*VAL(TG$)):
       S=DE
03010  RETURN

03020  REM" re-order of index array. ref. deletion"
03030  D1=RX(D6,0):
       D2=RX(D6,1):
       FOR T=D6 TO NI-1
03040     RX(T,0)=RX(T+1,0):
          LK(T)=LK(T+1):
          I$(T)=I$(T+1)
03050     RX(T,1)=RX(T+1,1):
       NEXT :
       RX(D6-1,1)=D2:
       RX(NI-1,1)=D1:
       RX(NI,0)=D1
03060  NI=NI-1:
       JT=I-1:
       IF JT=>NI THEN 07000
03065  GG=0:
       GOTO 01180
03070  REM RE-ORDER OF INDEX ARRAY. REF. INSERTION
03075  IF D6>NI THEN 03140
03080  D1=RX(NI+1,0):
       IF D1=<0 THEN
          D1=RX(NI,1):
          D2=D1+6:
          GOTO 03100
03090  D2=RX(NI+1,1)
03100  FOR T=NI+1 TO D6+1 STEP -1
03110     RX(T,0)=RX(T-1,0):
          I$(T)=I$(T-1):
          LK(T)=LK(T-1)
03120     RX(T,1)=RX(T-1,1):
       NEXT :
       RX(D6,0)=D1:
```

```
        GOTO 00225
00200   OPEN 2,8,2,"i:"+BN$+",u,r"
00205   INPUT £2,MM:
        INPUT £2,VN$:
        INPUT £2,NI:
        INPUT £2,BT$(SX)
00210   CLOSE 2:
        ER$="":
        LP$=""
00211   GOSUB 12000
00215   IF VA$="t" THEN
           TT$=T1$+T2$
00218   IF SX=1 THEN
           RETURN
00219   IF VA$="t" THEN
           TT$=T1$+T2$
00220   IF VA$="v" THEN
           TT$=T1$+VN$+T2$
00222   RETURN
00225   PRINT "{clear.screen}Output Device
00226   PRINT "{cursor.down}Screen        = 's'
00227   PRINT "{cursor.down}Olivetti      = 'o'
00228   PRINT "{cursor.down}Dolphin       = 'd'
00229   PRINT "{cursor.down}CBM matrix    = 'c'":
        PRINT "{6cursor.down}";ER$;"{6cursor.up}"
00230   PRINT "{2cursor.down}Which output Device
             *        {10cursor.left}";:
        INPUT IN$
00231   DV$=LEFT$(IN$,1)
00232   IF DV$="o" THEN
           DV=4:
           I$=CHR$(95):
           FF$="":
           GOTO 00254
00233   IF DV$="s" THEN
           DV=3:
           I$=CHR$(163):
           FF$="":
           GOTO 00254
00234   IF DV$="d" THEN
           DV=5:
           I$=CHR$(164):
           FF$=CHR$(12):
           GOTO 00254
00235   IF DV$="c" THEN
           DV=4:
           I$=CHR$(95):
           FF$=CHR$(12):
           GOTO 00254
00250   ER$="Error - no such device":
        GOTO 00225
00254   UL$="":
        FOR I=1 TO 79:
           UL$=UL$+I$:
        NEXT :
```

DESCRIPTION	QUAN.	UNIT	RATE	PRICE

BLUE CIRCLE SANDSWORTH

GENERAL ITEMS

	Time Related Charges				
K	£1011.66/18weeks=556.20per week	£55	Sum	£64	£55 00
	Prime Cost Sums Piling				
H	Piling works	£000	Sum	£8000	£000 00
J	Add for attendance	£0	Sum	90	£0 00
L	2.Surplus Material for disposal	£0	m3	6.30	63 00
K	add for attendance	£49	Sum	£64	£49 00

				Carried to Summary	£377 00
					========

EARTHWORKS

A	R.C. bed 0.25 - 0.5m thick	20	m3	8.50	£70 00
B	ditto inside existing building	£0	m3	£0.00	£00 00
F	Ditto max. depth 0.5-1.0 m	20	m3	6.30	£26 00
	Ditto max. depth 0.5-1.0m inside exts bldgs.				
G	Ditto max. depth 0.5-1.0m inside ext. blds.	£0	m3	8.39	84 00
H	Hamid testing	£5	m2	63.00	945 00
I	Ditto max. depth 1-2 m inside ext; building	£0	m3	8.39	84 00
J	Level and compact surfaces	20	m2	0.16	3 20
K	Truimming of slopes in fill material	£00	ks	0.26	26 00
1	Concrete Grade 30	£0	m3	31.64	316 40
7	Reinf. beams 0.25-1 m2.	£0.35	m3	£0.50	£08 65
9	reinf. pile cap.	£0.35	m3	4.19	43 47
8	Ditto -horizontal 0.2-0.4m wide	2345.2	m2	£3.65	3201£ 98

SUMMARY Blue Circle Handsworth

GENERAL ITEMS	1377 00
EARTHWORKS	34018 72
Total	35395 73

A P P E N D I X C

Outline of Sub-contractor/Supplier accounts and payment-

This package consists of nine programs which are accessed through the set-up program. After the initial set-up the program reads and displays: previous date of access and checks that entries are for the current week and subsequently reads the customised file.

The system uses an assembly language program FABS, (Fast Access Btree Structure) that uses key files for fast data retrieval since data files are relatively large.

FABS/86 assigns input data to key files and arranges those files in balanced trees (Btrees) to speed data retrieval. When access to the data file is required FABS/86 searches down the tree to locate that record. If necessary FABS/86 will rearrange the key files on that tree for easier access to the data base.

The following commands can be executed with FABS/86:-

B	Build key file	O	Open key file
K	Close key file	R	Replace key
C	Create key file	S	Search for key
D	Delete key (s)	F	Search for first key
M	Get maximum key length	G	Search for generic key
Q	Get next record number	L	Search for last key
U	Get number of open deletes	N	Search for next key
H	Get number of primary keys	P	Search for previous key
T	Get number of records	W	Write page map.
I	Insert key		

First program:

This acts as a main menu which displays options available after initial FABS set-up and reading of customised file which holds a number of sub-contractors, total VAT due and date limit for payments of tax etc.

The main functions are to:-

1) change the date limit of contract updating.
2) change of VAT amount due
3) give access to rest of option/programs

Second program: :

The major function of this program is to allow the user to enter a new certificate of payment for sub-contractors. After the initial set-up and reading of customised file a menu of options is displayed. Other functions of this program include recording acknowledgements of payments on sub-contractor files and listing those payments still pending acknowledgement from the sub-

contractor's file. Other options displayed provide access to other programs in this package. All payments are entered under a subcontractor code in a payfile.

Third program:

The main functions of this program are to :

1) update the contract file which contains the status of contracts, job title, date of completion and value of contract.

2) List/print, add and delete contracts from journal file which holds contract number, sub-contractor name and number, gross value and discount values, levy payments, liabilities, tax, VAT, payments(current and previous) and date of payments and retention.

Fourth program:-

This program is concerned with the listing and printing of contracts in which sub-contractors are involved with all payments such as gross discount, CITB, Tax and VAT, previous and net etc. This option also creates a holding file which contains exact details of print, of each contract for printing, and further examinations.

Fifth program:

The management and updating of the sub-contractors files (i.e. deleting and listing subcontractors etc.) is the major operation of this program. One of the options is to list and print only the sub-contractors whose records are still active in the address files.

Sixth program:

Its main function is the management of sub-contractors/ suppliers general data file which holds; name, address, trade code, certificate No. and expiry date of certificate. This program allows the listing/printing of the data file in the order of name, address or trade. Additionally the options allow amending, deletion and insertion to the address file.

Seventh program:

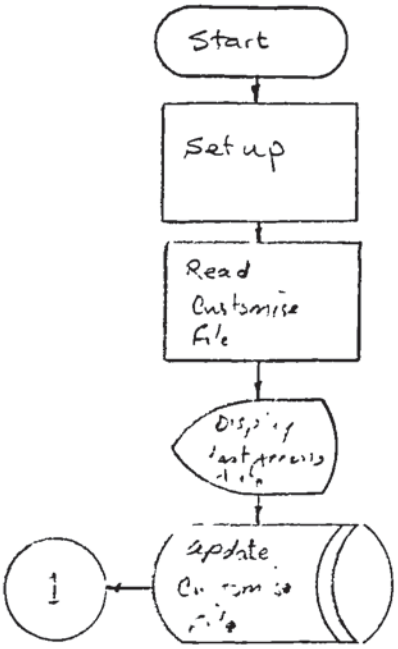
Its primary purpose is to interrogate the subcontractors' file and display or print the records of individual sub-contractors involvement within contracts and relevant payments made or due.

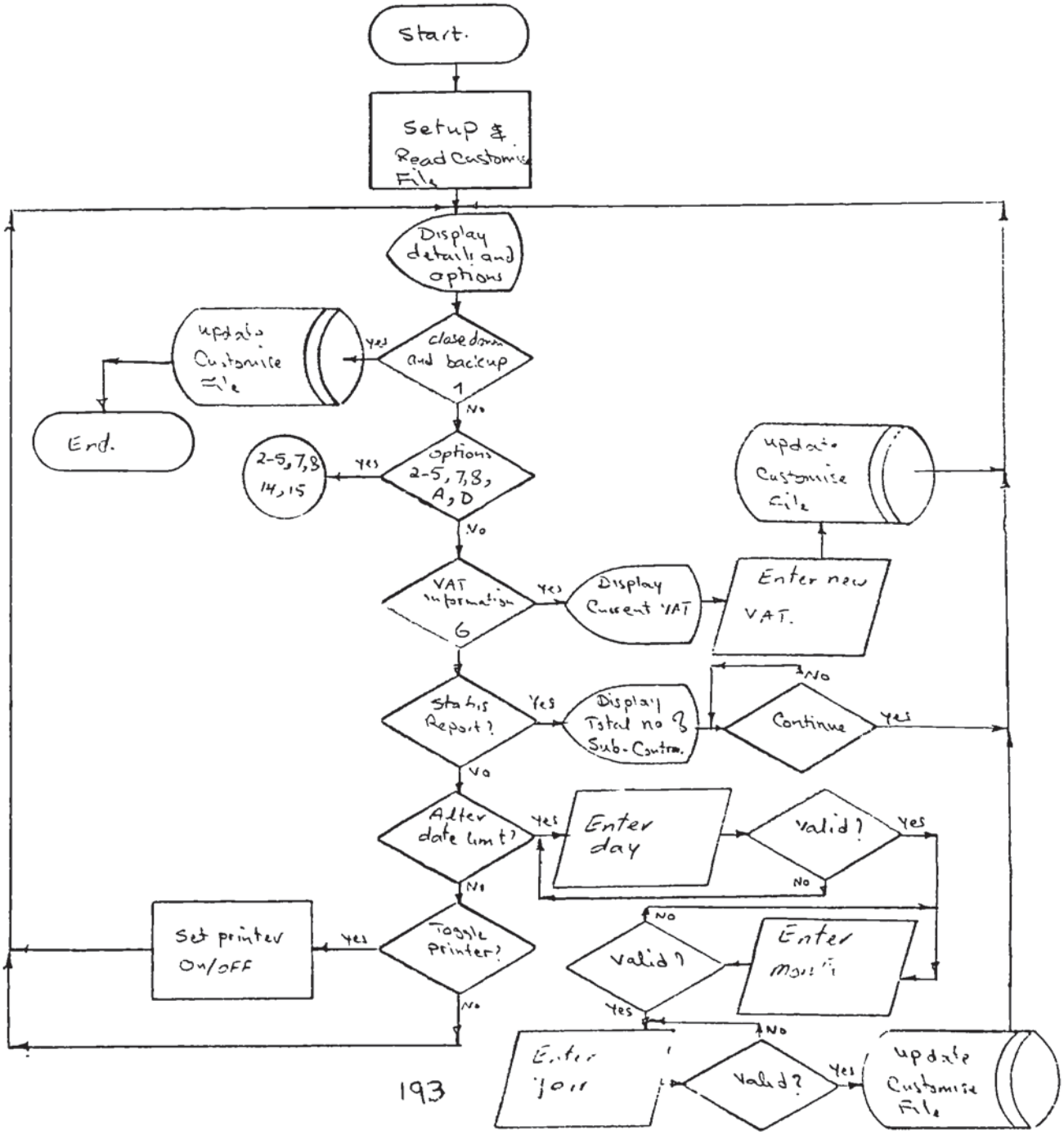
Eighth Program:

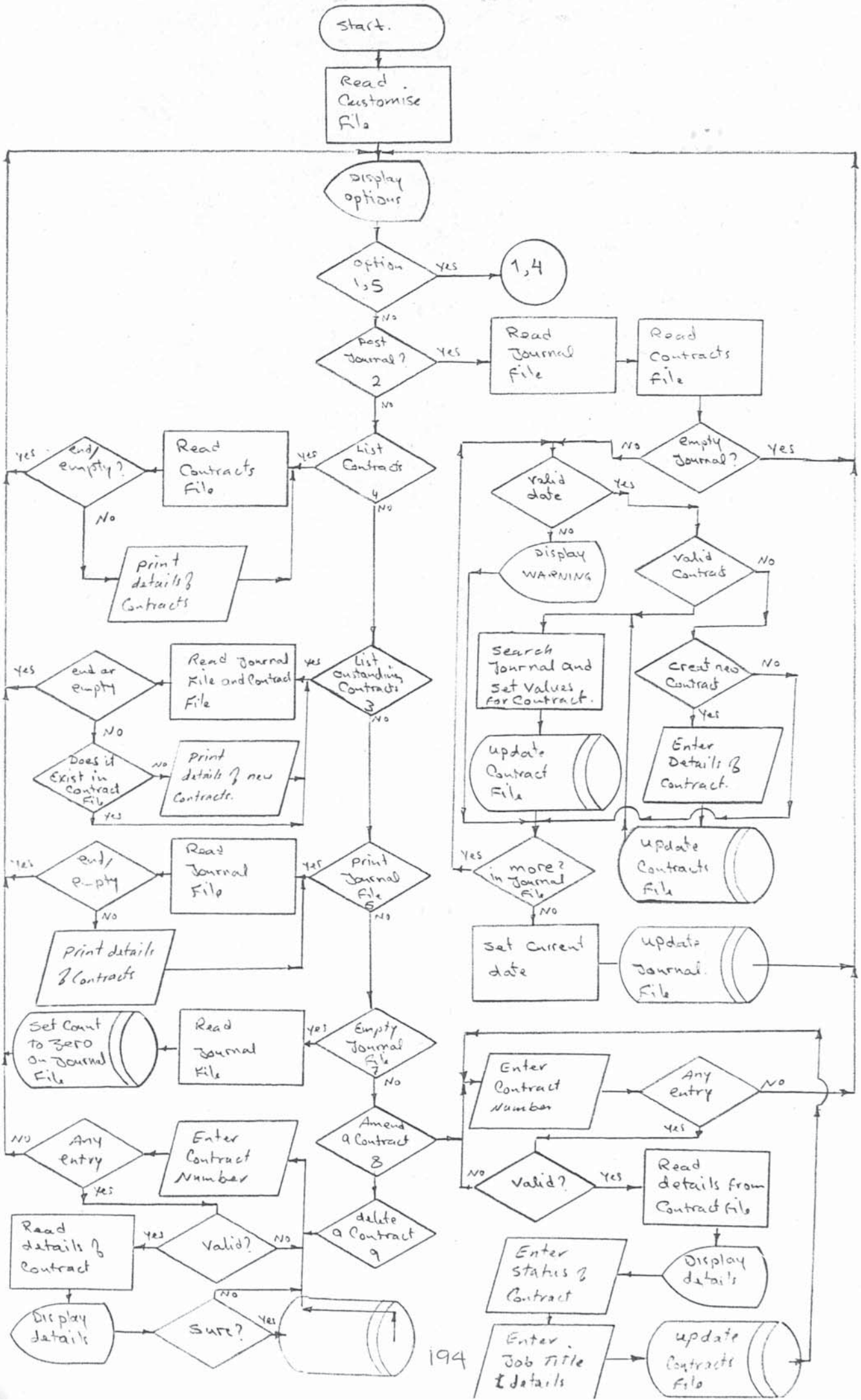
The main function is to issue tax forms for different types of sub-contractors. i.e. nominated, domestic or labour where tax has been withheld. With the labour-only sub contractors the system will issue tax forms based on the date limit set.

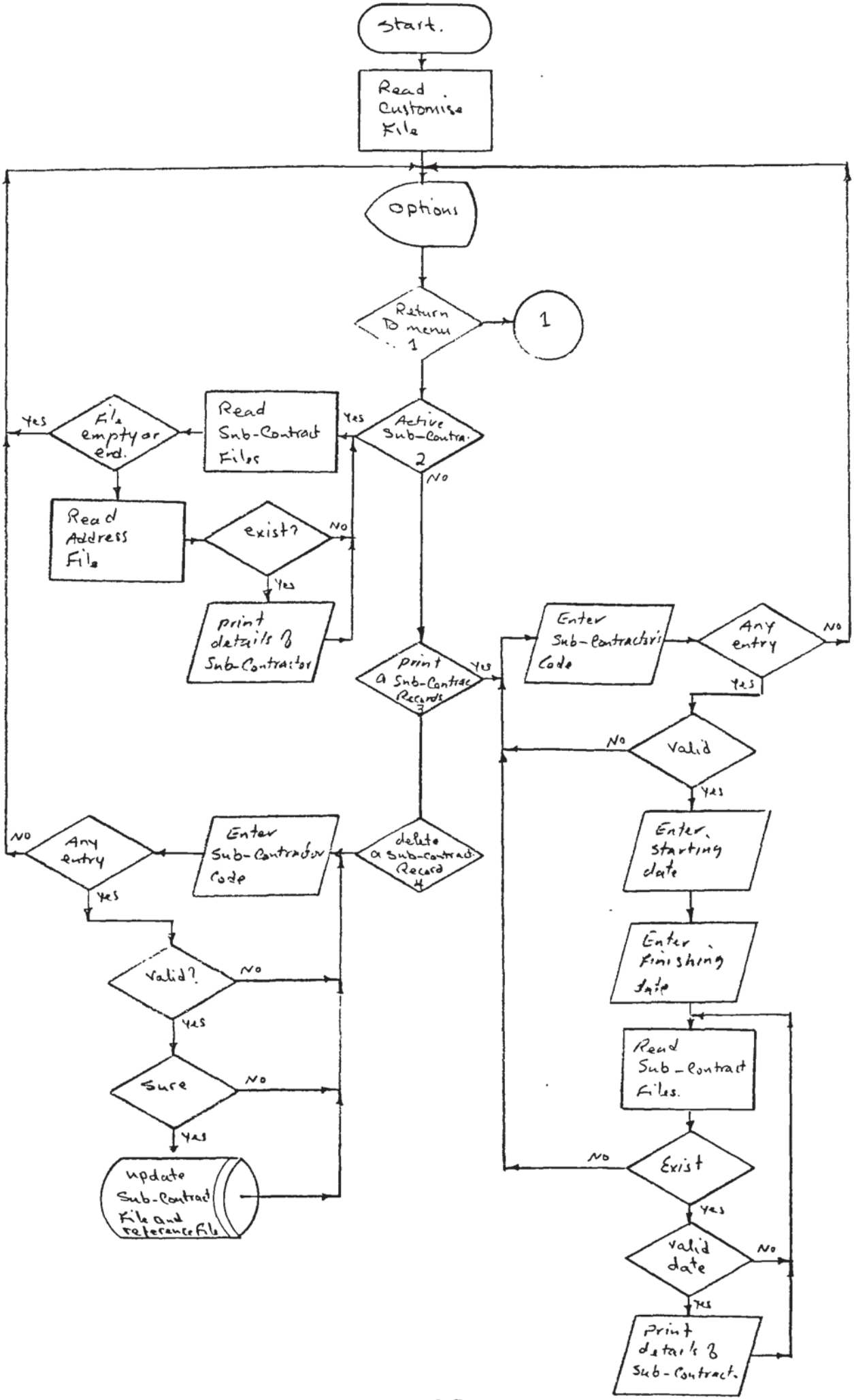
Ninth program:

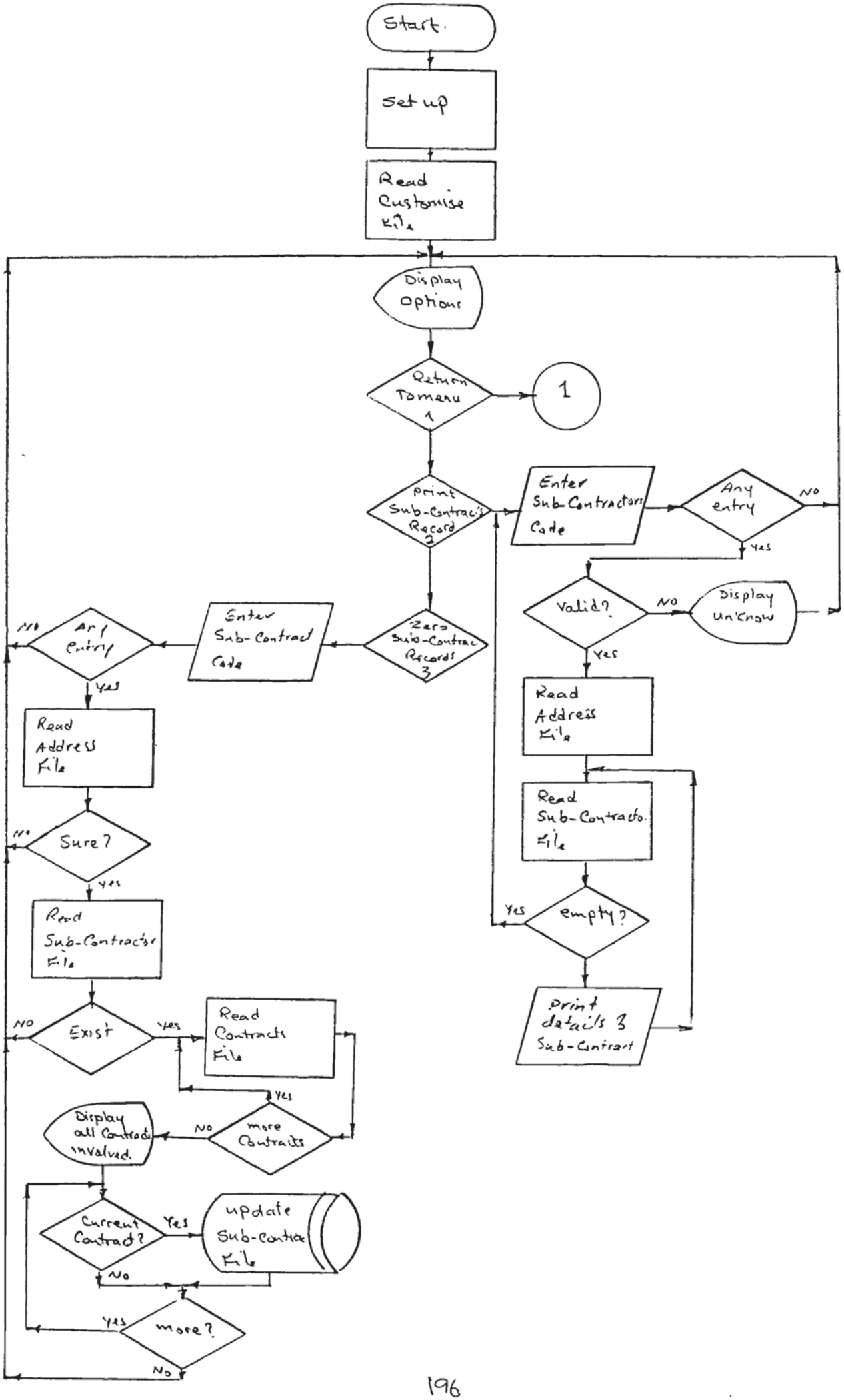
This program involves the cleaning of the contents of payfile for a sub contractor and totalling up the payments which have been previously acknowleged with all the relevant information regarding date, amount and contract name and description.

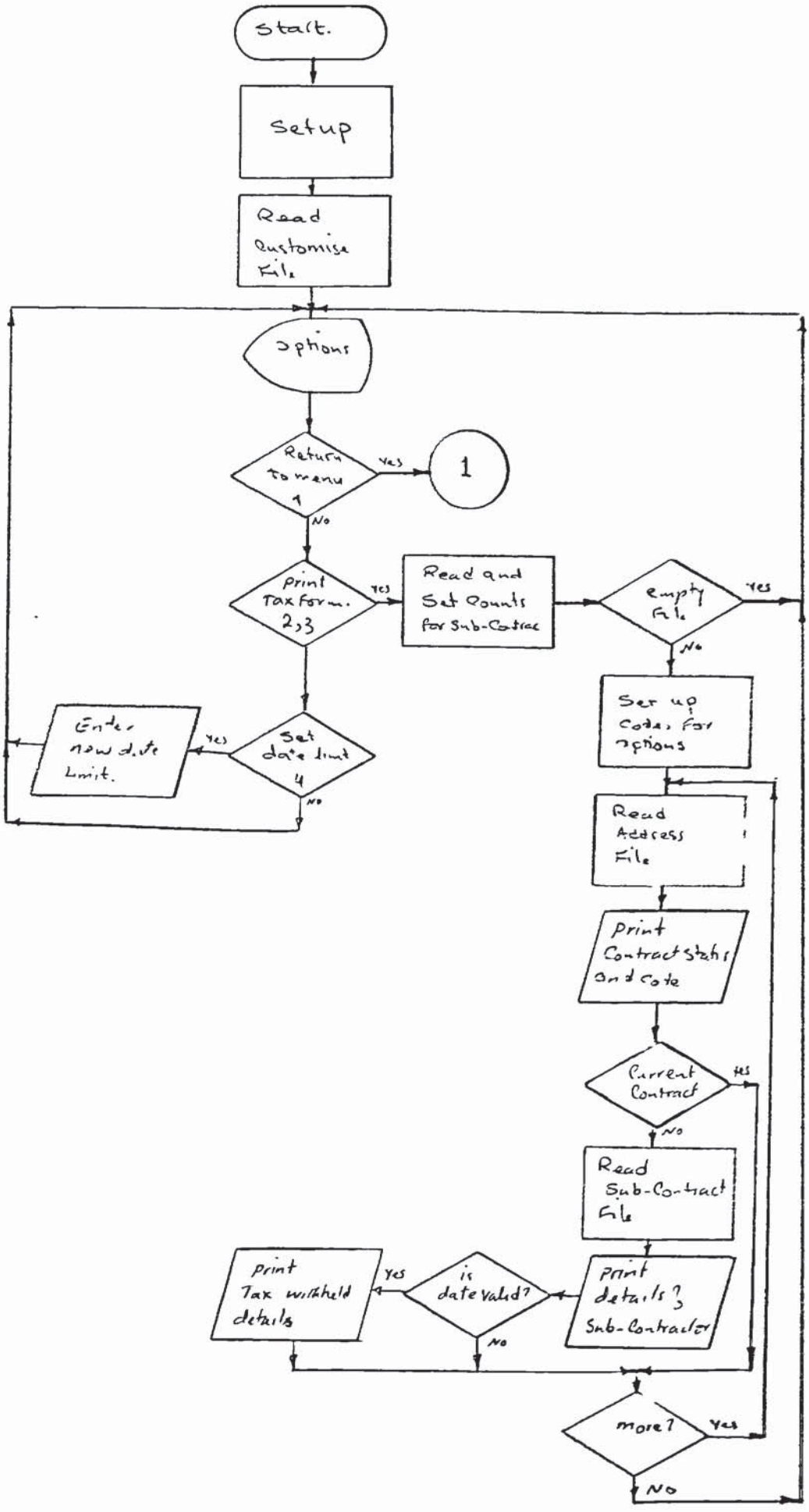

Start
Set up
Read Customise File
Display last errors file
Update Customise file
1

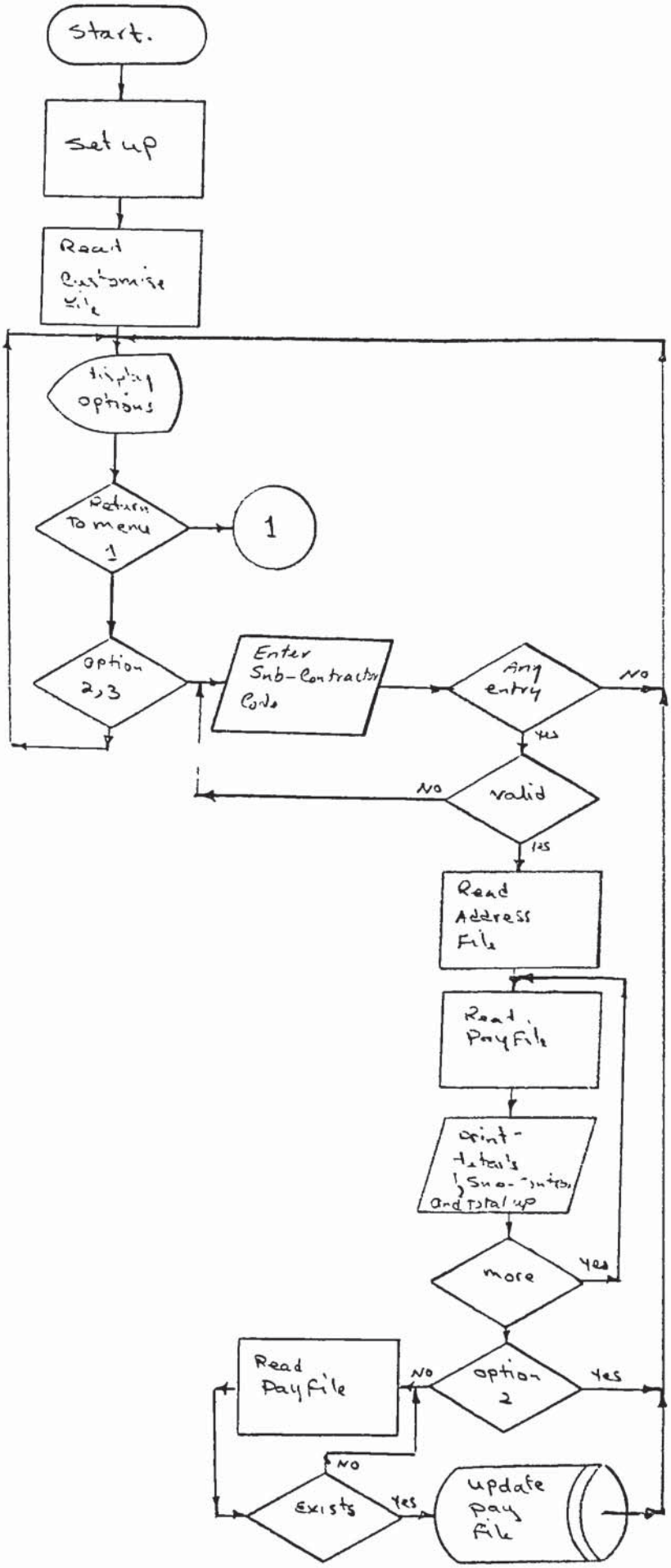

Start.
Setup & Read Customise File
Display details and options
close down and backup
Yes
Update Customise file
End.
No
options 2-5, 7, 8, A, D
Yes
2-5, 7, 8, 14, 15
No
VAT information 6
Yes
Display Current VAT
Enter new VAT.
Update Customise file
Stats Report?
Yes
Display Total no & Sub-Contrs.
Continue
No
Yes
No
Alter date limit?
Yes
Enter day
Valid?
Yes
No
No
Toggle printer?
Yes
Set printer On/OFF
No
Valid?
No
Enter
Yes
Enter your
Valid?
No
Yes
Update Customise File


start.
Read Customise File
Display options
option 1,5
Yes
1,4
No
Post Journal? 2
Yes
Read Journal file
Read Contracts file
No
empty Journal?
Yes
No
Valid date
Yes
No
Display WARNING
Valid Contract
No
Yes
Search Journal and set Values for Contract.
Create new Contract
No
Yes
update Contract File
Enter Details of Contract.
Update Contracts File
more? in Journal File
Yes
No
Set current date
Update Journal File
End/ empty?
Yes
No
Read Contracts File
List Contracts 4
Yes
No
Print details of Contracts
End or empty
Yes
No
Read Journal File and Contract File
List outstanding Contracts 3
Yes
No
Does it Exist in Contract File
No
Yes
Print details of new Contracts.
End/ empty
Yes
No
Read Journal File
Print Journal File 5
Yes
No
Print details of Contracts
Set Count to zero on Journal File
Read Journal File
Empty Journal File 7
Yes
No
Amend a Contract 8
Any entry
No
Yes
Enter Contract Number
Valid?
No
Yes
Read details from Contract File
Enter status of Contract
Display details
Enter Job Title & details
update Contracts File
delete a Contract 9
Any entry
No
Yes
Enter Contract Number
Valid?
Yes
No
Read details of Contract
Display details
Sure?
No
Yes


Start.
Read Customise File
Options
Return D menu 1
1
Active Sub-Contra. 2
Yes
Read Sub-Contract Files
File empty or end.
Yes
Read Address File
exist?
No
Yes
print details of Sub-Contractor
No
print a Sub-Contrac Records 3
Yes
Enter Sub-Contractor's Code
Any entry
No
Yes
Valid
No
Yes
Enter starting date
Enter finishing date
Read Sub-Contract Files.
Exist
No
Yes
valid date
No
Yes
Print details of Sub-Contract.
delete a Sub-Contract Record 4
Enter Sub-Contractor Code
Any entry
NO
Yes
Valid?
No
Yes
Sure
No
Yes
update Sub-Contract File and reference file


Start.
Set up
Read Customise File
Display options
Return To menu 1
1
Print Sub-Contract Record 2
Enter Sub-Contractors Code
Any entry
NO
Yes
Valid?
NO
Display Un'Know
Yes
Zero Sub-Contrac Records 3
Enter Sub-Contract Code
Any Entry
NO
Yes
Read Address File
Read Address File
Read Sub-Contracto. File
empty?
Yes
print details 3 Sub-Contract
Sure?
NO
Yes
Read Sub-Contractor File
Exist
NO
Yes
Read Contracts File
Yes
more Contracts
NO
Display all Contracts involved.
Current Contract?
Yes
update Sub-Contrac File
No
more?
Yes
No


Start.
Setup
Read Customise File
Options
Return to menu 1
Yes
1
No
Print Tax form. 2,3
Yes
Read and Set Counts for Sub-Contrac
Empty File
Yes
No
Set up Codes for Options
Set date limit 4
Yes
Enter new date Limit.
No
Read Address File
Print Contract Start and Cote
Current Contract
Yes
No
Read Sub-Contract File
Print details? Sub-Contractor
is date valid?
Yes
Print Tax withheld details
No
more?
Yes
No


Start.
Set up
Read Customise File
display options
Return To menu 1
1
Option 2,3
Enter Sub-Contractor Code
Any entry
NO
YES
valid
NO
YES
Read Address File
Read Pay File
print - totals - sub-totals and total up
more
YES
Read Pay file
NO
option 2
YES
NO
Exists
YES
update pay file

```
80 GOTO 100
90 SAVE"TIRE8":STOP
100 REM"jOB cOSTING&tIME rECORDING pROGRAM fEES rENDERED v3.0
      04/06/84 bY h.h"
102 ON ERROR GOTO 103:GOTO 105
103 IF ERR=53 OR ERR=58 THEN ER=ERR
      :RESUME NEXT ELSE ON ERROR GOTO 0
105 CV$="":CLR$=CHR$(27)+"E":HM$=CHR$(27)+"A"+CHR$(13)
      :UP$=CHR$(27)+"A"
110 FOR I=1 TO 79:UL$=UL$+"-":NEXT
115 PRINT CLR$:PW$="":P1$=""
      :GOSUB 63100
120 M$=CHR$(10)+CHR$(13)
      :SP$="                                                    "
125 DIM JB$(200),JB(200)
130 HM$=CHR$(19):S1$="                                                    2"
140 OPEN "R",#1,"LASTAC":FIELD #1,15 AS HDT$,15 AS HT9$,
      15 AS HMM$:GET #1,1
145 DT$=HDT$:T9$=HT9$:CLOSE#1
150 DEF FNA(X)=INT(X*100+.5)/100
160 J1$="JOB NO. FEES APPLIED   DATE OF LAST  TOTAL FEES   DATE
      OF LAST  MONEY
165 K2$="         FOR TO DATE    APPLICATION   RECIEVED     RECEIPT"
166 K2$=K2$+"OUTSTANDING"
220 T1$="JOB NO.  JOB NAME AND CLIENT                          FEE
      WIP   FEE APP
225 T1$=T1$+" DATE OF TOTAL FEES  DATE OF    MONEY    MONEY
      WIP
230 T2$="
      EARNED        FOR"
235 T2$=T2$+"     APP   RECIEVED  RECEIPT     OWED  OUTSTANDING
240 PRINT CLR$
243 '
245 UZ$=CHR$(95):
246 FOR I=1 TO 79:UM$=UM$+UZ$:NEXT
300 HDA$="     FEES APPLIED FOR / RECIEVED OPTIONS : "+LEFT$(T9$,
      INSTR(T9$," "))+LEFT$(DT$,8):PRINT CLR$;TAB(40-
      INT(LEN(HDA$)/2));HDA$:PRINT:PRINT
305 PRINT "         1  LIST ENTIRE FEES FILE
310 PRINT "         2  LIST INDIVIDUAL ENTRY IN Fees FILE
320 PRINT "         3  FEE RENDERED
330 PRINT "         4  FEE RECEIVED
332 PRINT "         5  WORK IN PROGRESS TO FEE COMPARISON SUMMARY
335 PRINT "         6  RETURN TO MAIN MENU
340 PRINT:PRINT "        WHICH OPTION ?";
344 OP$=INKEY$:IF OP$="" THEN 344
350 OP=VAL(OP$):IF OP>0 AND OP<7 THEN 400
360 GOTO 344
400 PRINT CLR$;:ON OP GOTO 550,1000,10000,20000,2000,500
410 END
500 F$="TIRE1"
505 RUN F$
550 GOSUB 2005
560 IF NF=0 THEN 300
562 PRINT CLR$;"PRINTER OUTPUT REQUIRED  (y/n)";
```

```
10 DIM FE$(30):FOR I=0 TO 30:READ FE$(I):NEXT
11 DATA "","Unknown","Unknown","Unknown","Improper key for integer
     key file","Attempted generic search on integer key"
12 DATA "Key not found on delete","Incorrect number of primary keys",
     "Syntax error in command string","No more key space"
13 DATA "Input key larger than maximum","Tried to access unopened file",
     "Key not found","Key not found","Unknown","Key not found",
     "Key not found"
14 DATA "","","","","","File not present on disc","Out of directory space",
     "Diskette full","Write error (faulty disc)","File not present on close",
     "Read error -end of file","","Cannot close","Random record out of range"
15 CMND$="O\ADDFILE.FAB\1":GOSUB 19
16 CMND$="T\1":GOSUB 19:NA=RECNO
17 CMND$="U\1":GOSUB 19:NA=NA-RECNO
18 GOTO 100
19 DEF SEG=&H2D8:FABS86M=&H5
20 CALL FABS86M(CMND$,ERRF%,RECNO%,ADRKEY%)
21 DEF SEG:IF ERRF%<>0 AND ERRF%<>ERX THEN PRINT "FABS ERROR NUMBER "ERRF%;
     :IF ERRF%<31 THEN PRINT FE$(ERRF%)
22 RECNO=RECNO%
23 IF RECNO<0 THEN RECNO=RECNO+65536!
24 RETURN
25 KEY$="":ADRKEY=ADRKEY%
26 IF ADRKEY<0 THEN ADRKEY=ADRKEY+65536!
27 FOR ISUB=ADRKEY TO ADRKEY+6
28 DEF SEG = &H2D8:RCHAR=PEEK(ISUB)
29 DEF SEG
30 KEY$=KEY$+CHR$(RCHAR)
31 NEXT:RETURN
90 SAVE "SPACE01",A:STOP
100 REM
110 OU$="":DIM N$(50),VV(50,5):BELL$=CHR$(7)
120 A$=CHR$(27):HM$=A$+"H":CLR$=A$+"E":CR$="":FOR I=1 TO 80:CR$=CR$+
     A$+"C":NEXT
130 DIM X(5):X(1)=21:X(2)=32:X(3)=43:X(4)=54:X(5)=67
140 DIM D$(7),M$(12),TH$(31),VT(5),VO(4),CD(5,40),AN$(30),AP(30)
150 OPEN "I",#1,"MOAKCONT.DAT"
160 INPUT#1,NR,MR,TL$,D1,DD,MM,YY,TD,NV
170 INPUT#1,NT,MS:DL=INT(NT/100):ML=NT-100*DL:YL=MS
180 INPUT#1,XX,XX,VT(0),VT(1),VT(2),VT(3),VT(4),VT(5)
190 INPUT#1,VO(1),VO(2),VO(3),VO(4),DV,MI,MU:CLOSE 1
200 FOR I=1 TO 7:READ D$(I):NEXT:GOTO 270
210 OPEN "O",#1,"MOAKCONT.DAT"
220 PRINT#1,NR","MR","TIME$","D1","DD","MM","YY","TD","NV;CHR$(13);
230 PRINT#1,NT","MS;CHR$(13);
240 PRINT#1,NA","MA","VT(0)","VT(1)","VT(2)","VT(3)","VT(4)","VT(5);CHR$(13);
250 PRINT#1,VO(1)","VO(2)","VO(3)","VO(4)","DV","MI","MU;CHR$(13);
260 CLOSE 1:RETURN
270 FOR I=1 TO 12:READ M$(I):NEXT
280 FOR I=1 TO 31:TH$(I)="th":IF I=1 OR I=21 OR I=31 THEN TH$(I)="st"
290 IF I=2 OR I=22 THEN TH$(I)="nd"
300 IF I=3 OR I=23 THEN TH$(I)="rd"
310 NEXT
320 DATA "Monday","Tuesday","Wednesday","Thursday","Friday"
330 DATA "Saturday","Sunday"
```

```
340 DATA "January","February","March","April","May","June","July"
350 DATA "August","September","October","November","December"
360 D=DD:M=MM:Y=YY:IF Y<100 THEN Y=Y+1900:YY=Y
370 DT$=D$(D1)+STR$(DD)+TH$(DD)+" "+M$(MM)+STR$(YY)+"."
380 PRINT CLR$:PRINT"Subcontractor Payment Certificates.  "DT$
390 PRINT:PRINT"Main option list."
400 NS=0:PRINT CHR$(27)"x5"
410 PRINT"Date limit for contracts updating ";STR$(DL);TH$(DL)" "M$(ML);YL
420 PRINT:PRINT"1 Close down - to backup data"
430 PRINT"2 Enter payment certificates
440 PRINT"3 Update contract files
450 PRINT"4 Produce face sheets
460 PRINT"5 Produce listing of subcontractor transactions"
470 PRINT"6 Produce VAT information"
480 PRINT"7 Subcontractor address and certificate maintenance"
490 PRINT"8 Year end clearance"
500 PRINT"9 System status"
510 PRINT"A Produce list for year end tax return
520 PRINT"B Alter date limit for contract updating"
530 PRINT "C Toggle printer - printer is ";:IF DV=1 THEN PRINT"on"
      ELSE PRINT"off"
532 PRINT "D Payments out maintenance"
540 PRINT:PRINT"CHOOSE ";:V=0
550 A$=INKEY$:IF A$<>"" THEN 590
560 PRINT HM$;LEFT$(CR$,140);LEFT$(TIME$,8)
570 FOR I=1 TO 19:PRINT:NEXT:PRINT"CHOOSE ";
580 GOTO 550
590 A=VAL(A$):IF A=0 THEN A=(ASC(A$) AND (255-32))-55:IF A<1 OR A>13
      THEN A=0
600 PRINT CHR$(27)"y5";:IF A=0 THEN PRINT BELL$;:GOTO 550
610 PRINT CLR$:IF A$="A" OR A$="a" THEN RUN "space14"
611 PRINT CLR$:IF A$="d" OR A$="D" THEN RUN "space15"
620 ON A GOTO 650,660,660,660,660,740,660,660,680,660,780,630
630 PRINT:IF DV=1 THEN DV=0 ELSE DV=1
640 GOSUB 210:GOTO 380
650 PRINT CLR$:GOSUB 210:PRINT CLR$"To restart type RESTART"
651 PRINT "To format a disc type FORMAT   Note:ONLY floppy drive B"
652 PRINT "To backup the data type BACKUP"
653 SYSTEM
660 A$=MID$(STR$(A),2):IF A<10 THEN A$="0"+A$
670 A$="SPACE"+A$:RUN A$
680 PRINT CLR$"System status":PRINT
690 PRINT NA"Subcontractors on record"
700 PRINT:PRINT"Press spacebar when ready"
710 A$=INKEY$:IF A$="" THEN 710
720 GOTO 380
730 IF A<>6 THEN 770
740 PRINT"Current VAT amount is"VO(2)
750 INPUT"New VAT amount";A$:IF A$<>"" THEN VO(2)=VAL(A$)
760 GOSUB 210:GOTO 380
770 REM
780 PRINT CLR$:PRINT:PRINT:PRINT:PRINT"Give new day, month and year
      for the date limit."
790 PRINT:PRINT"Current date limit is "STR$(DL);TH$(DL)" "M$(ML);YL
800 PRINT "Day ";DL
```

```
5 A$=CHR$(27):HM$=A$+"H":CLR$=A$+"E":CR$="":FOR I=1 TO 80:CR$=CR$+
      A$+"C":NEXT
6 BELL$=CHR$(7):SP$="":FOR I=1 TO 80:SP$=SP$+" ":NEXT:CU$=A$+"A"
10 DIM FE$(30):FOR I=0 TO 30:READ FE$(I):NEXT
11 DATA "","Unknown","Unknown","Unknown","Improper key for integer key file",
      "Attempted generic search on integer key"
12 DATA "Key not found on delete","Incorrect number of primary keys",
      "Syntax error in command string","No more key space"
13 DATA "Input key larger than maximum","Tried to access unopened file",
      "Key not found","Key not found","Unknown","Key not found","Key not found"
14 DATA "","","","","","File not present on disc","Out of directory space",
      "Diskette full","Write error (faulty disc)","File not present on close",
      "Read error -end of file","","Cannot close","Random record out of range"
15 CMND$="O\ADDFILE.FAB\2":GOSUB 19:CMND$="O\SUBFILE.FAB\1":GOSUB 19
      :CMND$="O\PAYFILE.FAB\3":GOSUB 19
16 CMND$="T\2":GOSUB 19:NA=RECNO:CMND$="T\1":GOSUB 19:NC=RECNO
17 CMND$="U\2":GOSUB 19:NA=NA-RECNO:CMND$="U\1":GOSUB 19:NC=NC-RECNO
18 GOTO 100
19 DEF SEG=&H2D8:FABS86M=&H5
20 CALL FABS86M(CMND$,ERRF%,RECNO%,ADRKEY%)
21 DEF SEG:REM IF ERRF%<>0 AND ERRF%<>ERX THEN PRINT "FABS ERROR NUMBER "
     ERRF%;:IF ERRF%<31 THEN PRINT FE$(ERRF%)
22 RECNO=RECNO%
23 IF RECNO<0 THEN RECNO=RECNO+65536!
24 RETURN
25 KEY$="":ADRKEY=ADRKEY%
26 IF ADRKEY<0 THEN ADRKEY=ADRKEY+65536!
27 FOR ISUB=ADRKEY TO ADRKEY+12
28 DEF SEG = &H2D8:RCHAR=PEEK(ISUB)
29 DEF SEG
30 KEY$=KEY$+CHR$(RCHAR)
31 NEXT:RETURN
90 SAVE "SPACE02",A:STOP
100 REM "SPACE02 MK2.0 18/12/84 H.H ENTER PYMNT CERT."
110 DIM VV#(12),VP#(12),VN#(12)
120 MO$="THIS":MO=0
130 OPEN "I",#1,"MOAKCONT.DAT"
140 INPUT#1,NR,MR,TL$,D7,DD,MM,YY,TD,NV:Y=YY:IF YY>1900 THEN Y=YY-1900
150 INPUT#1,NS,MS:D2=DD+32*MM+32*13*Y:DL=INT(NS/100):ML=NS-100*DL:YL=MS
160 INPUT#1,XX,XX,VT(0),VT(1),VT(2),VT(3),VT(4),VT(5)
170 INPUT#1,VO(1),VO(2),VO(3),VO(4),DV,MI,MU:CLOSE 1:GOTO 240
180 OPEN "O",#1,"MOAKCONT.DAT"
190 PRINT#1,NR","MR","TI$","D7","DD","MM","YY","TD","NV;CHR$(13);
200 PRINT#1,NS","MS;CHR$(13);
210 PRINT#1,NA","MA","VT(0)","VT(1)","VT(2)","VT(3)","VT(4)","VT(5);CHR$(13);
220 PRINT#1,VO(1)","VO(2)","VO(3)","VO(4)","DV","MI","MU;CHR$(13);
230 CLOSE 1:RETURN
240 PRINT CLR$:INPUT "Enter batch total of amounts now due";BT$:
      BT=VAL(BT$):BP=0
250 PRINT CLR$"Batch total"BT;TAB(27)"Amount posted"BP;
260 PRINT TAB(53)"Amount to be posted"BT-BP
270 PRINT:PRINT"1 Return to main option list"
280 PRINT"2 Enter new payment certificate"
290 PRINT"3 Proceed to update contract file"
300 PRINT"4 Goto subcontractor address maintenance"
```

```
1930 PUT#1,(J1+1):CLOSE#1
1931 CMND$="I\3\"+LEFT$(KEY1$,5):GOSUB 19:PRINT ERRF%,RECNO
1932 OPEN "R",#1,"PAYFILE.DAT",39
1933 FIELD#1,20 AS DES$,5 AS CON$,8 AS AMNT$,2 AS DD$,2 AS MM$,2 AS YY$
1934 LSET DES$="Payment Certificate":LSET CON$=MID$(KEY1$,6,5):LSET
     AMNT$=MKD$(VN#(10)):LSET DD$=MKI$(DD):LSET MM$=MKI$(MM):LSET
     YY$=MKI$(YY)
1935 PUT#1,RECNO:CLOSE#1
1940 GOTO 250
1950 PRINT"Press spacebar when ready"
1960 A$=INKEY$:IF A$<>" " THEN 1960
1970 RETURN
1980 PRINT CLR$"Payment acknowledgement received ":PRINT:GOSUB 720
1990 INPUT "Give subcontractor code";KEY1$:IF KEY1$="" THEN CLOSE#1:GOTO 250
2000 KEY1$=LEFT$(KEY1$+SP$,5)
2010 INPUT "Give contract number ";A$:KEY1$=KEY1$+RIGHT$("0000"+A$,4)
2020 INPUT "Give type (D/L/N)";A$:IF A$<>"D" AND A$<>"L" AND A$<>"N" THEN 2020
2030 KEY1$=KEY1$+A$:INPUT "Give certificate number";CN1
2040 CMND$="G\1\1\"+KEY1$
2050 GOSUB 19:IF ERRF%<>0 THEN 2110
2060 GOSUB 25:IF LEFT$(KEY$,10)<>KEY1$ THEN 2110
2070 GET#1,RECNO:CN=VAL(CN$):IF ABS(CN)<>CN1 THEN CMND$="N\1":GOTO 2050
2080 IF CN>1 THEN PRINT"Certificate number"CN" already acknowledged"
2090 PRINT"Certificate receipt recorded"
2100 LSET CN$=MID$(STR$(ABS(CN)),2):PUT#1,RECNO:GOTO 1990
2110 PRINT"Record Key "KEY1$" not found - try again":GOTO 1990
2120 IF DV=1 THEN PRINT CLR$"Printer not ready":LPRINT:PRINT CLR$
2130 OU$=CLR$+"List of unacknowledged payments":GOSUB 2230:PRINT:GOSUB 720
2140 CMND$="F\1\1":OU$="Subcon   Con. No.  Cert No":GOSUB 2230
2150 GOSUB 19:IF ERRF%<>0 THEN 2200
2160 GET#1,RECNO:CN=VAL(CN$):IF CN>=0 THEN 2190
2170 GOSUB 25:PRINT LEFT$(KEY$,5)"     "MID$(KEY$,6,5)"     ";-CN
2180 IF DV=1 THEN LPRINT LEFT$(KEY$,5)"   "MID$(KEY$,6,5)"  ";-CN
2190 CMND$="N\1":GOTO 2150
2200 CLOSE#1:GOSUB 2210:GOTO 250
2210 PRINT:PRINT"Press spacebar when ready"
2220 A$=INKEY$:IF A$<>" " THEN 2220 ELSE RETURN
2230 PRINT OU$:IF DV=1 THEN LPRINT OU$:RETURN ELSE RETURN
```

```
350 PRINT"2 Post contents of journal file
360 PRINT"3 List contracts"
370 PRINT"4 List outstanding contract entries on journal file"
380 PRINT"5 Proceed to print summary sheets"
390 PRINT"6 Print contents of journal file"
400 PRINT"7 Clear out journal file"
410 PRINT"8 Change name/status of a contract file"
420 PRINT"9 Delete a contract"
430 PRINT:PRINT"Choose ";
440 A$=INKEY$:IF A$="" THEN 440
450 A=VAL(A$):PRINT CLR$
460 IF A=0 OR A>9 THEN 320
470 ON A GOTO 480,500,1340,920,490,1010,1210,1220,1410
480 RUN "SPACE01"
490 RUN "SPACE04"
500 IF YL>100 THEN YL=YL-1900
520 DT=ML*31+YL*32*13+DL
550 GOSUB 1640:GOSUB 1610:GET#1,1:J1=CVS(DD$)
560 J3=0:IF J1=0 THEN PRINT"Journal file empty":GOTO 900
570 FOR J2=1 TO J1:GET#1,(J2+1)
580 FOR K=1 TO 12:VV#(K)=CVD(MID$(VVV$,(K-1)*8+1,8)):NEXT:DP=CVS(DD$)
      :MP=CVS(MM$):YP=CVS(YY$):CN=CVS(CN$)
600 IF YP>100 THEN YP=YP-1900
610 DQ=DP+MP*31+YP*32*13:IF DQ<=DT THEN 630
620 PRINT KEY11$,CN,DP,MP,YP;"Dated beyond cutoff date":GOTO 870
630 N$=MID$(KEY11$,6,5)+LEFT$(KEY11$,5)
640 PRINT"Updating file for journal entry code "N$
650 CMND$="G\1\1\"+LEFT$(N$,4):GOSUB 19
660 IF ERRF%=0 THEN 710
670 PRINT "New contract (no records found) Code "LEFT$(N$,4)
675 PRINT "Create New Contract";VAL(N$);:INPUT Q$:Q$=LEFT$(Q$,1)
      :IF Q$="n" OR Q$="N" OR Q$="" THEN 880
680 CMND$="I\1\"+N$:GOSUB 19:INPUT "Give this new contract a name
      please";CT$:LSET NME$=CT$:PM=0:PY=0
690 INPUT "Give status code (1 Current, 2 completed, 3 dead)";SC
      :IF SC<1 OR SC>3 THEN 690
700 LSET KEY1C$=N$:LSET CNC$=STR$(SC):LSET DDC$=STR$(0):MMC$=STR$(0)
      :YYC$=STR$(0):PUT#2,RECNO
710 REM
720 REM
750 CMND$="S\1\1\"+N$:GOSUB 19:IF ERRF%=0 THEN 780
770 VP#(8)=0:CMND$="I\1\"+N$:GOSUB 19:KEY1$=LEFT$(N$+SP$,10):GOTO 800
780 GET#2,RECNO:KEY1$=KEY1C$
790 FOR I=1 TO 12:VP#(I)=CVD(MID$(VVVC$,(I-1)*8+1,8)):NEXT
800 VO(2)=VO(2)+VV#(8)-VP#(8):VV#(11)=VP#(11)
810 VV$="":FOR K=1 TO 12:VV$=VV$+MKD$(VV#(K)):NEXT:LSET VVVC$=VV$
815 LSET CNC$=CN$:LSET DDC$=MID$(STR$(DP),2):LSET MMC$=MID$(STR$(MP),2)
      :LSET YYC$=MID$(STR$(YP),2)
816 LSET NME$=CT$
820 LSET KEY1C$=KEY1$:PUT#2,RECNO
830 GOTO 880
870 J3=J3+1:PUT#1,(J3+1)
880 PRINT:NEXT
890 LSET DD$=MKS$(J3):PUT#1,1
900 CLOSE#1:CLOSE#2:
```

```
330 A$=INKEY$:IF A$="" THEN 330
340 A=VAL(A$):PRINT CLR$
345 IF A$="a" OR A$="A" THEN GOSUB 380:GOTO 25000
350 IF A<1 OR A>9 THEN PRINT BELL$:GOTO 220
360 IF A=1 OR A=8 THEN 1420
370 GOSUB 380:GOTO 410
380 OPEN "R",#1,"ADDRESS.REL",248
390 FIELD#1,7 AS KEY11$,7 AS KEY21$,7 AS KEY31$,1 AS STW$,10 AS A01$,
     30 AS A11$,30 AS A21$,30 AS A31$,30 AS A41$,30 AS A51$,30 AS A61$,
     30 AS A71$,6 AS A81$
400 RETURN
410 ON A GOTO 1420,420,420,610,880,1000,1310,1420,1440
420 PRINT "Press 1 for listing by address code, 2 for listing by name"
     :PRINT"or 3 for listing by trade"
430 A$=INKEY$:IF A$="" THEN 430
440 INPUT "Give leading characters if required ";LC$:L=LEN(LC$)
450 B=VAL(A$):IF B>3 OR B=0 THEN B=1
460 A$=MID$(STR$(B),2)
470 IF NA=0 THEN CLOSE#1:GOTO 220
480 ERX=15:IF LC$="" THEN CMND$="F\"+A$+"\1":GOSUB 19
490 IF LC$<>"" THEN CMND$="G\"+A$+"\1\"+LC$:GOSUB 19
500 IF A=3 THEN PRINT CLR$;LEFT$(CD$,10);TAB(20);"Printer not ready"
510 IF A=3 THEN LPRINT "ADDRESS LISTING":LPRINT:PRINT CLR$
520 FOR I=1 TO NA
530 GET#1,RECNO:GOSUB 25
540 IF A=2 THEN PRINT KEY11$:PRINT A11$:PRINT A21$:PRINT A31$:PRINT
     A41$:PRINT A51$:PRINT A61$:PRINT A71$:PRINT CVS(A81$)
550 IF A=3 THEN LPRINT KEY11$:LPRINT A11$:LPRINT A21$:LPRINT A31$:
     LPRINT A41$:LPRINT A51$:LPRINT A61$:LPRINT A71$:LPRINT CVS(A81$)
555 IF H$="A" THEN LPRINT KEY11$;TAB(10);A11$:PRINT KEY11$;TAB(10);A11$
560 CMND$="N\1":GOSUB 19:GOSUB 25:IF L>0 THEN IF LEFT$(KEY$,L)<>LC$ THEN I=NS
570 A$=INKEY$:IF A$<>"" THEN GOSUB 850
580 NEXT:IF A=3 THEN LPRINT CHR$(12)
590 CLOSE 1:IF A=2 THEN GOSUB 850
600 GOTO 220
610 PRINT CLR$;"Setting up an address record"
620 INPUT "Give address code";KEY1$:IF KEY1$<>"" THEN 640
630 CLOSE 1:GOTO 220
640 KEY1$=LEFT$(KEY1$+SP$,7):CMND$="S\1\1\"+KEY1$:GOSUB 19
650 IF ERRF%<>0 THEN 670
660 PRINT "Address code ";KEY1$;" already on file":GOSUB 850:GOTO 620
670 NA=NA+1
680 INPUT "Give INITIALS OF NAME (INC Mr etc) (max 10 chars) ",A0$
690 INPUT "Give 1st NAME (max 30 chars) ",A1$
695 INPUT "Give 2nd NAME (max 30 chars) ",A2$
700 INPUT "Give TRADE CODE (2 chars) ",AZ$:L=LEN(AZ$):IF L<>2 THEN
     PRINT BELL$:GOTO 700
710 KEY2$=LEFT$(A1$+SP$,7)
720 KEY3$=LEFT$(AZ$+A1$+SP$,7):CMND$="I\1\"+KEY1$+"\"+KEY2$+"\"+
     KEY3$:GOSUB 19
730 PRINT"Record ";RECNO,KEY1$,KEY2$,KEY3$
740 INPUT "Give address line 1 of 3";A3$
750 INPUT "Give address line 2";A4$
760 INPUT "Give address line 3";A5$
770 INPUT "Give telephone number";A6$
```

```
5 A$=CHR$(27):HM$=A$+"H":CLR$=A$+"E":CR$="":FOR I=1 TO 80:CR$=CR$+A$+"C":NEXT
6 BELL$=CHR$(7):SP$="":FOR I=1 TO 80:SP$=SP$+" ":NEXT
10 DIM FE$(30):FOR I=0 TO 30:READ FE$(I):NEXT
11 DATA "","Unknown","Unknown","Unknown","Improper key for integer key file",
     "Attempted generic search on integer key"
12 DATA "Key not found on delete","Incorrect number of primary keys",
     "Syntax error in command string","No more key space"
13 DATA "Input key larger than maximum","Tried to access unopened file",
   "Key not found","Key not found","Unknown","Key not found","Key not found"
14 DATA "","","","","","File not present on disc","Out of directory space",
   "Diskette full","Write error (faulty disc)","File not present on close",
   "Read error -end of file","","Cannot close","Random record out of range"
15 CMND$="O\ADDFILE.FAB\2":GOSUB 19:CMND$="O\SUBFILE.FAB\1":GOSUB 19
16 CMND$="T\2":GOSUB 19:NA=RECNO
17 CMND$="U\2":GOSUB 19:NA=NA-RECNO
18 GOTO 100
19 DEF SEG=&H2D8:FABS86M=&H5
20 CALL FABS86M(CMND$,ERRF%,RECNO%,ADRKEY%)
21 DEF SEG:IF ERRF%<>0 AND ERRF%<>ERX THEN PRINT "FABS ERROR NUMBER "
     ERRF%;:IF ERRF%<31 THEN PRINT FE$(ERRF%)
22 RECNO=RECNO%
23 IF RECNO<0 THEN RECNO=RECNO+65536!
24 RETURN
25 KEY$="":ADRKEY=ADRKEY%
26 IF ADRKEY<0 THEN ADRKEY=ADRKEY+65536!
27 FOR ISUB=ADRKEY TO ADRKEY+12
28 DEF SEG = &H2D8:RCHAR=PEEK(ISUB)
29 DEF SEG
30 KEY$=KEY$+CHR$(RCHAR)
31 NEXT:RETURN
90 SAVE "space08",A:STOP
100 REM SPACE08 MK2.0 18/12/84 H.H (YEAR END CLEARANCE) "
110 OU$="":DIM VV#(12),N$(100),N%(100):GOTO 160
120 PRINT OU$:IF DV=1 THEN LPRINT OU$:RETURN ELSE RETURN
130 PRINT USING "######";O;:LPRINT USING "####";O;:RETURN
131 PRINT USING "#########.##";O#;:LPRINT USING "#########.##";O#;:RETURN
150 FOR II=1 TO N-L:OU$=OU$+" ":NEXT:OU$=OU$+O$:RETURN
160 OPEN "I",#1,"MOAKCONT.DAT"
170 INPUT#1,NR,MR,TL$,D1,DD,MM,YY,TD,NV
180 INPUT#1,NS,MS
190 INPUT#1,NA,MA,VT(0),VT(1),VT(2),VT(3),VT(4),VT(5)
200 INPUT#1,VO(1),VO(2),VO(3),VO(4),DV,MI,MU:CLOSE#1:GOTO 270
210 OPEN "O",#1,"MOAKCONT.DAT"
220 PRINT#1,NR","MR","TI$","D1","DD","MM","YY","TD","NV;CHR$(13);
230 PRINT#1,NS","MS;CHR$(13);
240 PRINT#1,NA","MA","VT(0)","VT(1)","VT(2)","VT(3)","VT(4)","VT(5);CHR$(13);
250 PRINT#1,VO(1)","VO(2)","VO(3)","VO(4)","DV","MI","MU;CHR$(13);
260 CLOSE#1:RETURN
270 IF DV=1 THEN PRINT CLR$"Printer not ready.":LPRINT:PRINT CLR$
280 PRINT CLR$"Year end clearance":PRINT
290 PRINT"1 Return to main option list"
300 PRINT"2 Print out a subcontractor's record
310 PRINT"3 Zero a subcontractor's record
320 PRINT:PRINT"Choose ";
330 A$=INKEY$:IF A$="" THEN 330
```

```
5 A$=CHR$(27):HM$=A$+"H":CLR$=A$+"E":CR$="":FOR I=1 TO 80:CR$=CR$+A$+"C":NEXT
6 BELL$=CHR$(7):SP$="":FOR I=1 TO 80:SP$=SP$+" ":NEXT
10 DIM FE$(30):FOR I=0 TO 30:READ FE$(I):NEXT
11 DATA "","Unknown","Unknown","Unknown","Improper key for integer key file",
     "Attempted generic search on integer key"
12 DATA "Key not found on delete","Incorrect number of primary keys",
     "Syntax error in command string","No more key space"
13 DATA "Input key larger than maximum","Tried to access unopened file",
   "Key not found","Key not found","Unknown","Key not found","Key not found"
14 DATA "","","","","","File not present on disc","Out of directory space",
   "Diskette full","Write error (faulty disc)","File not present on close",
   "Read error -end of file","","Cannot close","Random record out of range"
        ="O\ADDFILE.FAB\2":GOSUB 19:CMND$="O\SUBFILE.FAB\1":GOSUB 19
        ="T\1":GOSUB 19:NA=RECNO
     $="U\1":GOSUB 19:NA=NA-RECNO
   GOTO 100
19 DEF SEG=&H2D8:FABS86M=&H5
20 CALL FABS86M(CMND$,ERRF%,RECNO%,ADRKEY%)
21 DEF SEG:IF ERRF%<>0 AND ERRF%<>ERX THEN PRINT "FABS ERROR NUMBER "
     ERRF%;:IF ERRF%<31 THEN PRINT FE$(ERRF%)
22 RECNO=RECNO%
23 IF RECNO<0 THEN RECNO=RECNO+65536!
24 RETURN
25 KEY$="":ADRKEY=ADRKEY%
26 IF ADRKEY<0 THEN ADRKEY=ADRKEY+65536!
27 FOR ISUB=ADRKEY TO ADRKEY+12
28 DEF SEG = &H2D8:RCHAR=PEEK(ISUB)
29 DEF SEG
30 KEY$=KEY$+CHR$(RCHAR)
31 NEXT:RETURN
90 SAVE "SPACE14",A:STOP
100 REM SPACE14 MK2.0 18/12/84 H.H (TAX FORM) "
105 DL=1:ML=4:YL=1983:LL=DL+32*ML+400*(YL-1900)
110 OU$="":DIM NB(260),F$(260),VV#(12),CN$(100),PA(100):GOTO 130
120 PRINT OU$:IF DV=1 THEN LPRINT OU$:RETURN ELSE RETURN
130 OPEN "i",#1,"MOAKCONT.DAT"
140 INPUT#1,NR,MR,TL$,D1,DD,MM,YY,TD,NV
150 INPUT#1,NS,MS
160 INPUT#1,NA,MA,VT(0),VT(1),VT(2),VT(3),VT(4),VT(5)
170 INPUT#1,VO(1),VO(2),VO(3),VO(4),DV,MI,MU:CLOSE#1:GOTO 240
180 OPEN "O",#1,"MOAKCONT.DAT"
190 PRINT#1,NR","MR","TI$","D1","DD","MM","YY","TD","NV;CHR$(13);
200 PRINT#1,NS","MS;CHR$(13);
210 PRINT#1,NA","MA","VT(0)","VT(1)","VT(2)","VT(3)","VT(4)","VT(5);CHR$(13);
220 PRINT#1,VO(1)","VO(2)","VO(3)","VO(4)","DV","MI","MU;CHR$(13);
230 CLOSE#1:RETURN
240 IF DV=1 THEN PRINT CLR$"Printer not ready.":LPRINT:PRINT CLR$
250 PRINT CLR$"Produce year end tax form":PRINT
260 PRINT"1 Return to main option list
270 PRINT"2 Produce tax form (C) then (I with P)
280 PRINT"3 Produce tax form for this disc for any tax withheld"
285 PRINT"4 Set date limit for entries (d,m,y)";DL;ML;YL;"("LL")"
290 PRINT:PRINT"Choose ";
300 A$=INKEY$:IF A$="" THEN 300 ELSE A=VAL(A$)
310 IF A=0 OR A>4 THEN 250
```

```
5 A$=CHR$(27):HM$=A$+"H":CLR$=A$+"E":CR$="":FOR I=1 TO 80:CR$=CR$+A$+"C":NEXT
6 BELL$=CHR$(7):SP$="":FOR I=1 TO 80:SP$=SP$+" ":NEXT
10 DIM FE$(30):FOR I=0 TO 30:READ FE$(I):NEXT
11 DATA "","Unknown","Unknown","Unknown","Improper key for integer key file",
     "Attempted generic search on integer key"
12 DATA "Key not found on delete","Incorrect number of primary keys",
     "Syntax error in command string","No more key space"
13 DATA "Input key larger than maximum","Tried to access unopened file",
   "Key not found","Key not found","Unknown","Key not found","Key not found"
14 DATA "","","","","","File not present on disc","Out of directory space",
   "Diskette full","Write error (faulty disc)","File not present on close",
   "Read error -end of file","","Cannot close","Random record out of range"
15 CMND$="O\ADDFILE.FAB\2":GOSUB 19:CMND$="O\PAYFILE.FAB\1":GOSUB 19
16 CMND$="T\1":GOSUB 19:NA=RECNO
17 CMND$="U\1":GOSUB 19:NA=NA-RECNO
18 GOTO 100
19 DEF SEG=&H2D8:FABS86M=&H5
20 CALL FABS86M(CMND$,ERRF%,RECNO%,ADRKEY%)
21 DEF SEG
22 RECNO=RECNO%
23 IF RECNO<0 THEN RECNO=RECNO+65536!
24 RETURN
25 KEY$="":ADRKEY=ADRKEY%
26 IF ADRKEY<0 THEN ADRKEY=ADRKEY+65536!
27 FOR ISUB=ADRKEY TO ADRKEY+4
28 DEF SEG = &H2D8:RCHAR=PEEK(ISUB)
29 DEF SEG
30 KEY$=KEY$+CHR$(RCHAR)
31 NEXT:RETURN
90 SAVE "SPACE15",A:STOP
100 REM SPACE15 MK2.0 18/12/84 H.H (Payments out)
130 OPEN "i",#1,"MOAKCONT.DAT"
140 INPUT#1,NR,MR,TL$,D1,DD,MM,YY,TD,NV
150 INPUT#1,NS,MS
160 INPUT#1,NA,MA,VT(0),VT(1),VT(2),VT(3),VT(4),VT(5)
170 INPUT#1,VO(1),VO(2),VO(3),VO(4),DV,MI,MU:CLOSE#1:GOTO 240
180 OPEN "O",#1,"MOAKCONT.DAT"
190 PRINT#1,NR","MR","TI$","D1","DD","MM","YY","TD","NV;CHR$(13);
200 PRINT#1,NS","MS;CHR$(13);
210 PRINT#1,NA","MA","VT(0)","VT(1)","VT(2)","VT(3)","VT(4)","VT(5);CHR$(13);
220 PRINT#1,VO(1)","VO(2)","VO(3)","VO(4)","DV","MI","MU;CHR$(13);
230 CLOSE#1:RETURN
240 IF DV=1 THEN PRINT CLR$"Printer not ready.":LPRINT:PRINT CLR$
250 PRINT CLR$"Manage payments out":PRINT
260 PRINT"1 Return to main option list
270 PRINT"2 Print a subcontractors record"
280 PRINT"3 Print out and clear a subcontractors records"
285 PRINT"4 Insert a manual entry"
290 PRINT:PRINT"Choose ";
300 A$=INKEY$:IF A$="" THEN 300 ELSE A=VAL(A$)
310 IF A=0 OR A>4 THEN 250
320 AS1=A:PRINT CLR$:ON A GOTO 330,340,340,340
330 RUN "SPACE01"
340 PRINT CLR$"Give subcontractor code";:INPUT A$:IF A$="" THEN 250
345 KEY1$=LEFT$(A$+SP$,5)
```

```
80 GOTO 100
90 SAVE"TIRE5":STOP
100 REM "jOB cOSTING & tIME rECORDING pROGRAM vER 3.0
      02/06/84 bY h.h"
101 ON ERROR GOTO 62300
102 REM "oPTION 5 iNPUT cURRENT pERIODS wORK"
105 DEF FNA(X)=INT(X*100+.5)/100
110 M$="":Y$=""
      :D$="":Q$="":MT$="JanFebMarAprMayJunJulAugSepOctNovDec"
120 PC$="0.0":DY$="031028031030301030031031030031030031"
130 UL$="":FOR I=1 TO 75:UL$=UL$+"-":NEXT
135 DIM M$(12):GOSUB 65210
140 PS$=CHR$(27)+"E":CLR$=PS$
200 M=0:N=0:I=0:J=0:P=0:ER=0
      :SP$="                                        "
220 SP$=SP$+SP$:HM$=CHR$(27)+"H":UP$=CHR$(27)+"A"
250 CR$=CHR$(13):M1$=CR$+CHR$(10):FOR I=1 TO 76:LI$=LI$+"-":NEXT
450 OPEN "R",#1,"LASTAC":FIELD #1,15 AS HD$,15 AS HT9$
      ,15 AS HHM$:GET #1,1
460 D$=HD$:M$=HHM$:CLOSE#1
470 DT$=M$:GOSUB 63100:Y8=Y1:M8=L1
480 OPEN "R",#1,"customer":FIELD #1,40 AS HDR$:GET #1,3
      :DRIVE$=LEFT$(HDR$,1)+":":CLOSE:IF DRIVE$<>"A:" AND
      DRIVE$<>"B:" THEN DRIVE$="A:"
500 OPEN "R",#1,"ASSISTANTS":FIELD #1,15 AS HAS$,8 AS HNT$,8 AS
      HOT$:GET #1,1
600 M=VAL(HAS$):AS=M
850 DIM AS$(255),NT(255),OT(255)
900 FOR I=1 TO M:J=I+1:GET #1,J:AS$(I)=HAS$:NT(I)=CVD(HNT$)
      :OT(I)=CVD(HOT$):NEXT
1000 CLOSE#1
1350 DIM CT(50),U$(50),T$(50),T(50,50),O(50,50),TT(50),NZ(50,50)
      ,OZ(50,50)
7300 K=0
8300 MS$=LEFT$(M$,INSTR(M$," ")-1):MS$=MID$(MS$,LEN(MS$)-1,2)
      :PRINT PS$:PRINT "YOU ARE INPUTTING TIMES FOR MONTH "
      ;M$(VAL(MID$(M$,4,2)));" ";MS$
8360 PRINT "ASSISTANT    ";
8365 INPUT A$
8400 IF A$="" THEN  13200
8500 A=0:IF M=0 THEN 9200
8800 B=LEN(A$):FOR I=1 TO M:IF A$=LEFT$(AS$(I),B) THEN A=I:I=M
8900 NEXT
9000 IF A<>0 THEN 9380
9200 PRINT CLR$;"ASSISTANT "A$" NOT ON RECORD - PLEASE ENTER
     ASSISTANT AND RATES
9300 PRINT "UNDER option 4 BEFORE ENTEREING TIME SHEET
9350 PRINT "PRESS spacebar TO CONTINUE  ? ";
9360 Q$=INKEY$:IF Q$<>" "  THEN 9360
9370 GOTO 8300
9380 PRINT PS$;"ASSISTANT : "AS$(A)"  WEEK ENDING "M$
9385 PRINT "JOB NO";TAB(50);"NORMAL TIME";
9390 NC=6:T9=0:T8=0:PRINT TAB(65);"OVERTIME":PRINT UL$
9395 '
9400 INPUT C$
```

```
80 GOTO 100
90 SAVE"TIRE2":STOP
100 REM"jOB cOSTING & tIME rECORDING pROGRAM jOB eDIT V3.0
     02/06/84 bY h.h"
110 FOR I=1 TO 79:UL$=UL$+"-":NEXT:CLR$=CHR$(27)+"E"
    :UP$=CHR$(27)+"A"
115 PRINT CLR$;"":PW$="":P1$="":GOSUB 63100
120 M$=CHR$(10)+CHR$(13)
    :SP$="                                                    "
130 HM$=CHR$(27)+"H":S1$=SP$:CLR$=CHR$(27)+"E"
220 T1$="Job No.  Job name and client                          Start
    or        Fee    Budget
225 T3$="Job No. Job name and client
    Fee    Budget
230 T2$="
    Amended         #.pp      #.pp"
250 OPEN "R",#1,"lastac":FIELD #1,15 AS HD$,15 AS HT$,15 AS HMM$
    :GET #1,1:D$=HD$:T9$=LEFT$(HT$,INSTR(HT$," ")):CLOSE
2000 'OPEN "R",#1,"JOB FILE"
2010 GOSUB 64000:GET #1,1:N=VAL(HJN$)
2020 IF N=0 THEN PRINT CLR$;"":GOTO 3700
3500 PRINT CLR$;"";T1$:PRINT T2$:PRINT UL$
3505 '
3510 FOR I=1 TO N:R=I+1
3520 GET #1,R:GOSUB 64100
3570 IF LEFT$(JN$,1)="Z" THEN 3650
3580 T1=T1+VAL(JF$):T2=T2+VAL(JB$)
3600 PRINT LEFT$(JN$+SP$,9);LEFT$(JT$+SP$,40);" ";CI$;" ";
3610 JF$=STR$(VAL(JF$)):JB$=STR$(VAL(JB$))
3620 PRINT USING"########.##";VAL(JF$);VAL(JB$)
3630 IF I/22<>INT(I/22) THEN 3650
3635 PRINT "PRESS <spacebar> TO CONTINUE LISTING. 'q' to quit ";
3640 Q$=INKEY$:IF Q$<>" " AND Q$<>"q" AND Q$<>"Q" THEN 3640
3642 IF Q$="Q" OR Q$="q" THEN I=N
3645 PRINT SPACE$(60);
3650 NEXT:PRINT UL$;M$;:CLOSE#1:Q$=RIGHT$(SP$+STR$(INT(T1+.5)),8)
3655 Q$=Q$+RIGHT$(SP$+STR$(INT(T2+.5)),8):PRINT "TOTALS";TAB(58);
     USING"##########.##";T1
3700 PRINT "AMEND ANY JOB ENTRY (y/n) ? ";:Q$=INPUT$(1)
3730 IF Q$="N"OR Q$="n"  THEN 5000
3740 IF Q$<>"Y" AND Q$<>"y"  THEN PRINT CHR$(13);:GOTO 3700
3800 K=3:PRINT CLR$;"ENTER JOB NUMBER AND OTHER DETAILS WHEN
     PROMPTED"
3900 PRINT T3$:PRINT UL$
3950 '
3960 K=K+1:INPUT C$:IF C$="" THEN 5000
3980 IF N=0 THEN C=2:GOTO 4045
3985 'IF LEN(C$)<8 THEN PRINT UP$;CHR$(13);SPACE$(50);CHR$(13);
     "min length 8 char.": K=K-1:GOTO 3960
4000 GOSUB 62500
4040 IF C<>0 THEN 4060
4045 PRINT CHR$(27);"A";C$;TAB(12);"JOB DOES NOT EXIST":GOTO 3960
4060 S2$=LEFT$(JF$+""+SP$,11)
4065 S3$=LEFT$(JB$+""+SP$,10)
4070 S4$=LEFT$(JT$+""+SP$,38)
```

Contract 142 - Priorslee Reservoir

0

Domestic Subcontractors

S/contractor	No	Gross	Disc't	CITB	Contra	Liability	Reten'n	Tax	VAT	Nett	Previous	Period	Reserve
Alltype Indu	1	2835.32	70.88	0.00	62.00	2702.44	135.12	160.91	0.00	2406.41	2406.41	-0.00	
Colcrete Ltd	6	67946.30	0.00	0.00	0.00	67946.30	370.25	0.00	0.00	67576.05	67576.05	0.00	
Contract Fen	2	3499.56	174.98	0.00	0.00								

Contract 140 - Wolverton School Phas 2

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Domestic Subcontractors

S/contractor	No	Gross	Disc't	CITB	Contra	Liability	Reten'n	Tax	VAT	Nett	Previous	Period	Reserve
Asfare Ltd	3	5556.11	0.00	0.00	0.00	5556.11	138.90	0.00	0.00	5417.21	3.00	5414.21	
Asphalt Plus	3	4441.75	111.04	0.00	0.00	4330.71	216.54	0.00	0.00	4114.17	3.00	4111.17	
Bicester Roo	8	17029.09	425.73	0.00	0.00	16603.36	0.00	0.00	0.00	16603.36	8.00	16595.36	
Brackley Tim	1	464.78	0.00	0.00	0.00	464.78	23.24	0.00	66.23	507.77	1.00	506.77	
Cape Insulat	7	2769.44	69.24	0.00	0.00	2700.20	0.00	0.00	0.00	2700.20	7.00	2693.20	
J. Clark & E	8	3416.22	85.41	0.00	0.00	3330.81	166.54	0.00	0.00	3164.27	8.00	3156.27	
J.H. Cluley	9	6340.26	158.51	0.00	0.00	6181.75	154.54	0.00	0.00	6027.21	9.00	6018.21	
Coventry Dia	1	252.00	6.30	0.00	0.00	245.70	0.00	0.00	0.00	245.70	1.00	244.70	
Denmarc Deco	7	7859.05	196.47	0.00	0.00	7662.58	182.82	0.00	0.00	7479.76	7.00	7472.76	
Fensome & Ye	5	317.30	0.00	0.00	0.00	317.30	0.00	0.00	3.30	320.60	5.00	315.60	
C.J. Gidding	4	938.50	23.46	0.00	0.00	915.04	22.88	0.00	0.00	892.16	4.00	888.16	
Granwood Flo	8	8777.72	219.44	0.00	0.00	8558.28	213.96	0.00	0.00	8344.32	8.00	8336.32	
A. Hurst & S	1	393.00	9.82	0.00	0.00	383.18	0.00	57.48	0.00	325.70	1.00	324.70	
Layrite Floo	8	6921.45	173.04	0.00	0.00	6748.41	168.71	0.00	93.78	6673.48	8.00	6665.48	
F.D. Maidmen	5	653.83	0.00	0.00	0.00	653.83	0.00	0.00	0.00	653.83	5.00	648.83	
Meline Marki	1	405.00	10.13	0.00	0.00	394.87	0.00	0.00	0.00	394.87	1.00	393.87	
Modern Art G	1	716.84	17.92	0.00	0.00	698.92	0.00	0.00	104.84	803.76	1.00	802.76	
Parklands Pl	7	8450.75	0.00	0.00	0.00	8450.75	134.24	0.00	0.00	8316.51	7.00	8309.51	
Sandford Sur	3	11212.11	0.00	0.00	0.00	11212.11	537.19	0.00	0.00	10674.92	3.00	10671.92	
Weldflow Eng	0	2810.16	53.34	0.00	0.00	2756.82	0.00	246.72	0.00	2510.10	0.00	2510.10	
Woburn Sands	13	18941.42	473.54	0.00	0.00	18467.88	0.00	0.00	0.00	18467.88	13.00	18454.88	
Z.W.Plumbing	10	11008.46	275.21	0.00	0.00	10733.25	268.33	0.00	0.00	10464.92	10.00	10454.92	
Totals		119675.24	2308.60	0.00	0.00	117366.64	2227.89	304.20	268.15	115102.70	113.00	114989.70	

Labour only Subcontractors

S/contractor	No	Gross	Disc't	CITB	Contra	Liability	Reten'n	Tax	VAT	Nett	Previous	Period	Reserve
D. Balloqui	7	867.20	0.00	17.34	0.00	849.86	0.00	254.96	0.00	594.90	7.00	587.90	
P. Barrett	9	1146.80	0.00	22.94	0.00	1123.86	0.00	0.00	0.00	1123.86	9.00	1114.86	
B. McManus	4	847.00	0.00	16.95	0.00	830.05	0.00	0.00	0.00	830.05	4.00	826.05	
B. Walsh	5	518.24	0.00	10.36	0.00	507.88	0.00	0.00	0.00	507.88	5.00	502.88	
D.R. Chapman	5	855.75	0.00	17.13	0.00	838.62	0.00	0.00	0.00	838.62	5.00	833.62	
D. Goodwin	4	1200.00	0.00	24.00	0.00	1176.00	0.00	0.00	0.00	1176.00	4.00	1172.00	
D. Harvey	24	4198.62	0.00	84.01	0.00	4114.61	0.00	409.47	0.00	3705.14	24.00	3681.14	
E. Robinson	43	37834.57	0.00	758.41	60.00	37016.16	0.00	0.00	0.00	37016.16	43.00	36973.16	
F. Cerisola	8	1312.02	0.00	26.24	0.00	1285.78	385.75	0.00	0.00	900.03	8.00	892.03	
P.J. French	37	34354.07	343.54	680.21	0.00	33330.32	1000.00	0.00	0.00	32330.32	37.00	32293.32	
Gretabourne	2	526.50	0.00	10.54	0.00	515.96	0.00	0.00	0.00	515.96	2.00	513.96	
Herring Bros	10	1679.63	0.00	0.00	0.00	1679.63	0.00	0.00	0.00	1679.63	10.00	1669.63	
C. Horne	79	11735.94	0.00	234.71	0.00	11501.23	0.00	3479.78	0.00	8021.45	79.00	7942.45	
D. dutchison	1	153.00	0.00	3.06	0.00	149.94	0.00	0.00	0.00	149.94	1.00	148.94	
J. Brown	36	3748.18	0.00	75.00	0.00	3673.18	0.00	1100.89	0.00	2572.29	36.00	2536.29	
J. Cooper	1	57.00	0.00	0.75	0.00	56.25	0.00	0.00	0.00	56.25	1.00	55.25	
J. Irwin	1	135.40	0.00	2.71	0.00	132.69	6.64	0.00	0.00	126.05	1.00	125.05	
John. Brown	5	518.24	0.00	10.36	0.00	507.88	0.00	61.13	0.00	446.75	5.00	441.75	
Oakfield Con	1	360.00	9.00	0.00	0.00	351.00	0.00	0.00	0.00	351.00	1.00	350.00	
R. Gray	75	10219.40	0.00	204.28	0.00	10015.12	0.00	3004.54	0.00	7010.58	75.00	6935.58	
S.S. Suree	14	9261.90	0.00	186.84	0.00	9075.06	0.00	1136.31	0.90	7939.65	14.00	7925.65	
T. James	38	14895.16	0.00	297.90	0.00	14597.26	220.76	0.00	0.00	14376.50	38.00	14338.50	
W. Hepburn	33	9348.62	0.00	187.03	0.00	9161.59	0.00	0.00	0.00	916.59			

·. Gray	75	10219.40	0.00	204.28	0.00	10015.12	0.00	3004.54	0.00	7010.58	75.00	6935.58
S.S. Suree	14	9261.90	0.00	186.84	0.00	9075.06	0.00	1136.31	0.90	7939.65	14.00	7925.65
T. James	38	14895.16	0.00	297.90	0.00	14597.26	220.76	0.00	0.00	14376.50	38.00	14338.50
W. Hepburn	33	9348.62	0.00	187.03	0.00	9161.59	0.00	0.00	0.00	9161.59	33.00	9128.59
Totals		145773.24	352.54	2870.77	60.00	142489.93	1613.15	9447.08	0.90	131430.60	442.00	130988.60

Nominated Subcontractors

S/contractor	No	Gross	Disc't	CITB	Contra	Liability	Reten'n	Tax	VAT	Nett	Previous	Period	Reserve
Briggs & For	14	61310.83	1532.77	0.00	0.00	59778.06	896.67	0.00	47.88	58929.27	14.00	58915.27	
Beds Electri	16	41519.64	1037.99	0.00	0.00	40481.65	607.22	0.00	12.79	39887.22	16.00	39871.22	
Niels. Larse	4	5005.90	125.15	0.00	0.00	4880.75	73.21	0.00	0.00	4807.54	4.00	4803.54	
Mann Egerton	6	9605.74	240.14	0.00	0.00	9365.60	140.48	0.00	0.00	9225.12	6.00	9219.12	
Standard Pat	9	13184.77	329.62	0.00	0.00	12855.15	192.83	0.00	0.00	12662.32	9.00	12653.32	
Steelcon Con	6	22105.71	552.64	0.00	0.00	21553.07	323.30	0.00	0.00	21229.77	6.00	21223.77	
Totals		152732.59	3818.31	0.00	0.00	148914.28	2233.71	0.00	60.67	146741.24	55.00	146686.24	

Collection

S/contractor	No	Gross	Disc't	CITB	Contra	Liability	Reten'n	Tax	VAT	Nett	Previous	Period	Reserve
Domestic		119675.24	2308.60	0.00	0.00	117366.64	2227.89	304.20	268.15	115102.70	113.00	114989.70	
Labour only		145773.24	352.54	2870.77	60.00	142489.93	1613.15	9447.08	0.90	131430.60	442.00	130988.60	
Nominated		152732.59	3818.31	0.00	0.00	148914.28	2233.71	0.00	60.67	146741.24	55.00	146686.24	
Totals		418181.07	6479.45	2870.77	60.00	408770.85	6074.75	9751.28	329.72	393274.54	610.00	392664.54	

Total Liability 408770.85

Add Reserves

Gross to Date

Less Previous (0)

Cost for Period

213

A P P E N D I X D

OUTLINE OF TIME/COST RECORDING PROGRAMS.

Package consists of 14 separate programs, with 12 options in Program 1. Contracts File Management (CFM) contains details of individual jobs. This file contains following data:

	Byte	Format
- Contract/Job Number	8	Text
- Contract/Job Title	40	Text
- Job Fee	8	Dpn*
- Job Budget	8	Dpn
- WIP (Work In Progress)	8	Dpn

* (Double precision umber)

The customised program allows the end user to generate reports with the Companys' heading and address. This program also defines which drive of storage media is to be allocated for historical monthly resources/assistants files generated by this package.

Program 1 -

This program deals with date of last access, current day and date. It also displays the main menu, drives and gives access to the whole package since it checks on legality of passwords entered.

Program 2 -

This gives access to operator to LIST and REVIEW Fees and/or Budgets (FB). Any changes to F/B resets the flag date on that Contract which is always displayed/printed when listing F/B. Additional information printed on contracts is the contract number and clients'name or job title.

Program 3 -

Allows user to LIST and carry out manual adjustments to the cost to date of jobs and cost centres.

When choosing the listing option the system reads all the jobs on the contract file management and finally displays the total cost-to-date of all the jobs on the CFM.

Program 4 -

This gives access to assistant/resources file.
Options are given to list, amend or insert the assistant's name and normal/over time rates. Maximum number of assistants allowed in this file is 255.

Program 5 -

This is to record the accumulated time of assistant/resource of jobs for the current week. The operator calls an assistant from assistant/rates file and inputs the total number of normal/over time hours worked on each job/cost centre. These inputs are set for the month ending on last Friday of input date. The total cost is added to WIP on CFM and also added to the total cost of resources on each job.

Program 6 -

This displays/prints the historical monthly resources in hourly terms recorded on each job and totals are brought forward from ex-totals file for current job number. The system also displays the date of the last issued invoice.

Program 7 -

This gives access for changing the percentage of work completed and also prints job budget summary sheet accordingly. The system will prompt for one or all jobs.

Program 8 -

This program has a sub-menu with 5 options listing the cost-to-date of recoverable expenses, and work in progress, entering the fees rendered and received with dates, and producing a report which allows a comparison between fees and work in progress.

Program 9 -

This allows the user to delete jobs from CFM. If there are outstanding fees on the job to be deleted then it prompts with a warning.

Program 10 -

This allows insertion of a new contract in CFM. It prompts for a contract number, then checks if it exist on CFM. Failing this it then prompts for Job Title and F/B and finally sorts them in ascending alphanumeric order.

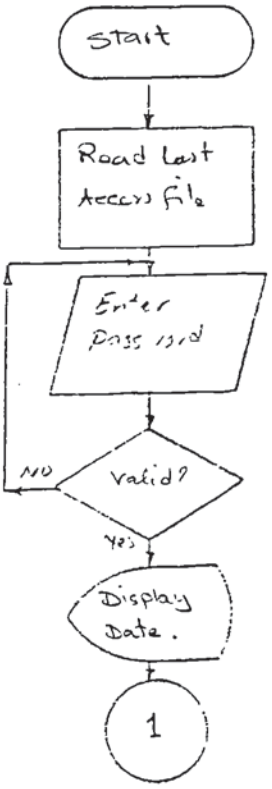
Program 11 -

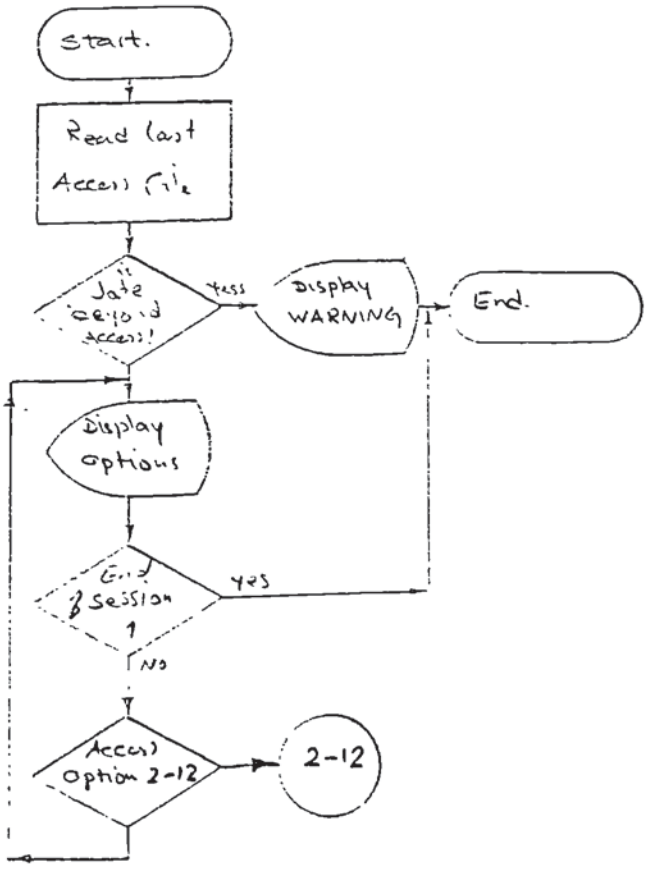
This program lists and allows review of recoverable fees as well as listing/printing WIP costs. This allows the cumulative totals to be monitored.

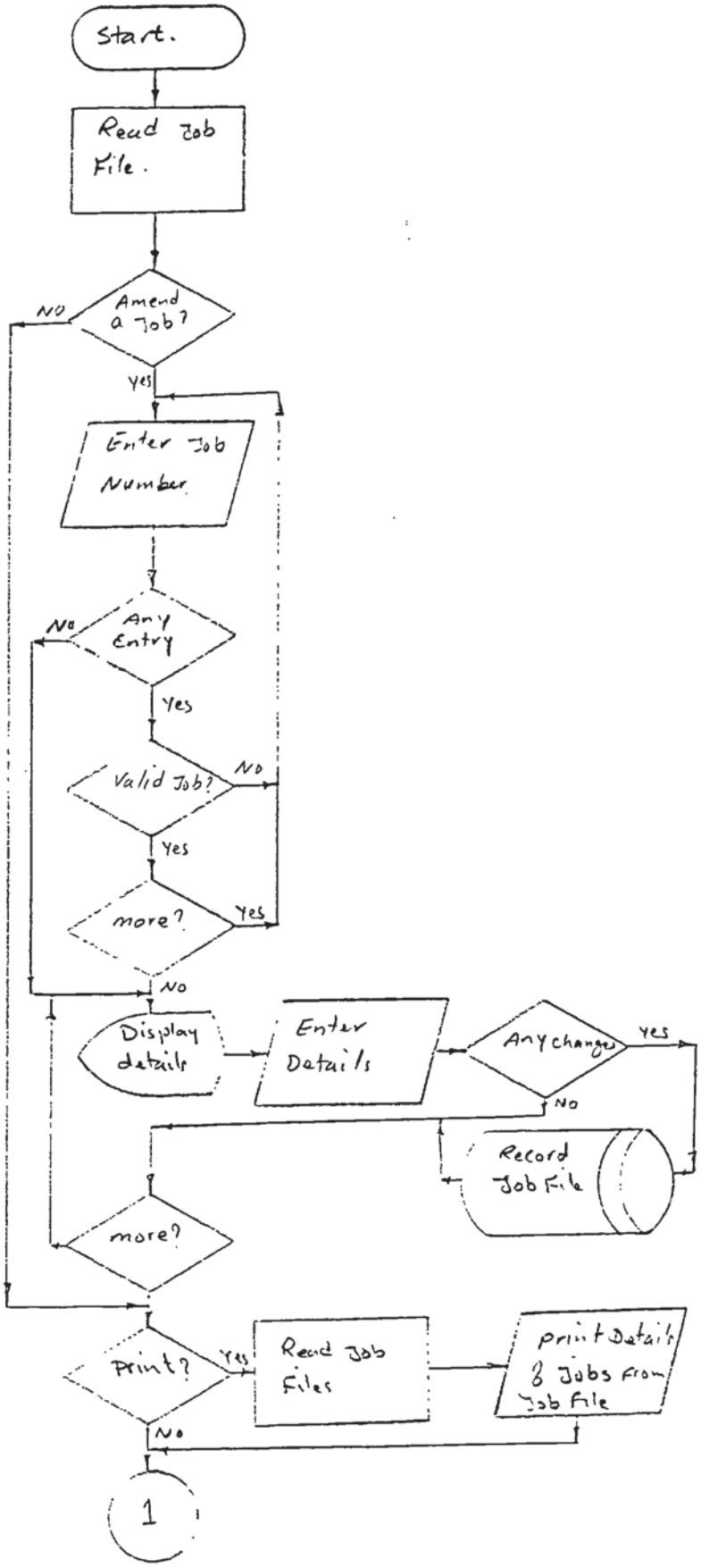
Program 12 -

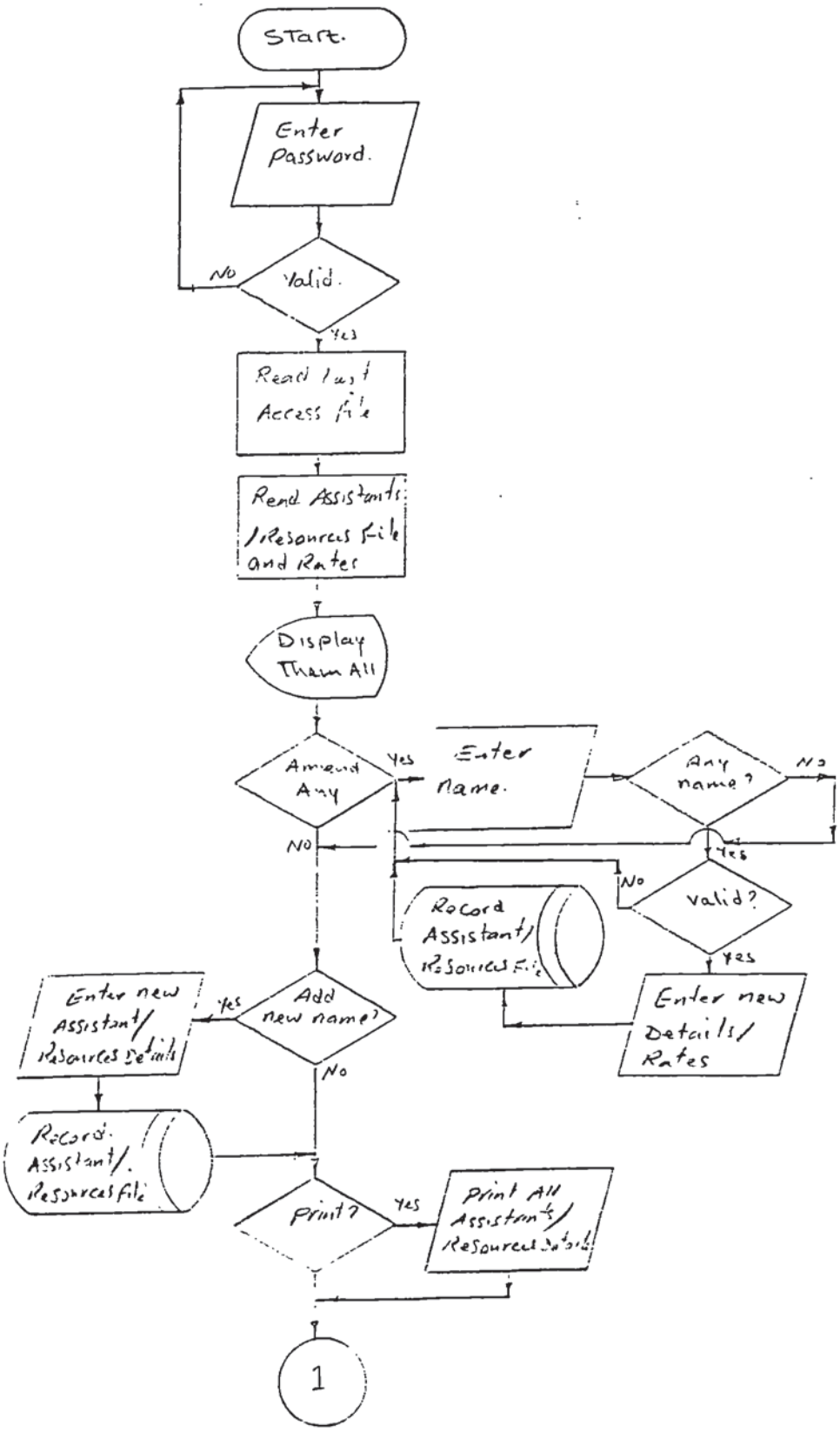
This enables the user to tidy up the storage media by transferring the totals of resources recorded on historical monthly job files into a new file called ex-totals.

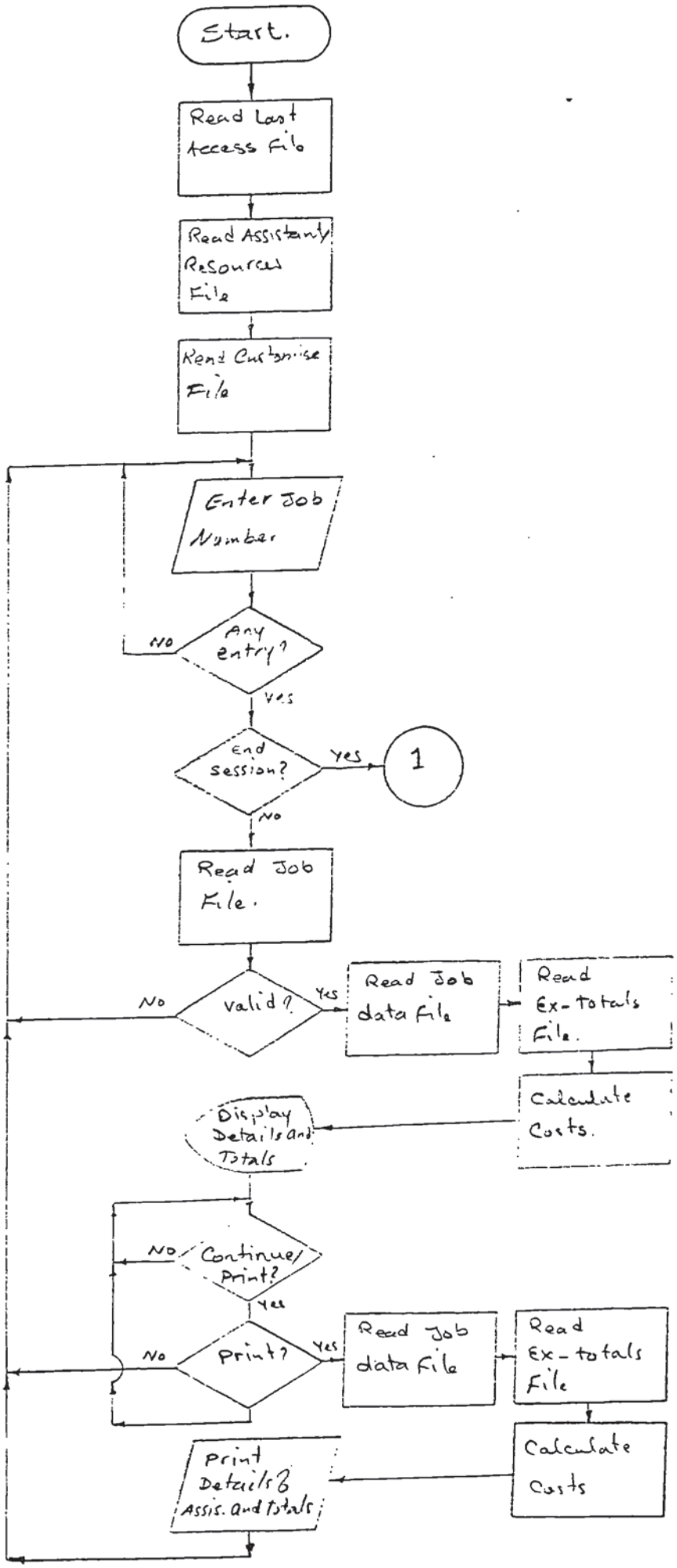
This file then after is accessed by option 6 and the totals are displayed under the current date. Any further time recorded with option 5 creates a new historical job file.

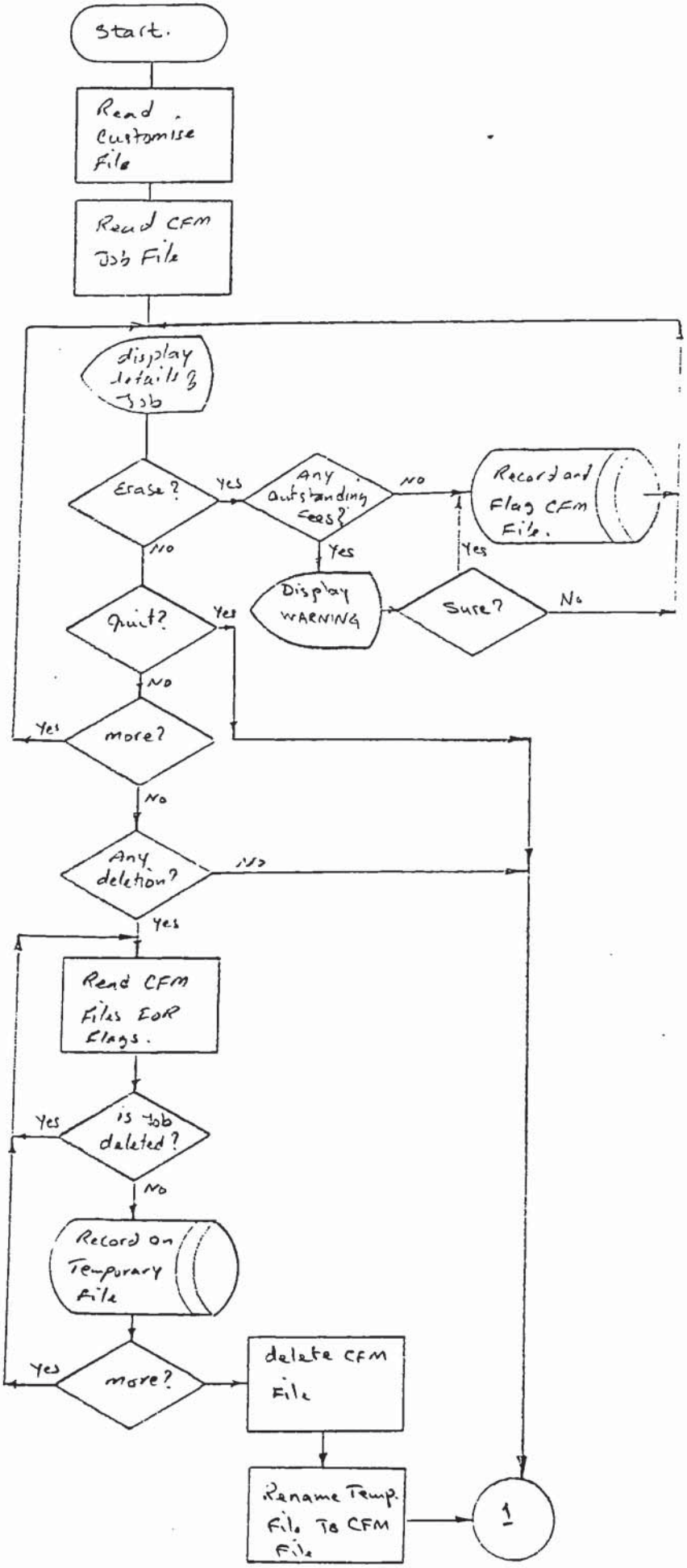

Start
Read last Access file
Enter Password
Valid?
NO
YES
Display Date.
1

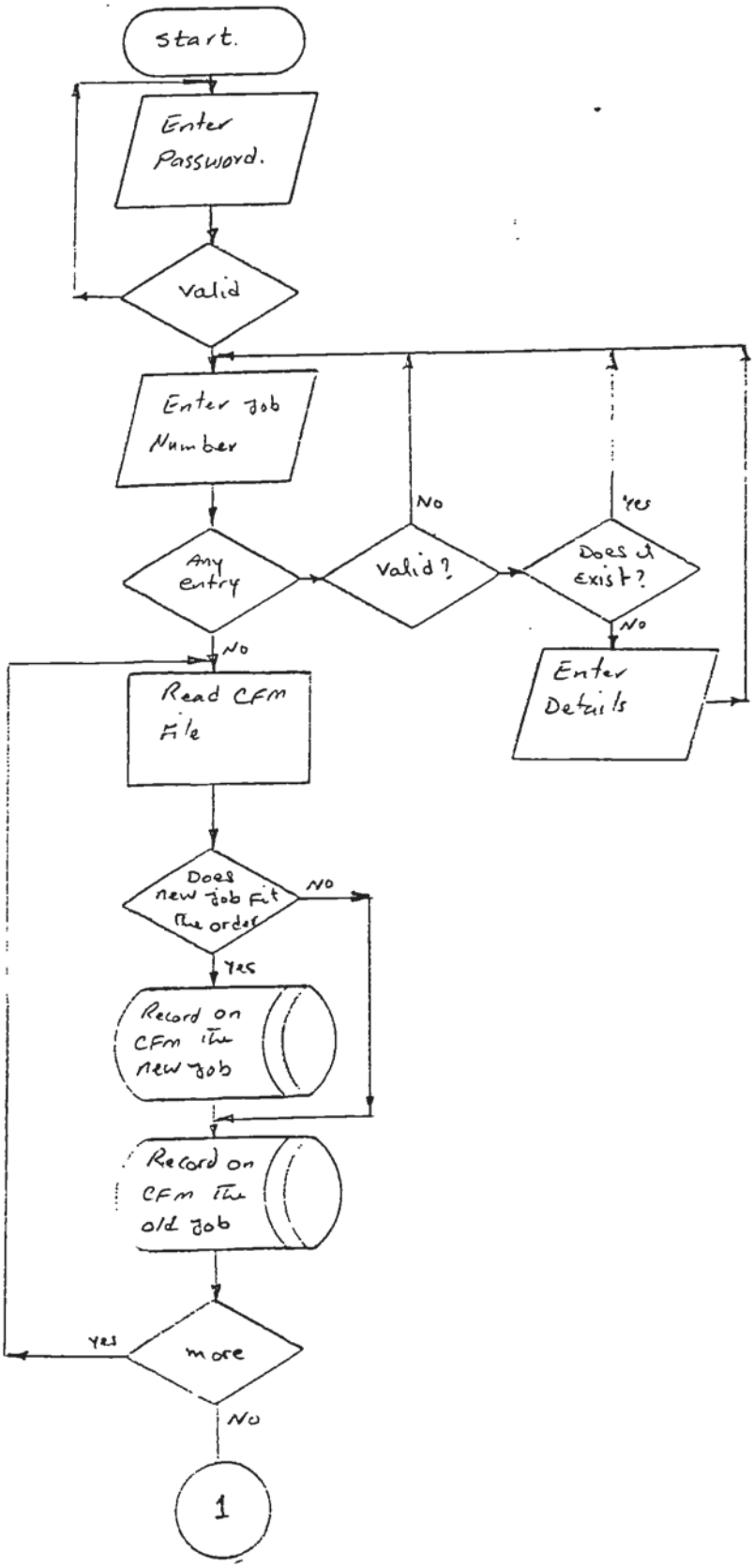

Start.
Read last Access file
Date valid access?
YES
Display WARNING
End.
Display options
End session?
YES
NO
Access Option 2-12
2-12

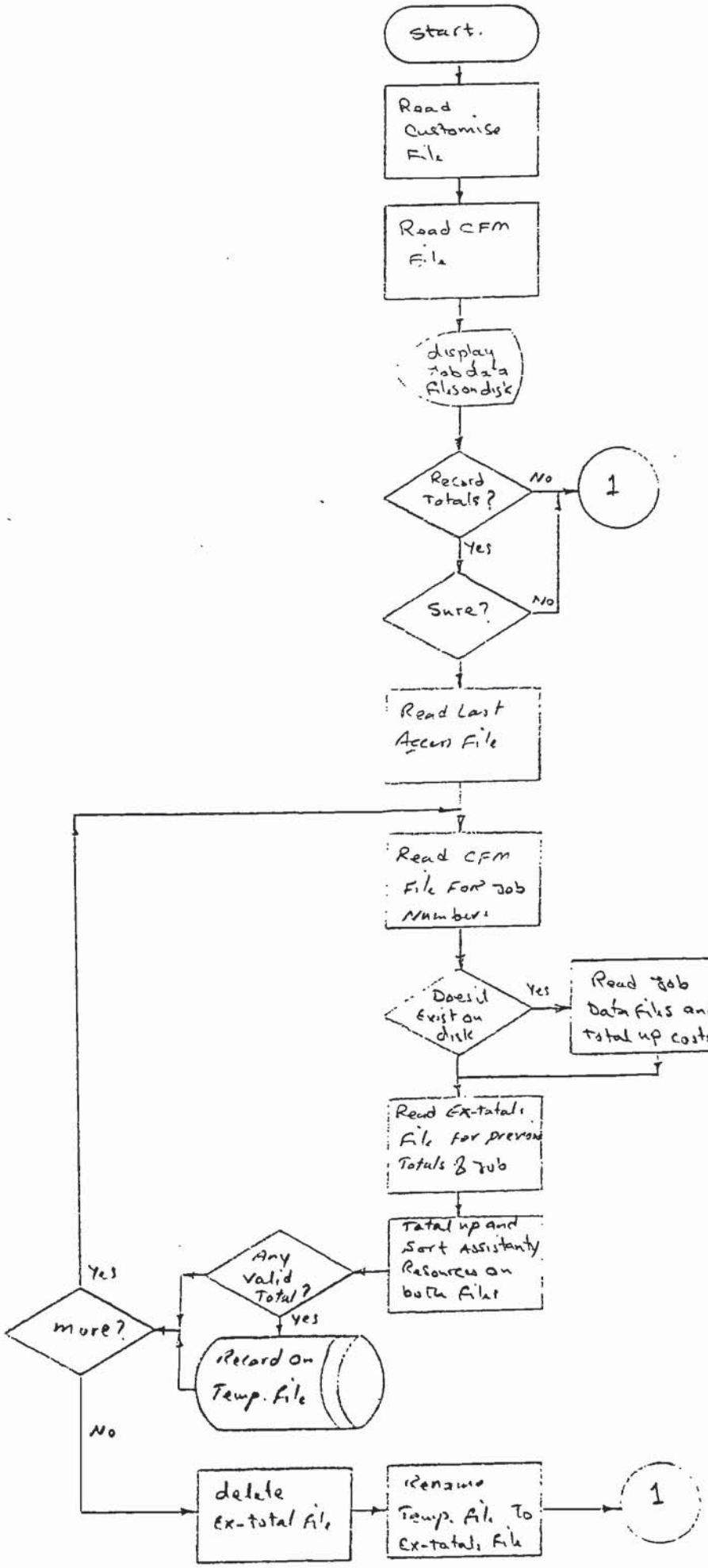

Start.
Read Job File.
Amend a Job?
NO
Yes
Enter Job Number
Any Entry
No
Yes
Valid Job?
No
Yes
more?
Yes
No
Display details
Enter Details
Any changes
Yes
No
Record Job File
more?
Print?
Yes
Read Job Files
print Details & Jobs from Job File
No
1


Start.
Enter password.
Valid.
No
Yes
Read last Access file
Read Assistants / Resources file and Rates
Display Them All
Amend Any
Yes
Enter name.
Any name?
No
Yes
No
Record Assistant / Resources file
No
Valid?
Yes
Enter new Details / Rates
Enter new Assistant / Resources Details
Yes
Add new name?
No
Record Assistant / Resources file
Print?
Yes
Print All Assistants / Resources Details
1


Start.
Read Last access file
Read Assistant Resources File
Read Customise File
Enter Job Number
Any entry?
No
Yes
End session?
Yes
1
No
Read Job File.
Valid?
No
Yes
Read Job data file
Read Ex-totals File.
Calculate Costs.
Display Details and Totals
Continue/ Print?
No
Yes
Print?
No
Yes
Read Job data file
Read Ex-totals File
Calculate Costs
Print Details & Assis. and Totals


Start.
Read Customise File
Read CFM Job File
display details of Job
Erase?
Yes
Any outstanding fees?
No
Record and Flag CFM File.
Yes
No
Yes
Display WARNING
Sure?
No
Quit?
Yes
No
more?
Yes
No
Any deletion?
No
Yes
Read CFM Files FOR Flags.
is Job deleted?
Yes
No
Record on Temporary File
more?
Yes
delete CFM File
Rename Temp. File To CFM File
1


Start.
Enter Password.
Valid
Enter Job Number
Any entry
Valid?
No
Yes
Does it exist?
No
Enter Details
No
Read CFM File
Does new job fit the order
No
Yes
Record on CFM the new job
Record on CFM the old job
more
Yes
No
1


Start.
Read Customise File
Read CFM File
display Job data files on disk
Record Totals?
No
1
Yes
Sure?
No
Read Last Accen File
Read CFM File For Job Number
Does it Exist on disk
Yes
Read Job Data Files and total up costs.
Read Ex-totals File for previous Totals & Job
Total up and Sort Assistanty Resources on both files
Any Valid Total?
Yes
More?
Yes
Record on Temp. File
No
delete Ex-total file
Rename Temp. file To Ex-totals file
1

```
 80 GOTO 100
 90 SAVE "TIRE" :STOP
 100 REM "START UP PROGRAM TIRE  VER 3.0 02/06/84"
 102 REM "JOB COSTING & TIME RECORDING PROGRAM BY H.HAGHDADI"
 105 DEF FNA(X)=INT(X*100+.5)/100
 110 M$="":Y$="":D$="":Q$=""
     :MT$="JanFebMarAprMayJunJulAugSepOctNovDec"
 120 DY$="031028031030301030031031030031030031"
 140 DIM DM(12),D$(7),M$(12),TH$(31)
 200 DV=5:VA=.15:M=0:N=0:I=0:J=0:P=0:ER=0:SP$=SPACE$(50)
     :CLR$=CHR$(27)+"E"
 251 GOSUB 63100:PRINT CLR$
 252 PRINT CHR$(27);"H";"Main option PASSWORD ????? "
 253 P2$=INKEY$:IF P2$="" THEN 253
 254 IF ASC(P2$)=13 THEN 257
 255 P1$=P1$+P2$
 256 GOTO 253
 257 IF P1$=PW$ THEN 260
 258 PRINT "PASSWORD INVALID":P1$="":GOTO 252
 260 PRINT CLR$;"PASSWORD ACCEPTED
 265 OPEN "R",#1,"LASTAC":FIELD #1,15 AS HD$,15 AS HT9$:GET #1,1
     :D$=HD$:T9$=HT9$
 270 CLOSE#1
 275 D$=LEFT$(D$,INSTR(D$," ")-1)
 280 PRINT CLR$
 290 HD1$=RIGHT$(D$,2)+MID$(D$,4,2)+LEFT$(D$,2)
 295 HD2$=RIGHT$(DATE$,2)+LEFT$(DATE$,2)+MID$(DATE$,4,2)
 296 IF HD1$=HD2$ THEN 3000
 300 '
 305 IF HD1$<HD2$ THEN D$=MID$(DATE$,4,2)+"/"+LEFT$(DATE$,2)+"/"+
     RIGHT$(DATE$,2):GOTO 335
 330 DATE$=MID$(D$,4,3)+LEFT$(D$,3)+RIGHT$(D$,2)
 335 GOSUB 60400:IF ER=0 THEN 440
 360 PRINT "ERROR IN DATE- PLEASE INPUT DATE IN CORRECT FORMAT"
 380 GOTO 300
 440  GOSUB 10000:'PRINT "YOU ARE ENTERING TIMES FOR WEEK STARTING
     FRIDAY ";M$
 450  OPEN  "R",#1,"LASTAC":FIELD #1,15 AS HD$,15  AS  HT9$,15  AS
      HHM$,10    AS   HPW$:LSET    HD$=D$:LSET    HT9$=D$(D2):LSET
      HHM$=M$:LSET HPW$=PW$:PUT #1,1
 460 CLOSE#1:GOTO 3000
 2000 PRINT "PRESS spacebar TO CONTINUE"
 2100 Q$=INKEY$:IF Q$<>" " THEN 2100
 3000 RUN "TIRE1"
 3100 END
 6000 '
 10000 FOR I=0 TO 12:READ DM(I):NEXT:FOR I=1 TO 7:READ D$(I):NEXT
 10350 FOR I=1 TO 12:READ M$(I):NEXT
 10360  FOR  I=1  TO 31:TH$(I)="th":IF I=1 OR I=21  OR  I=31  THEN
       TH$(I)="st"
 10370 IF I=2 OR I=22 THEN TH$(I)="nd"
 10380 IF I=3 OR I=23 THEN TH$(I)="rd"
 10390 NEXT
 10400 DATA 0,31,28,31,30,31,30,31,31,30,31,30,31
 10410 DATA "Monday","Tuesday","Wednesday","Thursday","Friday"
```

```
80 GOTO 100
90 SAVE"tirel":STOP
100  REM  "jOB  cOSTING & tIME rECORDING  pROGRAM  - MENU  vER3.0
     02/06/84 bY h.h"
105 DEF FNA(X)=INT(X*100+.5)/100
110 HM$=CHR$(27)+"H":CLR$=CHR$(27)+"E"
265  OPEN  "R",#1,"LASTAC":FIELD  #1,15 AS HD$,15 AS  HT9$,15  AS
     HM$,10 AS HPW$:GET #1,1:D$=HD$:T9$=HT9$:M$=HM$:PW$=HPW$
     :CLOSE#1
270 IF DATE$>PW$ THEN PRINT CLR$;"Sorry  !!":PRINT:PRINT:PRINT"No
     more access to this lot.":END
300  HZ$="JOB  COSTING  &  TIME  RECORDING  PROGRAM"+":"+
     LEFT$(T9$,INSTR (T9$," "))+LEFT$(D$,INSTR(D$," "))
1805 PRINT CLR$;TAB(40-INT(LEN(HZ$)/2));HZ$
1820 PRINT:PRINT:PRINT "     OPTION LIST:-
1850 PRINT "      1  End Program
1900 PRINT "      2  Review Fees/Budget summary
1950 PRINT "      3  Review Cost to Date (WIP)
2000 PRINT "      4  Review Assistants/Resources File"
2100 PRINT "      5  Input current Weeks work "
2200 PRINT "      6  List Job Time record/Flag Invoice date
2300 PRINT "      7  Print Job Budget summary
2310 PRINT "      8  Fees Applied/Recieved or WIP summary
2320 PRINT "      9  Delete Jobs from JOB FILE
2330 PRINT "      A  Add NEW Jobs to  JOB FILE
2340 PRINT "      B  Input/List  Recoverable Expenses
2350 PRINT "      C  Prepare Ex-Totals File
2400 PRINT :PRINT :PRINT
2500 PRINT "     OPTION ?";:Q$=""
2530 A$=INKEY$:IF A$="" THEN 2530
2535 O=INT(VAL(A$))
2540 IF A$="A" OR A$="a" THEN O=10:GOTO 2700
2542 IF A$="B" OR A$="b"  THEN O=11:GOTO 2700
2543 IF A$="C" OR A$="c" THEN O=12:GOTO 2700
2700 IF O<1 OR O>13 THEN 2530
2920 IF O=1 THEN PRINT CLR$;:END
2950 F$="TIRE"+MID$(STR$(O),2)
2960 PRINT CLR$:PRINT "Loading Option ";O
3000 RUN F$
3100 END
```

```
80 GOTO 100
90 SAVE "TIRE3":STOP
100 REM"JOB cOSTING & tIME rECORDING pROGRAM cLIENT/wIp V3.0
      02/06/84 bY h.h"
110 CV$="":FOR I=1 TO 70:UL$=UL$+"_":NEXT
115 WW$="0"
120 M$=CHR$(10)+CHR$(13)
      :SP$="                                                    "
130 HM$=CHR$(27)+"H":CLR$=CHR$(27)+"E":S1$=SP$
220 T1$="JOB NO.    JOB NAME AND CLIENT
      COST TO DATE
230 T2$="                                                      #
251 PW$="3":PRINT CLR$;
252 PRINT "PASSWORD ????? "
253 P2$=INKEY$:IF P2$="" THEN 253
254 IF ASC(P2$)=13 THEN 257
255 P1$=P1$+P2$
256 GOTO 253
257 IF P1$=PW$ THEN 260
258 PRINT "PASSWORD INVALID":P1$="":GOTO 252
260 PRINT CLR$;"PASSWORD ACCEPTED
300 OPEN "R",#1,"LASTAC":FIELD #1,15 AS HD$,15 AS HT9$,15 AS HHM$
      :GET #1,1
310 D$=HD$:XX$=LEFT$(HHM$,9):CLOSE#1
400 PRINT CLR$;"COST TO DATE  OPTIONS";M$;LEFT$(UL$,24);M$;M$;
410 PRINT"1  LIST COST TO DATE FILE
430 PRINT"2  MANUAL ADJUSTMENT OF COST TO DATE FIGURES
440 PRINT "3  RETURN TO MAIN MENU"
450 PRINT "WHICH OPTION  ? ";
455 Q$=INPUT$(1):Q=VAL(Q$)
460 IF Q<1 OR Q>3 THEN 455
470 ON Q GOSUB  2000,3800,6060
480 GOTO 400
2000 GOSUB 64000 'OPEN JOB FILE
2010 T1=0:GET #1,1:N=VAL(HJN$)
3500 PRINT CLR$;"";T1$;M$;UL$;M$;
3510 FOR I=1 TO N:R=I+1
3520 GET #1,R:GOSUB 64100
3580 T1=T1+VAL(WP$)
3600 PRINT LEFT$(JN$+SP$,10);LEFT$(JT$+SP$,40);
3620 PRINT "  ";USING"#######.##";VAL(WP$)
3630 IF I/22<>INT(I/22) THEN 3650
3635 PRINT "PRESS <spacebar> TO CONTINUE LISTING  ? ";
3640 Q$=INKEY$:IF Q$<>" " THEN 3640
3645 PRINT M$;SPACE$(60);
3650 NEXT:PRINT UL$;M$;:CLOSE#1
3655 PRINT "TOTAL";TAB(50);"  ";USING"########.##";T1
3662 PRINT "PRINTER LISTING OF COST TO DATE FILE  (y/n) ";
3666 Q$=INPUT$(1)
3668 IF Q$="Y" OR Q$="y" THEN GOSUB 8000:RETURN
3670 IF Q$<>"N" AND Q$<>"n" THEN 3666
3680 RETURN
3800 K=2:PRINT CLR$;"ENTER JOB NUMBER AND ADJUSTMENT TO COST
      FIGURE";
3850 PRINT" WHEN PROMPTED
```

```
80 GOTO 100
90  SAVE"TIRE4":STOP
100 REM"jOB cOSTING & tIME rECORDING pROGRAM aSSIS'TS vER 3.0
      02/06/84 bY h.h"
105 CV$="":UP$=CHR$(27)+"A"
110 DIM A$(255),NT(255),OT(255)
120 C$=CHR$(13)
      :CR$=C$+CHR$(10):T1$=" Assistant        N/Time      O/Time
130 WF=0:HM$=CHR$(27)+"H":UL$="":FOR I=1 TO 78:UL$=UL$+"-":NEXT
      :CLR$=CHR$(27)+"E"
140 DEF FNA(X)=INT(X*100+.5)/100
150 SP$="                                          "
160 S2$="..............................."
251 GOSUB 63100:PRINT CLR$
252 PRINT "PASSWORD ????? "
253 P2$=INKEY$:IF P2$="" THEN 253
254 IF ASC(P2$)=13 THEN 257
255 P1$=P1$+P2$
256 GOTO 253
257 IF P1$=PW$ THEN 260
258 PRINT "PASSWORD INVALID":P1$="":GOTO 252
260 PRINT CLR$;"PASSWORD ACCEPTED
265 OPEN "R",#1,"LASTAC":FIELD #1,15 AS HDT$,15 AS HT9$
      ,15 AS HHM$:GET #1,1
270 DT$=HDT$:T9$=HT9$:CLOSE#1
280 PR$=""
310 U2$="":FOR I=1 TO 78:U2$=U2$+CHR$(96):NEXT
500 OPEN "R",#1,"ASSISTANTS"
501 FIELD #1,15 AS HA$,8 AS HN$,8 AS HO$:GET #1,1:M=VAL(HA$)
520 FOR I=1 TO M:R=I+1:GET #1,R:A$(I)=HA$:NT(I)=CVD(HN$)
      :OT(I)=CVD(HO$):NEXT:CLOSE#1
522 PRINT CLR$"Option 4 : CHARGING RATES (ALL VALUES IN POUNDS";
523 PRINT " STERLING)        ";DT$
525 PRINT T1$;TAB(41);T1$;CR$;UL$;CR$;
527 '
530 FOR I=1 TO M:A=0:M$="":IF I/2=INT(I/2) THEN  A=40
      :M$=CHR$(13)+CHR$(10)
535 A$=LEFT$(A$(I)+S2$,15)
540 B=A+2:C=A+17:D=A+28:PRINT TAB(B);A$;TAB(C);USING"####.##"
      ;NT(I);:PRINT TAB(D);USING"####.##";OT(I);:PRINT M$;
543 IF I/40=INT(I/40) THEN 545
544 GOTO  550
545 PRINT "PRESS SPACEBAR TO CONTINUE."
546 GET ZZ$:IF ZZ$="" THEN 546
547 IF ZZ$<>" " THEN 546
548 PRINT "                                        ":PRINT " ";
550 NEXT:PRINT
560 PRINT UL$;CR$;
570 PRINT "AMEND NAMES OR RATES  (y/n)? ";:Q$=INPUT$(1)
580 IF Q$<>"Y" AND Q$<>"y" THEN Q$="Y":GOTO 665
590 WF=1
592 PRINT CLR$;"PLEASE ENTER NAME OF ASSISTANT TO BE AMENDED
      return TO END"
595 INPUT "ASSISTANT     ";A$:IF A$="" THEN 665
```

```
80 GOTO 100
90 SAVE "TIRE6":STOP
100 REM"JOB cOSTING & tIME rECORDING pROGRAM  dISPLAY vER 3.0
     03/06/84 bY h.h"
101 ON ERROR GOTO 62300
105 DEF FNA(X)=INT(X*100+.5)/100
110 M$="":Y$="":D$="":Q$=""
     :MT$="JanFebMarAprMayJunJulAugSepOctNovDec"
120 DY$="031028031030301030031031030031030031"
200 M=0:N=0:I=0:J=0:P=0:ER=0
     :SP$="                                   "
250 CR$=CHR$(13)+CHR$(10):FOR I=1 TO 76:LI$=LI$+"-":NEXT
     :CLR$=CHR$(27)+"E":HM$=CHR$(27)+"H"
255 GOSUB 63100
265 OPEN "R",#1,"LASTAC":FIELD #1,15 AS HD$,15 AS HT9$,15 AS HHM$
270 GET #1,1:D$=HD$:T9$=LEFT$(HT9$,INSTR(HT9$," ")):CLOSE#1
280 PRINT CLR$
500 OPEN "R",#1,"ASSISTANTS":FIELD #1,15 AS HA$,8 AS HN$,8 AS HO$
     :GET #1,1
800 M=VAL(HA$):AS=M
850 DIM AS$(255),NT(255),OT(255)
900 FOR I=1 TO M:J=I+1:GET #1,J:AS$(I)=HA$:NT(I)=CVD(HN$)
     :OT(I)=CVD(HO$):NEXT
1000 CLOSE#1
1100 OPEN "R",#1,"customer":FIELD #1,40 AS HDR$:GET #1,3
     :DRIVE$=LEFT$(HDR$,1):CLOSE:IF DRIVE$<>"A" AND DRIVE$<>"B"
     THEN DRIVE$="a"
1350 DIM T$(50),O(50,50),T(50,50),TT(50),XX(50),CT(50),O$(50),N$(50)
1400 GOTO 20000
1500 FLG=0:FOR I=0 TO 50:CT(I)=0:TT(I)=0:XX(I)=0:O$(I)=""
     :N$(I)="":NEXT
1600 H$="":HA$=""
1700 EX$=""
20000 PRINT CLR$;TAB(15)"PLEASE ENTER JOB NUMBER";
20100 PRINT "     ENTER * TO END SECTION"
20200 PRINT:PRINT
20350 INPUT "JOB NUMBER    ";C$:IF C$="" THEN PRINT SPACE$(75);
     CHR$(13);CHR$(27);"A";:GOTO 20350
20400 IF C$="*" THEN PRINT CLR$;:GOTO 30000
20500 GOSUB 62500
20600 IF C=0 THEN PRINT SPACE$(75);CHR$(13);"NO SUCH Job AS ";C$;
     CHR$(13);CHR$(27)+"A";SPACE$(75);CHR$(13);:GOTO 20350
20650 PRINT CLR$;"Read in Data."
20700 CL$=C$:C$=DRIVE$+":"+C$:GOSUB 62200:DD%=0
     :IF ER=53 THEN DD%=1
20750 GOSUB 63600:IF Z<>0 OR DD%=0 THEN 20820
20800 PRINT "NO RECORD FOR "C$"":GOTO 20350
20820 IF DD%=0 THEN GOSUB 45000
21000 GOSUB 47620
21010 REM
21020 H%=1
21810 PRINT CLR$;"JOB NUMBER       ";JN$;"  ";MES$
21820 PRINT "JOB NAME         ";JT$
21840 PRINT "JOB BUDGET       ";MID$(STR$(VAL(JB$)),2)
21850 PRINT "LAST INVOICE     ";DI$
```

```
21860 PRINT "Date of report    ";T9$;LEFT$(D$,8)
21900 GOSUB 48000
22100 '
22110 PRINT "PRESS return  TO CONTINUE P TO PRINT? ";
22150 '
22200 Q$=INKEY$
22210 IF Q$="P" OR Q$="p" OR Q$=CHR$(13) THEN  22250
22220 GOTO 22200
22250 PRINT CLR$:IF Q$="P" OR Q$="p" THEN GOSUB 49900:PRINT CLR$
      :PRINT
22260 Q$=INKEY$:IF Q$<>"" THEN 22260
22300 PRINT "Today is ";T9$;LEFT$(D$,9):PRINT"Client    ";JT$
      :PRINT"Job No.  ";JN$:PRINT:PRINT
22350 PRINT "Invoice issued today (y/n) ? ";
22360 Q$=INPUT$(1)
22370 IF Q$="N" OR Q$="n" OR Q$=CHR$(13) THEN 22750
22380 IF Q$<>"Y" AND Q$<>"y" THEN 22360
22390 GOSUB 64000:GET #1,C:LSET HD$=D$:PUT #1,C:CLOSE
22750 PRINT CLR$:PRINT "JUST A SECOND!":GOTO 1500
30000 RUN "TIRE1"
45000 MES$=""
45001 OPEN "R",#1,C$,253:GOSUB 65100:GET #1,1:P=VAL(ABC$)
45003 IF FLG=0 AND VAL(HTEMP$)=1 THEN MES$="Recorded on Ex-Totals
      on: "+T$(0):CLOSE:P=0:RETURN
45004 GOSUB 65000
45005 FOR I=1 TO P:T$(I)="":NEXT
45010 FOR I=1 TO P:R=I*2:GET #1,R:T7$=ABC$:T$(I)=LEFT$(T7$,8):K=1
45020 MI=CVI(HMIO$):IF MI=8224 OR MI=0 THEN MI=0:GOTO 45110
45030 N$(I)="":FOR J=1 TO MI:K=(J-1)*5+1:HT$=MID$(HTEMP$,K,1)
      :J1=ASC(HT$)
45035 IF J1>255 THEN J1=0
45040 N$(I)=N$(I)+CHR$(J1):HT$=MID$(HTEMP$,K+1,4):T(I,J)=CVS(HT$)
45045 L=LEN(HA$):ZZ=0:IF L=0 THEN HA$=CHR$(J1):GOTO 45050
45046 FOR T=1 TO L:IF ASC(MID$(HA$,T,1))=J1 THEN ZZ=1
45047 NEXT:IF ZZ=0 THEN HA$=HA$+CHR$(J1)
45050 NEXT:IF LEN(N$(I))<>MI THEN STOP
45110 R=R+1:K=1
45120 GET #1,R:MO=CVI(HMIO$):IF MO=8224 OR MO=0 THEN MO=0
      :GOTO 45150
45130 O$(I)="":FOR J=1 TO MO:K=(J-1)*5+1:HT$=MID$(HTEMP$,K,1)
      :J1=ASC(HT$)
45135 IF J1>255 THEN J1=0
45140 O$(I)=O$(I)+CHR$(J1):HT$=MID$(HTEMP$,K+1,4):O(I,J)=CVS(HT$)
45141 L=LEN(HA$):ZZ=0:IF L=0 THEN HA$=CHR$(J1):GOTO 45145
45142 FOR T=1 TO L:IF ASC(MID$(HA$,T,1))=J1 THEN ZZ=1
45143 NEXT:IF ZZ=0 THEN HA$=HA$+CHR$(J1)
45145 NEXT:IF LEN(O$(I))<>MO THEN STOP
45150 NEXT
45200 CLOSE#1
47620 H$="":FOR L=1 TO AS
47630 FOR K=1 TO LEN(HA$)
47640 IF L=ASC(MID$(HA$,K,1)) THEN 47660
47650 GOTO 47670
47660 H$=H$+CHR$(L)
47670 NEXT K,L:RETURN
```

```
564 P=0:Q$=INPUT$(1):IF Q$="Y" OR Q$="y" THEN P=1
566 PRINT CLR$;
570 GOSUB 64000:GET #1,1
580 N=VAL(HJN$):IF N=0 THEN PRINT "No Jobs on File.":GOTO 750
592 PRINT CLR$;J1$;M$;K2$;M$;UL$;M$;
594 IF P=1 THEN LPRINT J1$;M$;K2$;M$;UM$;M$;
600 CT1=0:FOR I=1 TO N:R=I+1
610 GET #1,R:GOSUB 64100
655 RE=VAL(RE$):FS=VAL(FS$):FR=VAL(FR$):IF FR=0 AND FS=0 THEN 740
660 CV$=LEFT$(JN$+SP$,12)+LEFT$(FS$+SP$,12)+LEFT$(DF$+SP$,12)
680 CV$=CV$+LEFT$(FR$+SP$,13)+LEFT$(DR$+SP$,15)
690 XX=FS-FR+RE:CV$=CV$+LEFT$(STR$(XX)+SP$,14)
695 CT1=CT1+XX
700 IF I/22<>INT(I/22) THEN 715
710 PRINT "Press spacebar to continue";
711 Q$=INPUT$(1):IF Q$<>" " THEN 711
712 PRINT UP$;
715 PRINT CV$
720 IF P=1 THEN LPRINT CV$;M$;
730 CT=CT+1:IF CT=NF THEN I=N
740 NEXT
750 CLOSE#1:
755 PRINT STRING$(79,"-"):PRINT TAB(5);"Total (outstanding)";
      TAB(60);USING"#########.##";CT1:PRINT STRING$(79,"-")
756 IF P=1 THEN LPRINT STRING$(79,"-"):LPRINT TAB(5);
      "Total (outstanding)";TAB(60);USING"#########.##";CT1
      :LPRINT STRING$(79,"-")
760 PRINT "PRESS return TO CONTINUE";
770 Q$=INKEY$:IF Q$<>CHR$(13) THEN 770
775 CLOSE
780 GOTO 300
1000 PRINT CLR$;:GOSUB 2005
1010 IF NF=0 THEN 300
1020 PRINT "JOB NUMBER  ";:GOSUB 60000
1040 PRINT:IF IN$="" THEN 1250
1050 C$=IN$:GOSUB 62500:IF C>0 THEN 1070
1060 PRINT HM$;"JOB "IN$;" DOES NOT EXIST PLEASE RE-ENTER";SP$;HM$;
1065 GOTO 1020
1070 IF VAL(FS$)<>0 OR VAL(FR$)<>0 THEN 1100
1095 PRINT HM$;"NO FEE RENDERED FOR JOB "C$;SP$;HM$;
1098 GOTO 1020
1100 PRINT CLR$;"JOB NUMBER              : ";C$
1150 PRINT "FEES RENDERED           : ";FS$
1160 PRINT "LAST APPLICATION DATE   : ";DF$
1165 PRINT "TOTAL FEES RECIEVED     : ";FR$
1170 PRINT "DATE LAST FEE RECIEVED  : ";DR$
1175 XX=VAL(FS$)-VAL(FR$):CV$=CV$+LEFT$(STR$(XX)+SP$,14)
1180 PRINT "MONEY OWED              :";XX
1181 PRINT "DATE LAST INVOICE SEND  : ";DI$:PRINT
1185 PRINT :PRINT "PRESS return TO CONTINUE"
1190 Q$=INKEY$:IF Q$<>CHR$(13) THEN 1190
1200 PRINT CLR$;:GOTO 1020
1250 PRINT HM$;:GOTO 300
2000 PRINT CLR$;:GOSUB 2005:GOTO 2080
2005 F$="fees":GOSUB 61000:IF ER=0 THEN NF=0:GOTO 2020
```

```
80 GOTO 100
90 SAVE "TIRE7":STOP
100 REM"jOB cOSTING & tIME rECORDING pROGRAM jOB sUMMARY v3.0
      03/06/84 bY h.h"
101 ON ERROR GOTO 2590
105 CV$="":
108 FOR I=1 TO 79:UL$=UL$+"-":NEXT
110 UM$=UL$
120 M$=CHR$(10)+CHR$(13)
      :SP$="                                                    "
130 HM$=CHR$(27)+"H":CLR$=CHR$(27)+"E":S1$="                                                                    "
135 XX$="   JanFebMarAprMayJunJulAugSepOctNovDec"
140 T2$="JOB NO.     JOB TITLE                              % WORK
      COMPLETE"
150 T3$="PLEASE CHANGE PERCENTAGE COMPLETE FIGURE IF REQUIRED"
160 T4$="JOB NO.   JOB TITLE"+LEFT$(SP$+SP$,31)+
      "FEE         BUDGET       "
162 PD$=LEFT$(SP$+SP$,52)+"#            #          "
164 PD$=PD$+"               #            #            #              #"
170 T4$=T4$+"% COMPLETE  BUDGET    RECOVERABLE   COST TO     BUDGET"
180 T5$=LEFT$(SP$+SP$+SP$,85)+"EXPENDED":TA$="           0"
251 GOSUB 62110:PRINT CLR$
252 PRINT "PASSWORD ????? "
253 P2$=INKEY$:IF P2$="" THEN 253
254 IF ASC(P2$)=13 THEN 257
255 P1$=P1$+P2$
256 GOTO 253
257 IF P1$=PW$ THEN 260
258 PRINT "PASSWORD INVALID":P1$="":GOTO 252
260 PRINT CLR$;"PASSWORD ACCEPTED
450 OPEN "R",#1,"LASTAC":FIELD #1,15 AS HD$,15 AS HT9$,15 AS HHM$
      :GET #1,1
460 D$=HD$:MM$=HHM$:CLOSE#1:ZZ$="-"
500 XX=LEN(MM$):YY=0:FOR I=1 TO XX:IF MID$(MM$,I,1)=ZZ$ THEN
      YY=I:I=XX
510 NEXT:IF YY=0 AND ZZ$="-" THEN ZZ$=" ":GOTO 500
520 IF YY=0 AND ZZ$=" " THEN ZZ$=".":GOTO 500
530 IF YY=0 THEN STOP
540 LM=VAL(MID$(MM$,YY+1)):IF LM=0 THEN LM=12
545 YR=VAL(RIGHT$(MM$,2))
550 DY=VAL(MM$):VV$=MID$(XX$,(LM*3)+1,3)+MID$(STR$(YR),2)
570 T5$=T5$+"  EXPENSES      DATE       COST COMP"
600 OPEN "R",#1,"ASSISTANTS":FIELD #1,15 AS HAS$,8 AS HT$,
      8 AS HO$:GET #1,1
601 M3=VAL(HAS$)
605 DIM AS$(255),NT(255),OT(255)
610 FOR I=1 TO M3:R=I+1:GET #1,R:AS$(I)=HAS$:NT(I)=CVD(HT$)
      :OT(I)=CVD(HO$)
620 NEXT:CLOSE#1
1000 PRINT CLR$;"JOB SUMMARY SHEET"
1010 PRINT "DO YOU WISH TO CHANGE ALL % COMPLETE FIGURES
1020 PRINT"OR JUST INDIVIDUAL % COMPLETE FIGURES
1030 PRINT"('A' = ALL  'I' = INDIVIDUAL ";
1040 Q$=INPUT$(1)
1060 IF Q$="I" OR Q$="i" THEN PRINT CLR$;:GOTO 1995
```

```
80 GOTO 100
90 SAVE "TIRE9":STOP
100 REM"jOB cOSTING & tIME rECORDING pROGRAM fILE eDIT vER3.0
      03/06/84 bY h.h"
105 CV$="":CLR$=CHR$(27)+"E":HM$=CHR$(27)+"H"
      :UP$=CHR$(27)+"A"+CHR$(13)
110 FOR I=1 TO 79:UL$=UL$+"-":NEXT
115 PRINT CLR$
120 M$=CHR$(10)+CHR$(13)
      :SP$="                                                    "
125 OPEN "R",#1,"TEMPFILE":CLOSE#1
130 S1$="                                                "
220 T1$="JOB NO.   JOB NAME AND CLIENT
      FEE        BUDGET
230 T2$="                                                                    #        #"
240 OPEN "R",#1,"customer":FIELD #1,40 AS HDR$:GET #1,3
      :DRIVE$=LEFT$(HDR$,1):CLOSE:IF DRIVE$<>"A" AND DRIVE$<>"B"
      THEN DRIVE$="A"
2000 CT$="ERASED..":CT=0:GOSUB 64000
2010 GET #1,1:N=VAL(HJN$)
2020 IF N=0 THEN PRINT CLR$:PRINT "No  Jobs on File":PRINT
      "Press any key to continue":A$=INPUT$(1):CLOSE#1:GOTO 4800
3500 PRINT CLR$;T1$;M$;UL$;M$;
3510 FOR I=1 TO N:R=I+1
3520 GET #1,R:GOSUB 64100
3525 IF JN$="ERASED.." THEN  JT$="":GOTO 3810
3600 PRINT LEFT$(JN$+SP$,10);LEFT$(JT$+SP$,40);TAB(55);VAL(JB$);
      TAB(65);VAL(FE$)
3610 PRINT"DELETE THIS JOB  (y/n)? 'q' to quit ";:Q$=INPUT$(1)
      :PRINT CHR$(13);SPACE$(65);CHR$(13);
3615 IF Q$="Y" OR Q$="y" THEN GOSUB 6000:GOTO 3700
3620 IF Q$="N" OR Q$="n" THEN 4500
3630 IF Q$="Q" OR Q$="q" THEN I=N:GOTO 4500
3650 GOTO 3610
3700 PRINT "ARE YOU SURE  (y/n)? ";:Q$=INPUT$(1):PRINT CHR$(13);
      SPACE$(77);CHR$(13);
3710 IF Q$="Y" OR Q$="y" THEN 3800
3720 IF Q$="N" OR Q$="n" THEN 4500
3730 GOTO 3700
3800 PRINT TAB(72);LEFT$(UP$,2);"Erased":KILL DRIVE$+":"+JN$
3810 CT=CT+1:LSET HJN$=CT$:LSET HJT$=JT$:PUT #1,R
4500 NEXT:CLOSE#1:IF CT=0 THEN 4800
4502 GOSUB 4505:GOTO 4550
4505 PRINT CLR$;"CREATING TEMPORARY FILE":KILL "TEMPFILE.*"
4510 OPEN "R",#1,"TEMPFILE",138
4520 M=N-CT:GOSUB 64020:LSET HJN$=STR$(M)
4530 PUT #1,1:CLOSE
4540 RETURN
4550 PRINT CLR$;"COPYING FILES":PRINT:PRINT
4560 S=1:FOR I=1 TO N:R=I+1:PRINT UP$;"          ";I
4570 GOSUB 64000:GET #1,R:GOSUB 64100:CLOSE:
4580 IF JN$="ERASED.." THEN GOTO 4700
4618 S=S+1
4620 OPEN "R",#1,"TEMPFILE",138:GOSUB 64020:GOSUB 64200:PUT #1,S
      :CLOSE
```

```
80 GOTO 100
90 SAVE "TIRE10":STOP
100 REM"jOB cOSTING & tIME rECORDING pROGRAM new jobs v2.0
      03/06/84 bY h.h"
105 CV$="":CLR$=CHR$(27)+"E":UP$=CHR$(27)+"A"
106 CON$=CHR$(27)+"p":COFF$=CHR$(27)+"q"
107 ON ERROR GOTO 61200
110 FOR I=1 TO 79:UL$=UL$+"-":NEXT
115 PRINT CLR$:GOSUB 63100
120 M$=CHR$(10)+CHR$(13)
    :SP$="                                                    "
130 S1$="                                          "
220 T1$="JOB NO.   JOB NAME AND CLIENT
    FEE    BUDGET
230 T2$="                                                    #        #"
240 DIM JN$(60),JT$(60),JF$(60),JB$(60)
245 D$=MID$(DATE$,4,2)+"/"+LEFT$(DATE$,2)+"/"+RIGHT$(DATE$,2)
250 GOTO 3800
300 PRINT TAB(X%);UP$;:RETURN
3800 K=3:I=0:PRINT CLR$;"ENTER JOB NUMBER AND OTHER DETAILS WHEN
    PROMPTED"
3900 PRINT T1$;M$;T2$;M$;UL$;M$;:PRINT HM$;
3955 K=K+1:IF K=20 THEN K=4
3957 I=I+1:IF I=31 THEN 12000
3960 INPUT C$:IF C$="" THEN 12000
3970 IF LEN(C$)>8 THEN PRINT"Error not more than 8 char.";UP$;
    CHR$(13);:GOTO 3960
3980 FOR J=1 TO LEN(C$):IF MID$(C$)="/" THEN MID$(C$,J)="-"
3981 NEXT
4000 GOSUB 62500
4040 IF C<>0 THEN 10000
4041 FOR  J=1 TO I:IF C$=JN$(J) THEN C=1:J=I
4042 NEXT:IF C=1 THEN CL$=C$:GOTO 10000
4045 JN$(I)=C$:JT$(I)="":JB$(I)="0.00":JF$(I)="0.00"
4050 RE$="0":FS$="0":DF$="0":FR$="0":DR$="0":CI$=D$:CC$="0"
    :DI$="No Entry":PC$="0"
4060 PRINT UP$;:S2$=LEFT$(JF$(I)+""+SP$,11)
4065 S3$=LEFT$(JB$(I)+""+SP$,10)
4070 S4$=LEFT$(JT$(I)+""+SP$,38)
4075 S1$=LEFT$(JN$(I)+SP$,11)
4080 PRINT S1$;CON$;S4$;COFF$;"  ";S2$;"  ";S3$;M$;
4085 X%=12:GOSUB 300
4090 PRINT HM$;:INPUT JT$(I)
4095 X%=52:GOSUB 300
4100 PRINT HM$;:INPUT JF$(I)
4105 X%=63:GOSUB 300
4110 PRINT HM$;:INPUT JB$(I)
4200 PRINT UP$;SPACE$(78):PRINT UP$;S1$;JT$(I);TAB(52);JF$(I);
    TAB(63);JB$(I)
5000 GOTO 3955
10000 PRINT "JOB NUMBER ";CL$;" ALREADY EXISTS":PRINT HM$;"";SP$;
    HM$:GOTO 3960
12000 REM ADD NEW JOBS TO FILE
12005 PRINT CLR$;"PLEASE WAIT WHILE JOBS ARE ADDED TO THE FILE"
12006 PRINT "This may take a little time"
```

```
80 GOTO 100
90 SAVE "TIRE11":STOP
100 REM"sHIPWAY tIME rECORDING oPTION 11 REC EXPS TIRE11
     V1.1 10.01.83"
110 CV$="":FOR I=1 TO 79:UL$=UL$+"_":NEXT
115 WW$="0":CLR$=CHR$(27)+"E":HM$=CHR$(27)+"A"+CHR$(13)
120 M$=CHR$(10)+CHR$(13)
     :SP$="                                                    "
130 S1$="                                          "
220 T1$="JOB NO.   JOB NAME AND CLIENT                        COST TO
     DATE
230 T2$="                                                          #
251 PW$="11":PRINT CLR$
252 PRINT "PASSWORD ????? "
253 P2$=INKEY$:IF P2$="" THEN 253
254 IF ASC(P2$)=13 THEN 257
255 P1$=P1$+P2$
256 GOTO 253
257 IF P1$=PW$ THEN 260
258 PRINT "PASSWORD INVALID":P1$="":GOTO 252
260 PRINT CLR$;"PASSWORD ACCEPTED
300 OPEN "R",#1,"LASTAC":FIELD #1,15 AS HD$,15 AS HT9$,15 AS HXX$
     :GET #1,1
310 D$=HD$:X1$=LEFT$(HXX$,8):T9$=HT9$:CLOSE#1
400 HAMID=0:PRINT CLR$;"COST TO DATE  OPTIONS";M$;LEFT$(UL$,24);
     M$;M$;
410 PRINT "1  LIST RECOVERABLE EXPENSES TO DATE
415 PRINT "2  LIST WORK IN PROGRESS TO DATE
430 PRINT "3  INPUT RECOVERABLE EXPENSES
440 PRINT "4  RETURN TO MAIN MENU"
450 PRINT "WHICH OPTION ? ";:Q$=INPUT$(1):Q=VAL(Q$)
460 IF Q<1 OR Q>4 THEN PRINT"ERROR IN OPTION ";Q;:GOTO 450
465 PRINT CLR$
470 ON Q GOSUB  2000,2000,3800,6060
480 GOTO 310
2000 IF Q=2 THEN HAMID=1
2005 GOSUB 64000
2010 GET #1,1:N=VAL(HJN$)
3500 PRINT CLR$;T1$;M$;UL$;M$;
3510 T1=0:FOR I=1 TO N:R=I+1
3520 GET #1,R:GOSUB 64100
3530 IF HAMID=1 THEN T1=T1+VAL(WP$)
3580 IF HAMID=0 THEN T1=T1+VAL(RE$)
3600 PRINT LEFT$(JN$+SP$,10);LEFT$(JT$+SP$,40);
3601 IF HAMID=1 THEN Q=VAL(WP$)
3602 IF HAMID=0 THEN Q=VAL(RE$)
3605 Q$=STR$(Q):IF Q=INT(Q) THEN Q$=Q$+".00":GOTO 3615
3610 Q=LEN(Q$):IF MID$(Q$,Q-1,1)="." THEN Q$=Q$+"0"
3615 Q$=RIGHT$(SP$+Q$,12)
3620 PRINT Q$;M$;
3630 IF I/22<>INT(I/22) THEN 3650
3635 PRINT "PRESS <return> TO CONTINUE LISTING ";
3640 Q$=INKEY$:IF Q$<>CHR$(13) AND Q$<>"Q" AND Q$<>"q" THEN 3640
3645 IF Q$="Q"OR Q$="q" THEN I=N
3646 PRINT CHR$(13);UP$;SPACE$(70);CHR$(13);
```

```
80 GOTO 100
90 SAVE"TIRE12":STOP
100 REM"jOB cOSTING & tIME rECORDING pROGRAM eXtOTS vER3.0
      03/06/84 bY h.h"
110 OU$="":CLR$=CHR$(27)+"E":HM$=CHR$(27)+"H"
111 UP$=CHR$(27)+"A"
115 PRINT CLR$:GOSUB 63100
120 C$=CHR$(10)+CHR$(13):
125 ON ERROR GOTO 61000
140 OPEN "R",#1,"CUSTOMER":FIELD #1,40 AS HDR$:GET #1,3
      :DRIVE$=LEFT$(HDR$,1):CLOSE:IF DRIVE$<>"A" AND DRIVE$<>"B"
      THEN DRIVE$="A"
180 DIM F$(400),T(256),O(256)
190 FOR I=1 TO 78:SP$=SP$+" ":NEXT
430 PRINT CLR$;"LIST OF JOB FILES:- "
440 GOSUB 64000:GET #1,1:N=VAL(HJN$)
450 FOR I=1 TO N:R=I+1:GET #1,R:A$=LEFT$(HJN$+SPACE$(10),12)
      :PRINT A$;:F$(I)=A$:IF I/6=INT(I/6) THEN PRINT
460 NEXT:PRINT:PRINT:CLOSE
540 PRINT "PRESS return TO go back to menu     OR     'R' TO record
      Totals";
545 Q$=INPUT$(1):IF Q$<>CHR$(13) AND Q$<>"r" AND Q$<>"R" THEN 545
550 IF Q$=CHR$(13) THEN 570
553 PRINT CLR$"Are you SURE (y/n) ?";
554 Q$=INPUT$(1):IF Q$="n" OR Q$="N" THEN 570 ELSE IF Q$="Y" OR
      Q$="y" THEN 592
555 GOTO 552
560 KILL "TEX-TOTA.LS"
570 RUN "tire1"
592 OPEN "R",#1,"LASTAC":FIELD #1,15 AS HD$:GET #1,1:D$=HD$:CLOSE
      :D$=LEFT$(D$,8)
594 NAME "EX-TOTAL.S" AS "TEX-TOTA.LS":GOTO 597
595 CLOSE:OPEN "R",#1,"EX-TOTAL.S",253
596 FIELD #1,8 AS HD$,2 AS HNO$,243 AS HTEMP$:RETURN
597 PRINT CLR$;"Please DO NOT remove or replace disc on drive 'B'
      while recording"
598 PRINT:PRINT TAB(40)"This may take a while..!"
599 PRINT:PRINT
600 JJ=1:FOR II=1 TO N:C$=DRIVE$+":"+LEFT$(F$(II),8):PRINT II;
      "Recording Job File ";F$(II):GOSUB 60000
610 JJ=JJ+1
620 GOSUB 2000:IF ER=58 THEN GOSUB 45000
621 GOSUB 63600:KK$="":FOR I=1 TO 255:IF VAL(MID$(AS$,I,1))=0
      THEN 629
625 KK$=KK$+CHR$(I)
629 NEXT:IF LEN(KK$)=0 THEN 900
630 GOSUB 595:HT$="":FOR K%=1 TO LEN(KK$)
640 X%=ASC(MID$(KK$,K%,1)):HT$=HT$+CHR$(X%)+MKS$(T(X%))+MKS$(O(X%))
645 IF K%/27=INT(K%/27) THEN LSET HTEMP$=HT$:LSET HD$=F$(II)
      :LSET HNO$=MKI$(LEN(KK$)):PUT #1,JJ:JJ=JJ+1:HT$=""
650 NEXT:GOSUB 595:LSET HTEMP$=HT$:LSET HD$=F$(II)
      :LSET HNO$=MKI$(LEN(KK$)):PUT #1,JJ
900 NEXT:GOSUB 595:LSET HD$=D$:LSET HNO$=MKI$(JJ):PUT #1,1:CLOSE
1000 PRINT:PRINT N;"Jobs recorded.  Press spacebar to continue.";
1010 Q$=INPUT$(1):IF Q$<>" " THEN 1010
```

Four indices are used for the formula, two of which are for the cost of labour, based on average earnings in the mechanical and engineering industry which are published in the Monthly Bulletin.

The other two are for mechanical and electrical engineering materials and fuel purchased by the mechnical and electrical industries respectively.

The formula is used for adjusting lift installations' prices in respect of shop fabrication and completion of site installation. The shop fabrication adjustment includes the date of completion of component manufactured and the delivery date of the components to the site.

The formula is used with provisional and firm Index Number except for labour, the latest published provisional Index numbers should be used.

The labour Index Numbers for this formula are calculated on the basis of four-month moving averages. As this means publication in the Monthly Bulletins is up to three months late, only the latest published Numbers should be used.

2) Structural steelwork installations.

The following formula is for structural steelwork when carried out as the Contractor's Specialist Work as stated in the Contract Bills.

The formula is as follows:-

$$C=Vm*((Md-Mo)/Mo) + Vf*((Lf-Lo)/Lo) + Ve*((Le-Lo)/Lo)$$

where:

C = the amount of the adjustment to be paid to or recovered from, the Contractor.
Vm = the weight in tonnes of steel delivered to site during the Valuation Period (the value of which is to be included in Interim Certificates multiplied by the average price of steel recorded in the Contract Bills.
Vf = the value of fabrication and delivery obtained by deducting the amount Vm and the amount Ve from the sum of the Value of Work for the Valuation Period.
Ve = the weight in tonnes of steel erected during the Valuation Period multiplied by the average price of erection recorded in the Contract Bills.
Md = the Index number for structural steel for the month in which the date seven weeks before delivery to site occurred.
Mo = the Index Number for structural steel for the month before the Base month.

Lf = the Index number for labour in the month in which the date three weeks before delivery to site occurred.
Le = the Index Number for labour for the month in which the Mid-point of the Valuation Period occurred.
Lo = the Index Number for labour for the Base Month.
The Bills of Quantities should contain the following:-

a) For the calculation of Vm in the formula the average price per tonne of steel delivered to the fabricator's works is used.

b) For Ve the average price per tonne for erection of steelwork should be included.

Two indices for Labour and Materials are required to operate the Formula:

The labour index includes factors Lf and Le for use in the formula. Lf includes the cost of fabrication and delivery to site, overheads, plant, power and maintenance etc. while Le represents the cost of erection on site, including plant used in erection. The materials index for structural steel published by the Department of Industry is published in the Monthly Bulletins.

Application of Formula:-

a) Formula adjustment cannot be used for the value of unfixed materials and goods included in a valuation certificate but can be applied when the value of unfixed materials and goods is included in a subsequent valuation.

Any discrepancy between the total recorded deliveries to site and the final measured weight is corrected in the last interim valuation or in the calculations for the Final Certificate. The Index number appropriate to the last recorded delivery to the site can be used for the valuation.

b) Weight and date of delivery of steel for fabrication to the site should be noted for the determination of factor Vm and the Index numbers Md and Lf.

c) The formula is used with provisional and firm Index Number except for labour, the latest published provisional Index numbers should be used. The labour Index Numbers for this formula are calculated on the basis of four-month moving averages. As this means publication in the Monthly Bulletins is up to three months late, only the latest published Numbers should be used.

Outline of NEDO valuation package.

Indices are recorded on two separate files historically with 49 categories, 7 appendix categories and 8 special labour/ material categories of electrical, heating, lift installation and steel structure installation.

Set-up Program.

The main function of the program is to read and reset the last access date and check for passwords etc.

First Program.

Apart from being the main menu for accessing other programs the major function of this program is to amend/enter display and print the provisional and firm indices.

Second Program.

The main function of this program is to create a data file for a new job with the following data:

i) Job number, job title, the base month when the job starts, completion date, a percentage for elements of work groups which are non adjustable.

ii) After initial data has been entered the system prompts for the specialists' work. i.e. electrical, heating etc. When electrical or heating specialists are involved in the job the labour weighting percentage is required.

iii) The user can enter a number of different categories within each work group but categories can be re-entered in the rest of the work groups again.

Finally the system calculates a weighted work group index based on the average base month indices of all categories.

Third Program.

This program displays details of the contract, and prompts for a cumulative figure, which is the total of work completed for individual work groups for valuation purposes.

If the value entered is less that displayed in the previous month the system verfies it before accepting it.

This historical cumulative valuation data is saved on a separate file which will be accessed by the next program and the adjusted

prices are calculated and printed.

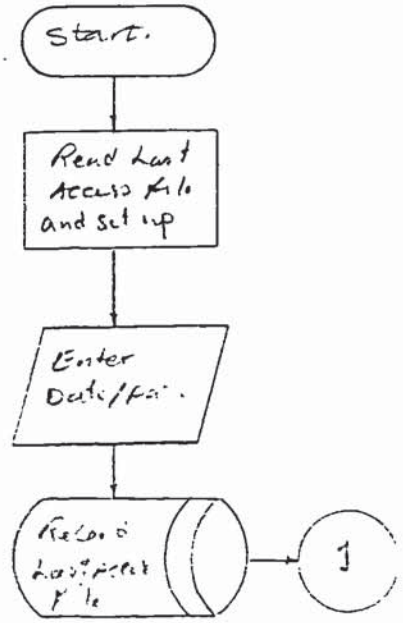
Fourth program.

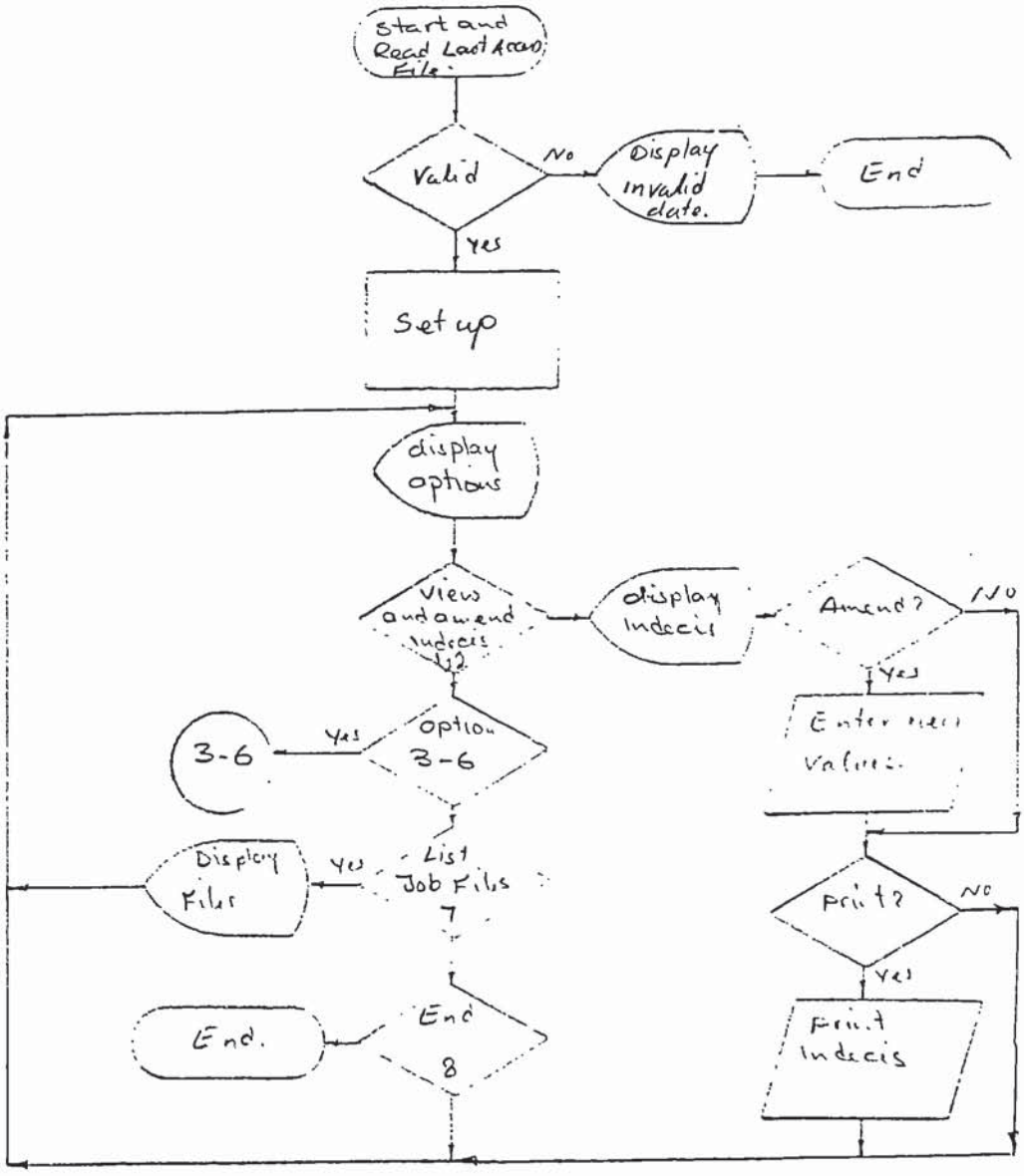
This program displays first/last valuation month and also the dates of which historical forms of provisional and firm indices are kept. The user can list/print these valuation from the following options:

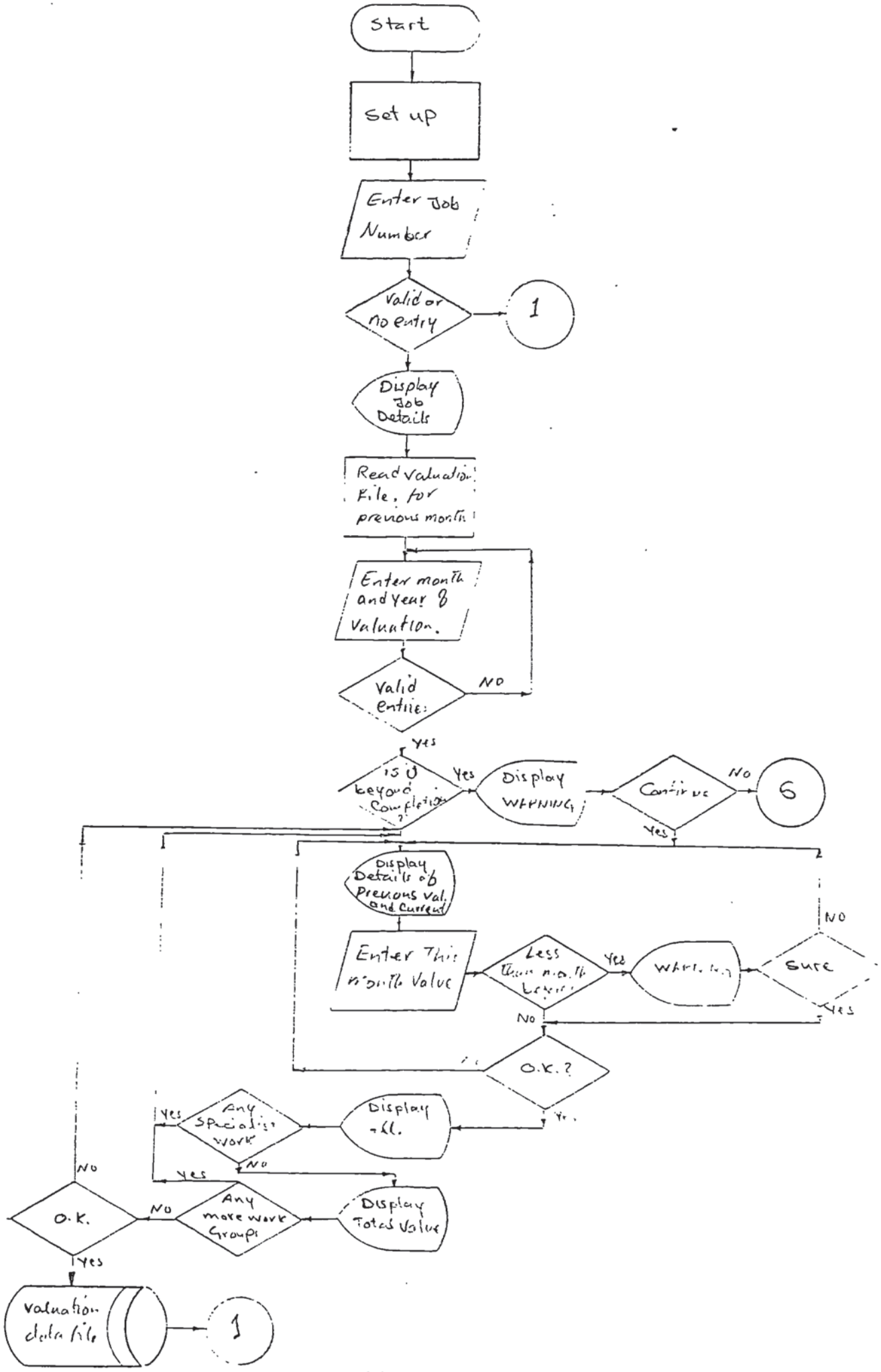
- Latest provisional or firm valuation
- provisional or firm valuations form month number N to month number M inclusively.

Fifth Program.

The main function of the program is to allow the user to alter the completion date or edit the entered cumulative valuation data for all of the valuations already on the file.


Start.
Read Last Access File and set up
Enter Date/Fair.
Record Last Accessed File
1


Start and Read Last Access File
Valid
No
Display invalid date.
End
Yes
Set up
display options
View and amend indexes 1/2
display indexes
Amend?
No
Yes
Enter new values.
Option 3-6
Yes
3-6
List Job Files 7
Display Files
Yes
Print?
No
Yes
Print Indexes
End 8
End.


Start
Set up
Enter Job Number
Valid or no entry
1
Display Job Details
Read Valuation File for previous month
Enter month and year of Valuation.
Valid entries
NO
Yes
Is it beyond completion?
Yes
Display WARNING
Confirm
NO
6
Yes
Display Details of previous val. and Current
Enter This month Value
Less than month before
Yes
Warning
Sure
NO
Yes
No
O.K.?
Yes
Display all.
Any Specialist work
Yes
No
Yes
Display Total Value
Any more work Groups
No
O.K.
NO
Yes
Valuation data file
1

```
1 ON ERROR GOTO 9100
2 HAMID3$=RIGHT$(DATE$,4)+LEFT$(DATE$,2)+MID$(DATE$,4,2)
3 IF LEFT$(HAMID3$,4)<"1984" THEN PRINT CHR$(27);"E":PRINT
      " Correct Date PLEASE.":END
4 DAT$=CHR$(15)+CHR$(23)+CHR$(22)
5 OPEN "I",#1,"lastac.dat":INPUT#1,DT$:CLOSE#1:IF LEFT$(DT$,3)<>DAT$
      THEN 12
6 DAT$="":FOR I=1 TO 8:A=ASC(MID$(DT$,I,1))-14:DAT$=DAT$+MID$(STR$(A),
      2):NEXT
7 IF DAT$>HAMID3$ THEN 13
8 DT$=RIGHT$(DT$,6):GOTO 10
9 DT$=CHR$(15)+CHR$(23)+CHR$(22)+CHR$(18)+CHR$(14)+CHR$(19)+CHR$(15)+
      CHR$(18):DAT$=LEFT$(DT$,3)
10 OPEN "O",#1,"LASTAC.dat":PRINT#1,DT$:CLOSE#1
12 PRINT CHR$(27);"E":PRINT "Please Call H.H? ":PRINT :END
13 REM
14 REM
410 M3$="ENTER INDICES FOR "
420 M2$="AMEND INDICES FOR "
430 Q1$="PLEASE AMEND INDICES WHERE NECESSARY"
450 DIM P(67),D$(17),M$(12)
460 HM$=CHR$(19):M$=CHR$(10)+CHR$(13):SP$="                                "
470 FOR I=1 TO 17:READ D$(I):D$(I)=LEFT$(D$(I)+SP$,30):NEXT
472 DATA"Appendix 1","Appendix 2","Appendix 3","Appendix 4"
474 DATA"Appendix 5","Appendix 6","Appendix 7"
476 DATA"E1-Labour","E2-Materials","H1-Labour"
478 DATA"H2-Materials","L1-Mechanical Labour"
480 DATA"L2-Mechanical Materials","L3-Electrical Material"
482 DATA"L4-Electrical Labour","S1-Labour"
484 DATA"S2-Materials"
488 FOR I=1 TO 12:READ M$(I):NEXT
490 DATA JANUARY,FEBRUARY,MARCH,APRIL,MAY,JUNE,JULY,AUGUST
492 DATA SEPTEMBER,OCTOBER,NOVEMBER,DECEMBER
500 A=1:PRINT CHR$(27);"E";CHR$(27)+"x5"
600 PRINT MID$(DATE$,4,3)+LEFT$(DATE$,3)+"19"+RIGHT$(DATE$,2);
650 PRINT TAB(25);CHR$(27);"p";"NEDO FORMULA PRICE ADJUSTMENT";CHR$(27);
      "q";TAB(69);TIME$
651 GOTO 700
655 PRINT TAB(25);CHR$(27);"p";"H.HAGHDADI"CHR$(27)"q"
656 REM
700 PRINT
800 PRINT"       OPTIONS AVAILABLE :-
850 PRINT
860 AA$="":IF A=1 THEN AA$=CHR$(27)+"p"
900 PRINT TAB(10);AA$;"1-VIEW & AMEND PROVISIONAL INDICES";CHR$(27);"q"
950 PRINT"             (INCLUDING INPUT OF LATEST INDICES)
960 AA$="":IF A=2 THEN AA$=CHR$(27)+"p"
1000 PRINT TAB(10);AA$;"2-VIEW & AMEND FIRM INDICES";CHR$(27);"q"
1020 PRINT"              (INCLUDING INPUT OF LATEST INDICES)
1030 AA$="":IF A=3 THEN AA$=CHR$(27)+"p"
1050 PRINT TAB(10);AA$;"3-INPUT  INITIAL JOB DATA";CHR$(27);"q"
1055 PRINT
1060 AA$="":IF A=4 THEN AA$=CHR$(27)+"p"
1100 PRINT TAB(10);AA$;"4-INPUT VALUE OF WORK COMPLETED PER WORK GROUP";
      CHR$(27);"q"
```

```
20 PRINT CHR$(27);"E"
70 REM DATA ENQUIRY AND EDIT PROGRAM PNEDO6
75 REM H.H VERSION 3.2 18/04/84
80 Y$="         ":SP$="                                                    "
85 DEF FNA(X)=10-LEN(STR$(X))
95 DIM L$(40)
100 FOR I=1 TO 40:L$=" ":N=I+64:IF I>26 THEN N=I+38:L$="A"
105 L$(I)=L$+CHR$(N):NEXT
110 ON ERROR GOTO 61000
115 DIM T3$(5),P$(45,45)
120 T3$(1)="ELECTRICAL EQUIPMENT "
130 T3$(2)="HEATING AND VENTILATING"
140 T3$(5)="STRUCTURAL STEELWORK"
150 T3$(3)="LIFT ENGINEERING "
160 T3$(4)="CATERING EQUIPMENT "
170 T3$(0)="BALANCE OF ADJUSTABLE WORK"
175 DIM MO$(12)
180 FOR B=1 TO 12:READ MO$(B):NEXT
185 DATA JANUARY,FEBRUARY,MARCH,APRIL,MAY,JUNE,JULY,AUGUST
190 DATA SEPTEMBER,OCTOBER,NOVEMBER,DECEMBER
195 PRINT "Data Correction."
200 INPUT"JOB NUMBER    ";JN$
210 IF JN$="" THEN 860
215 F$="B:"+JN$+".REL":NAME F$ AS F$
220 PRINT"JOB "JN$" DOES NOT EXIST":GOTO 200
225 OPEN "R",#2,"B:"+JN$+".REL"
226 ON ERROR GOTO 62000
227 FIELD #2,4 AS Z$,20 AS Y$,20 AS X$,20 AS W$,20 AS V$,20 AS U$,
      20 AS T$,4 AS N1$
230 GET #2,1:I=VAL(Z$):J=I+5
231 BB$=Y$:JT$=X$:EX$=W$:EC$=V$:L1$=U$:L2$=T$:NA$=MID$(STR$(CVS(N1$)),2)
232 CLOSE
235 K1=INT((I+4)/10)+2
236 PRINT CHR$(27);"E":PRINT"JOB NUMBER        ";JN$
237 PRINT"JOB TITLE         ";JT$
238 PRINT"BASE MONTH        ";BB$
239 PRINT"COMPLETE BY       ";EC$
240 PRINT"NUMBER OF GROUPS ";I
241 PRINT:PRINT "NON ADJUSTABLE ELEMENT  %";NA$:PRINT:INPUT
      " ALTER COMPLETION DATE  ";Q$
242 IF LEFT$(Q$,1)<>"Y" AND LEFT$(Q$,1)<>"y"  THEN 245
243 GOSUB 30000
245 F$="B:V"+JN$+".dat":NAME F$ AS F$
246 PRINT "JOB VALUATION FILE DOES NOT EXIST ":GOTO 800
249 OPEN "R",#2,F$
250 FIELD #2,5 AS K$:GET #2,1:K=VAL(K$)
252 DIM P(65,55),M$(65),V(65)
255 FOR J=1 TO K:R=(J-1)*K1+2
256 FIELD #2,10 AS V$,20 AS M$,10 AS P$:GET #2,R
257 V(J)=VAL(V$):P(J,0)=VAL(P$):M$(J)=M$:K2=0
262 FOR A=0 TO I+4:R1=R+INT(A/10)+1:K2=K2+10:IF K2=110 THEN K2=10
264 FIELD #2,K2 AS P$(J,A+1):GET #2,R1:P(J,A+1)=VAL(RIGHT$(P$(J,
      A+1),10)):NEXT
265 NEXT
266 CLOSE #2:N=K:M=I
```

```
990 PRINT TAB(40);"JOB TITLE       ";JT$
1000 PRINT TAB(40);"BASE MONTH      ";BB$
1010 PRINT TAB(40);"COMPLETE BY     ";EC$
1020 PRINT TAB(40);"NO. GROUPS      ";I
1030 GOTO 1160
1040 OPEN "R",#2,TY$+".DAT":X$=LEFT$(BB$+SP$,15):B1=0:CHKB=0
1050 FIELD #2,5 AS N$:GET #2,1:N=VAL(LEFT$(N$,5)):FIELD #2,90 AS N$
1060 FOR X1=1 TO N:R=2+(X1-1)*6:GET #2,R:R1$=LEFT$(N$,15)
1070 IF R1$=X$ THEN B1=X1:X1=N
1080 NEXT:IF B1=0 AND LIFTB=1 THEN CHKB=1:CLOSE#2:PRINT
      "Indices NOT found for Month ";BB$:LPRINT
      "Indices NOT found for month ";BB$:RETURN
1090 IF B1=0 THEN PRINT "BASE INDICES FOR MONTH "BB$" NOT FOUND"
      :CLOSE#2:GOTO 5010
1100 J=0:FOR K=R TO R+5:GET #2,K:B$=N$:A1=13
1110 IF K=R THEN B$=MID$(B$,16):A1=10
1120 IF K>R+4 THEN A1=4
1130 FOR H=1 TO A1:A$=MID$(B$,(H-1)*6+1,6)
1140 J=J+1:I1(J)=VAL(A$):NEXT:NEXT
1150 CLOSE #2:RETURN
1160 K1=INT((I+4)/10)+2:C1$="NO PREVIOUS DATA"
1170 K=0:VN=0
1180 CLOSE#2:OPEN "R",#2,F$
1190 FIELD #2,5 AS K$:GET #2,1:K=VAL(K$):FIELD #2,10 AS V$,15 AS MM$
1200 GET #2,2:V1=VAL(V$):M1$=MM$
1210 R=K1*(K-1)+2
1220 GET #2,R:V2=VAL(V$):M2$=MM$
1230 CLOSE #2
1240 PRINT CHR$(27)+"H";:PRINT:PRINT  "DATA ON FILE FOR JOB "JN$" :"
1250 PRINT "    VALUATION NO.";V1;" ";M1$
1260 PRINT "TO  VALUATION NO.";V2;" ";M2$
1270 PRINT:PRINT:PRINT
1280 PRINT "       FIRM INDICES ON RECORD FOR ";F1$;" TO ";F2$
1290 PRINT "PROVISIONAL INDICES ON RECORD FOR ";P1$;" TO ";P2$
1300 PRINT
1310 PRINT TAB(1);"VALUATION OPTIONS:-":PRINT
1320 PRINT "";TAB(20);"1 RETURN FOR NEXT JOB"
1330 PRINT TAB(20);"2 LATEST PROVISIONAL VALUATION
1340 PRINT TAB(20);"3 LATEST FIRM        VALUATION
1350 PRINT TAB(20);"4 PROVISIONAL VALUATIONS #N TO #M INCLUSIVE
1360 PRINT TAB(20);"5 FIRM        VALUATIONS #N TO #M INCLUSIVE
1370 PRINT TAB(20);"6 RETURN TO MAIN MENU":PRINT
1380 PRINT;TAB(20);:INPUT"WHICH OPTION  ";O$:O=VAL(O$)
1390 PRINT LEFT$(SP$+SP$+SP$,76);""
1400 IF O>0 AND O<7 THEN 1420
1410 PRINT "ERROR IN OPTION ";O;"":GOTO 1240
1420 ON O GOTO 1430,1450,1450,1500,1500,1440
1430 RUN
1440 RUN "pnedo"
1450 VA=V2:VB=V2:M3$=M2$:IF O=2 THEN TY$="PROV":P3$=P2$
1460 IF O=3 THEN TY$="FIRM":P3$=F2$
1470 TY$="FIRM":IF O=2 THEN TY$="PROV"
1480 IF H%=1 THEN GOSUB 1040
1490 GOTO 1600
1500 PRINT
```

```
10 FOR I=1 TO 79:UL$=UL$+"-":NEXT
100 REM PNEDO3 H.H 05/04/1984
110 PRINT""
150 ON ERROR GOTO 61000
200 DIM W(40,40),D#(40),L$(40),N%(40,40),C$(40,40),C#(40),P(40,40),I(67)
210 G=40:FOR I=1 TO G:L$="":N=I+64:IF I>26 THEN N=I+38:L$="A"
220 L$(I)=L$+CHR$(N):NEXT:HM$=CHR$(19):M$=CHR$(10)+CHR$(13):CR$=CHR$(13)
230 DEF FNB(X)=X:REM INT(X*10000)/10000
235 DEF FNA(X)=X:PRINT CHR$(27);"E"
241 SP$="                                   "
245 TO$="CALCULATION OF WEIGHTED BASE INDICES"+M$+"BASE MONTH   "
250 T1$="  WORK              TOTALS          FACTOR"
255 T1$=T1$+"  CATEGORY    INDEX    GROUP      WORK"
260 T2$="GROUP  CAT    CATEGORY      GROUP"
265 T2$=T2$+LEFT$(SP$+SP$,21)+"WEIGHTED    INDEX      GROUP"
280 DIM M$(12):FOR I=1 TO 12:READ M$(I):NEXT
300 DATA JANUARY,FEBRUARY,MARCH,APRIL,MAY,JUNE,JULY,AUGUST,SEPTEMBER,OCTOBER
310 DATA NOVEMBER,DECEMBER
315 DIM EX$(5)
320 EX$(1)="ELECTRICAL EQUIPMENT     "
330 EX$(2)="HEATING AND VENTILATING  "
340 EX$(5)="STRUCTURAL STEELWORK     "
350 EX$(3)="LIFT ENGINEERING         "
360 EX$(4)="CATERING EQUIPMENT       "
1000 PRINT"INITIAL JOB DATA"
1100 GOSUB 50000:JJ=0:IF JT$="" THEN 4600
1105 PRINT"";:I=1
1110 S9$=""
1120 J=1:GOSUB 5000
1145 REM
1150 PRINT CHR$(27);"j";:INPUT L:L=INT(L)
1155 REM
1160 IF L=0 THEN 1200
1162 IF L>56 THEN PRINT "ERROR NO CATEGORY":PRINT CHR$(27);"k";:GOTO 1145
1163 IF J=1 THEN 1168
1164 ZZ=0:FOR YY=1 TO J-1:IF L=N%(I,YY) THEN ZZ=1
1165 NEXT
1166 IF ZZ=1 THEN PRINT "ERROR CATEGORY USED":PRINT CHR$(27);"k";:GOTO 1145
1168 IF J>=JJ THEN S9$=""
1170 PRINT SPACE$(30):PRINT CHR$(27);"k";L;TAB(30);""S9$;:INPUT C$(I,J)
1173 PRINT CHR$(27);"k";L;TAB(35);"";:PRINT USING "########.##";VAL(C$(I,J))
1174 C#=C#+VAL(C$(I,J))
1175 N%(I,J)=INT(L)
1180 J=J+1:IF J=15 OR J=30 OR J=45 THEN GOSUB 5000:PRINT CHR$(27);"H";
      TAB(40);"Please Continue.":PRINT:PRINT:PRINT
1182 IF J>40 THEN 1200
1185 GOTO 1145
1200 IF J=1 THEN 1300
1220 REM
1221 PRINT "TOTAL VALUE OF THIS WORK GROUP=";:PRINT USING
      "##########.##";C#:C#(I)=C#:C#=0
1222 PRINT:INPUT"DETAILS OK    ";Q$:Q$=LEFT$(Q$,1)
1224 PRINT HM$;HM$;:IF I>1 THEN PRINT
1226 IF Q$="n" OR Q$="N"  THEN S9$="":JJ=J:J=1:GOTO 1120
1230 J=J-1:N%(I,0)=J
```

```
470 SN$="  #    P"
480 DIM EX$(5),EC$(5),GV$(7),DM$(7),WM$(7),MMH3$(7),MMH7$(7),LF(9),
      VM(9),MD(9),VF(9)
490 EX$(1)="ELECTRICAL EQUIPMENT     "
500 EX$(2)="HEATING AND VENTILATING  "
510 EX$(5)="STRUCTURAL STEELWORK     "
520 EX$(3)="LIFT ENGINEERING         "
530 EX$(4)="CATERING EQUIPMENT       "
540 DIM M$(12)
550 FOR I=1 TO 12:READ M$(I):NEXT
560 DATA JANUARY,FEBRUARY,MARCH,APRIL,MAY,JUNE,JULY,AUGUST,SEPTEMBER
570 DATA OCTOBER,NOVEMBER,DECEMBER
580 PRINT""
590 F$="PROV.dat":G$="PROVISIONAL":GOSUB 4730
600 A=LEN(B1$):Z=0:FOR B=1 TO A:IF MID$(B1$,B,1)=" " THEN Z=B-1:B=A
610 NEXT:P1$=LEFT$(B1$,Z)
620 A=LEN(B2$):Z=0:FOR B=1 TO A:IF MID$(B2$,B,1)=" " THEN Z=B-1:B=A
630 NEXT:P2$=LEFT$(B2$,Z)
640 F$="FIRM.dat":G$="       FIRM":GOSUB 4730
650 A=LEN(B1$):Z=0:FOR B=1 TO A:IF MID$(B1$,B,1)=" " THEN Z=B-1:B=A
660 NEXT:F1$=LEFT$(B1$,Z)
670 A=LEN(B2$):Z=0:FOR B=1 TO A:IF MID$(B2$,B,1)=" " THEN Z=B-1:B=A
680 NEXT:F2$=LEFT$(B2$,Z)
690 PRINT HM$;HM$;""
700 PRINT CHR$(27);"E"
710 PRINT "Valuation Output."
720 INPUT"JOB NUMBER    ";JN$
730 IF JN$="" THEN 2910
740 F$="B:V"+JN$+".dat":NAME F$ AS F$
750 PRINT"JOB "JN$" DOES NOT EXIST":GOTO 720
760 REM
770 H%=1:REM INPUT"Update BASE Indices  Yes or No";Q$
780 OPEN "R",#2,"B:"+JN$+".REL",220
790 FIELD #2,4 AS I$,20 AS Z$,20 AS Y$,20 AS X$,20 AS W$,20 AS V$,
      20 AS Q$,4 AS N1$
800 GET #2,1:I=VAL(I$):BB$=Z$:JT$=Y$:EX$=X$:EC$=W$:L1$=V$:L2$=Q$:J=I+5
805 BBB$=Z$
810 DIM F(40),C(40),L(40),W(40),B(40),P(40,40),N%(40,40)
820 NA=CVS(N1$):NA=NA*-1:NA$=MID$(STR$(NA),2)
830 R=1:FOR A=1 TO I:R=R+1
840 FIELD #2,5 AS N$:GET #2,R:J=VAL(N$):K=220
850 FIELD #2,K AS N$:GET #2,R
860 FOR B=0 TO J:Z=B*10+1
870 IF B=21 THEN R=R+1:GET #2,R
880 IF B>20 THEN Z=Z-200
890 N%(A,B)=VAL(MID$(N$,Z,10)):NEXT
900 R=R+1:GET #2,R:FOR B=0 TO J:Z=B*10+1
910 IF B=21 THEN R=R+1:GET #2,R
920 IF B>20 THEN Z=Z-200
930 P(A,B)=VAL(MID$(N$,Z,10)):NEXT
940 B(A)=P(A,0):P(A,0)=0
950 NEXT
960 CLOSE #2
970 FOR A=1 TO 5:EC$(A)=MID$(EX$,A,1):NEXT
980 PRINT CHR$(27)+"E":PRINT TAB(40);"JOB NUMBER     ";JN$
```

ILATION OF GROSS FLUCTUATION FOR INTERIM VALUATION

RACT : OAKENGATES TOWN HALL GENERAL + STEELWORK TEST JOB NUMBER : R47

INDICES FOR THE MONTH OF SEPTEMBER1983

ATION NO.: 3 DATE : 12-04-1984

	VALUE OF WORK EXECUTED			INDEX		GROSS FLUCTUATION	
GROUP	TO DATE	PREVIOUS	THIS VALUATION	THIS MONTH	BASE MONTH	DECREASE	INCREASE
	£	£	£			£	£
A	10302.4	0.0	1455.2	237.0	226.0		70.82
B	2959.2	0.0	336.0	235.0	225.0		14.96
C	520.0	0.0	387.2	237.0	229.0		13.52
D	12016.8	8092.8	3924.0	244.0	238.0		98.92
E	2375.1	1653.9	721.2	209.0	197.0		43.93
F	9.5	0.0	9.5	245.0	238.0		0.27
G	0.0	0.0	-	244.0	234.0		0.00
H	2005.3	1021.9	983.4	221.0	208.0		61.46
I	19414.9	2674.7	16740.1	255.0	243.0		826.67
J	0.0	0.0	-	241.0	233.0		0.00
K	0.0	0.0	-	214.0	192.0		0.00
L	0.0	0.0	-	244.0	232.0		0.00
M	0.0	0.0	-	218.0	207.0		0.00
N	0.0	0.0	-	209.0	195.0		0.00
O	646.0	646.0	-	246.0	230.0		0.00
P	0.0	0.0	-	211.0	205.0		0.00
Q	0.0	0.0	-	228.0	219.0		0.00
R	0.0	0.0	-	214.0	205.0		0.00
S	0.0	0.0	-	221.0	215.0		0.00
T	0.0	0.0	-	263.0	248.0		0.00
U	0.0	0.0	-	244.0	234.0		0.00
V	338.0	51.0	287.0	197.0	193.0		5.94
W	0.0	0.0	-	256.0	251.0		0.00
X	0.0	0.0	-	228.0	221.0		0.00
Y	0.0	0.0	-	237.0	234.0		0.00
Z	459.1	87.8	371.2	213.0	207.0		10.76
AA	0.0	0.0	-	234.0	224.0		0.00
AB	3.5	3.5	-	252.0	245.0		0.00
AC	0.0	0.0	-	222.0	214.0		0.00
AD	0.0	0.0	-	235.0	230.0		0.00
AE	0.0	0.0	-	216.0	210.0		0.00
AF	0.0	0.0	-	188.0	189.0		0.00
AG	0.0	0.0	-	231.0	219.0		0.00
AH	421.9	265.6	156.2	220.0	214.0		4.38
AI	0.0	0.0	-	282.0	271.0		0.00
AJ	0.0	0.0	-	189.0	193.0		0.00
AK	0.0	0.0	-	227.8	225.4		0.00
AL	0.0	0.0	-	238.6	225.8		0.00
AM	0.0	0.0	-	238.8	225.9		0.00
	TOTAL	25372.1					1151.63

ULATION OF GROSS FLUCTUATION FOR INTERIM VALUATION

RACT : DATE CHANGE TEST JOB NUMBER : DATE

INDICES FOR THE MONTH OF SEPTEMBER1983

ATION NO.: 2 DATE : 12-04-1984

	VALUE OF WORK EXECUTED			INDEX		GROSS FLUCTUATION	
GROUP	TO DATE	PREVIOUS	THIS VALUATION	THIS MONTH	BASE MONTH	DECREASE	INCREASE
	£	£	£			£	£
A	120.0	100.0	20.0	235.6	225.3		0.91
B	180.0	200.0	-20.0	240.4	234.2	0.53	
		TOTAL	0.0				.38

NUMBER : DATE CONTRACT : DATE CHANGE TEST

ULATION OF FLUCTUATION DUE ON BALANCE OF ADJUSTABLE WORK
D ON FIRM INDICES FOR SEPTEMBER1983

ATION NO.: 2 DATE : 12-04-1984

		£ P
CE OF ADJUSTABLE WORK		
T INCLUDED IN VALUATION TO DATE	=	15.00
T INCLUDED IN PREVIOUS VALUATION	=	10.00
T INCLUDED IN THIS VALUATION	=	5.00

	VALUE £ P	DECREASE £ P	INCREASE £ P
G FLUCTUATION DUE ON F OF WORK EXECUTED			.38
TUATION DUE ON BALANCE OF STABLE WORK FOR THIS VALUATION			0.00
-10% NON-ADJUSTABLE ELEMENT		.04	
FIRM NET FLUCTUATION			.34

A P P E N D I X F

Integration of stand-alone packages.

Example:

Let it be assumed that it is required to export a Bill of Quantity from your BQ system to a spread sheet package such as Lotus 123.

It is required to prepare the follwing temporary files on the computer system.

1 - a batch file which allows loading BQ and Lotus system

2 - at least 4 ascii export files from your BQ system

3 - an ascii macro file for importing a file into Lotus

The batch file loads your BQ system where you select a file to be re-written into four ascii files. A flag file must be created for batch file to load Lotus 123. After loading Lotus 123 the macro file loads these four ascii files into Lotus system where the Bill of Quantity can be analysed or priced. After terminating Lotus session the batch file either terminates or loads your BQ system, if a return flag file was created by the BQ system.

1) Batch file is required (x.bat)

- erase all flag files
- load the BQ system
- if flag file exists, load Lotus
- if return flag exists, load Batch file (x.bat)
- exit

2) Ascii files prepared by the BQ system

- Create 4 (A.ASC, B.ASC, C.ASC, D.ASC) sequential out put files and repeate the following for the whole BQ that is intended to be exported to Lotus spread sheet.
  - out put CODES to file A.ASC
  - out put DESCRIPTIOS to file B.ASC

- out put QUANTITY to file C.ASC
- out put UNIT to file D.ASC
- create flag file.

- If it is required for the batch file to load the BQ system after Lotus session has finished then Create a return flag file.

- Exit to operating system from the BQ system

3) Macro file should contain instructions as follows:

- clear work sheet
- format column A for CODES, text, width 10 chars.
- format column B for DESCRIPTIONS, text, width 40 chars.
- format column C for QUANTITIES, integer, width 7 chars.
- format column D for UNITS, text, width 4 chars.
- import, ascii file, 'A.ASC' as text, range A1-A999
- import, ascii file, 'B.ASC' as text, range B1-B999
- import, ascii file, 'C.ASC' as numbers, range C1-C999
- import, ascii file, 'D.ASC' as text, range D1-D999

The Bill of Quantity is now imported to Lotus 123.

WEEKLY COST AND VALUE SHEET | CONTRACT________ No.______ | WEEK No.______ | CONTRACT PERIOD ______ WEEKS | COMPILED BY______ | WEEK ENDING ______

		INCOME		K.C. WORK		SUB-CONTRACT	
ITEM No.	DESCRIPTION	QUANTITY	UNIT	NETT RATE	VALUE	RATE	VALUE
	TOTALS						

SUMMARY		
	WEEKLY	CUMULATIVE
INCOME		
EXPENDITURE		
PROFIT		
LOSS		

REMARKS

EXPENDITURE				
DESCRIPTION	QUANTITY	UNIT	RATE	VALUE
K.C. LABOUR				
K.C. BONUS				
K.C. PLANT				
HIRED PLANT				
PLANT BONUS & OVERTIME				
FUEL				
PLANT HAULAGE				
SUB-CONTRACTORS				
1				
2				
3				
4				
5				
MATERIALS USED THIS WEEK				
Total				
ON COSTS				
Vans and Offices				
Damaged Services				
Miscellaneous				
TOTAL EXPENDITURE				
MATERIAL RECONCILLIATION				
MATERIALS on Site at Start of Week				
ADD Materials Recd. This Week				
Total				

Department of the Environment
Property Services Agency

Measured Term Contract Final Account

Contractor's Name M.A. Appleton Ltd.
Address COPPICE SIDE IND. ESTATE, WEST COPPICE ROAD, COPPICE SIDE, BROWNHILLS
VAT Reg No 138 - 1296
Payment for Period ending January 1984.

(1) BA214 — DOE USE ONLY
Payee No. (2)
MTC Type (2a) — TO BE COMPLETED BY THE QUANTITY SURVEYOR
Date of Account (3)
Contract Number (4) [illegible]
Contractor's Ref (5) 2/7/02 — TO BE COMPLETED BY CONTRACTOR

Separate figures must be inserted for each order.

	VAT EXCLUSIVE – FOR COMPLETION BY CONTRACTOR								DOE USE ONLY					(See Note below)
(6) Order Number	(7) Estimated Value of Order £	(8) Value of Final Account £ p	(8a) Value of Daywork included in Final Account (Col 8) £ p	(9) Payments on Account £	Insert CR if Credit	(10) Net Amount Due £ p	Assessment of Total VAT liability on Final Account (Box 3) Value of Work	VAT Rate	(11) Total VAT Assessment £ p	(12) VAT Previously Reimbursed £ p	Insert CR if Credit	(13) VAT Now Due £ p	Insert CR if Credit	(14) Total VAT to be entered in Box 1? £ p	15 Etc.
F696565	1500	1581 34	+	+		1581 34	£ 1581·34	15 %							(20) Client's Reference (if applicable)
							£ —	Zero							
							£	%							
							£	Zero							
							£	%							
							£	Zero							
							£	%							
							£	Zero							
							£	%							
							£	Zero							
TOTALS:		1581 34	+	+		1581 34									

For multiple cost codes and/or VAT rates against a single order insert 'VAR' and attach completed form AE

W1821 (December 1982)

CHARLES CORNELL WHEELER
Chartered Quantity Surveyors

132 Hagley Road,
Edgbaston
BIRMINGHAM B16 9NX

MEASURED TERM CONTRACT

Contract No

Order No

V.O. No s

PAGE No	JOB SUMMARY SHEET	INVOICES £ p	AGREED RATES & DAYWORKS £ p	SCHEDULE £
1.			14437 4	
2.				11
	Add 302.7 %			33
	Ddt 57.5 %			44
				25
	Add 5% Sdy Measure			18
				0
				19
				1443
				1463
	N.P.O.			
	Sheet no 1.	2550		
	" " 2.	2550		
	" " 3.	2550		
	" " 4.	3825		117
	Final Account Value.			£ 15851