A STUDY OF BUDGETARY CONTROL SYSTEMS FOR BUILDING MAINTENANCE MANAGEMENT

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PART ONE

CHAPTER ONE

1.0 INTRODUCTION

The main objective of the study is to investigate how Budgetary Control Systems may be used to achieve a better control of maintenance funds and provide a basis for the evaluation of management efficiency.

Maintenance is a combination of any actions carried out to retain an item in or restore it to an acceptable condition[1]. It has also been defined as those activities required to keep a facility in "as built" condition and therefore continuing to have its original productive capacity[2]. The management of maintenance activities has been a long-neglected field. In organisations it is rarely accorded the same importance as income generating activities. This is reflected in their financial policies where budgets for maintenance operations are regarded as a burden and kept as low as possible. Maintenance management competes with production for use of the firm's resources. The budget presented by production is based on "per cent return on investment". The budget normally submitted by maintenance management is based on "demand" for its "services"[2]. To successfully compete with production for funds, maintenance management must, therefore, reform its budget so that it too reflects per cent return on investment. A case arises for one to convince the management to allocate sufficient funds for necessary maintenance. This requires a proper system of monetary control to prove to management that they are getting value for money. A budgetary control system in

maintenance management is necessary for a maintenance manager to control effectively maintenance funds. Lack of such control may perpetuate the low status accorded to maintenance in organisations.

1.2 METHODOLOGY

I will begin the study by going through the literature on or related to budgetary control systems for maintenance management. Then I will conduct a field survey visiting maintenance management departments in the following organisations:

1.2.1 The Property Services Agency (PSA) in the Department of the Environment (DOE) in London.

1.2.2 PSA Regional Headquarters, Reading

1.2.3 PSA District Works Depot, Arborfield.

1.2.4 The Greater London Council (GLC).

1.2.5 Milton Keynes Development Corporation, Peterborough.

1.2.6 John Mowlem Construction Company.

1.2.7 The Royal Berkshire Hospital, Reading.

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I will conduct interviews with the key officers concerned with maintenance of the organisations' properties, plant and equipment. In most organisations these are normally maintenance managers who have a major responsibility in dealing with documents for maintenance budgetary control. Most of the data in the study will be based on information gathered from conducting interviews with the officers assigned with the responsibility of maintenance

management. An outline list of persons interviewed by position and their organisation is shown in Table 1.

1.3 PLAN OF PRESENTATION

The study is in three parts as follows:

Part 1 forms the background and the study structure. It is made of the first three chapters. The objectives of the study are set out in Chapter 1 and the methodology adopted in conducting the study outlined with a list of organisations visited while conducting the field survey. Chapter 2 illustrates how an organisation's building maintenance policy will influence its maintenance budgetary control system. Here explanation is also given of the objectives of a building maintenance budgetary control system and its advantages in building maintenance management. Chapter 3 explains the various building maintenance management structures and organisations which are commonly adopted in which maintenance departments operate. Factors which determine the form of management structure adopted in maintenance management and factors influencing maintenance budget decision making are also discussed in this Chapter. It will be seen that most maintenance departments operate within a Mechanistic Management System (3). These tend to be characterised by:

1.3.1 Strong emphasis of functional specialisation.

1.3.2 Much formalisation of procedures for example, job descriptions, rules and regulations, highly centralised and bureaucractic.

TABLE 1

PERSONS INTERVIEWED, BY POSITION AND ORGANISATIONS	
Senior Assistant Director of Housing (Maintenance)	Greater London Council, Housing Department, Maintenance Branch.
Principal Maintenance Officer	Greater London Council, Maintenance Branch.
Depot Works Officer	Tower Hamlets, GLC - Maintenance Branch.
Chief Building Maintenance Officer	Property Services Agency (PSA), Department of the Environment (DOE).
Area Officer - Reading	PSA/DOE - Regional Office, Reading.
District Works Manager	PSA/DOE - Arborfield
Depot Works Manager	PSA/DOE - Arborfield
Maintenance Manager	University of Reading
Building Maintenance Manager	Royal Berkshire Hospital, Reading.
Maintenance Manager	Milton Keynes Development Corporation.
Senior Quantity Surveyor	John Mowlem Construction Co. Ltd.

1.3.3 Co-ordination is achieved through successive hierarchical levels of superior authority.

1.3.4 Hierarchic structure of control, authority and communications.

1.3.5 A reinforcement of the hierarchic structure by a flow of information to the top of the hierarchy where the final co-ordination is made.

It will be shown how this type of management system affects the nature of maintenance budget decision making.

Part 2, Chapters 4 to 6, deal mainly with planning and control of building maintenance expenditure. It starts with a discussion on the organisation of a planned building maintenance system, outlining the features of such a system and its components in Chapter 4. The chapter includes explanation of how building information is collected for maintenance planning purposes and the preparation of maintenance plans. Further explanation is given of the management of the building maintenance programmes with outline principles on how to provide for scheduled and contingency maintenance in a building maintenance budget. In Chapter 5 a framework for reviewing maintenance labour performance will be considered outlining the procedures used for measurement of maintenance labour performance and the basis of financial control of building maintenance contracts. The chapter goes on to show the procedure for comparison of lowest tender prices of maintenance contract jobs with costs of doing similar jobs using directly employed labour. The basis of such comparisons is explained together with an

explanation of the relevance of cost comparison to building maintenance budgetary control system. Chapter 6 starts with an outline of various ways of presentation of maintenance budgets, then goes on to explain classifications of maintenance costs and maintenance works. It further illustrates the presentation of total maintenance workload in the maintenance budget by use of costs of Productive Standard Hours (PSH) for maintenance jobs done by direct labour. Types of maintenance contracts are outlined with a discussion on total occupancy costs. Universal Maintenance Standards (UMS) and their relavence in maintenance budgeting; and the presentation of the maintenance budget on cost centre basis. The second half of the chapter is devoted mainly to maintenance variance reporting outlining the causes of maintenance budget variances. The use of variance reports and the preparation of variance reports is outlined. Explanation is given of Maintenance Budgets on "significant" maintenance budget variances together with a discussion on the assumptions made while using statistical techniques of probability theory and normal distribution to analyse maintenance budget variances.

Part 3 concentrates on the evaluation of management efficiency and incorporates the findings of the field survey and discusses critically the building maintenance budgetary control procedures for the various organisations visited. Out of the various maintenance organisations shown in Table 1, only maintenance budgetary control procedures of two of these organisations are described in detail. These are the Property Services Agency (PSA) in the Department of the Environment (DOE), and the Maintenance

Branch of the Greater London Council (GLC). Although budgetary control procedures in the other organisations will be examined, the final choice of describing the procedures of the two organisations is because of their contrasting maintenance policies. The PSA though, with a large volume of maintenance workload, prefers to let most of the maintenance jobs to outside contractors while the GLC uses direct labour in executing most of its maintenance jobs. Chapter 8 starts with an outline of the criticisms found from my field survey of maintenance budgetary process and then goes on to suggest various recommendations to improve the quality of existing building maintenance budgetary control procedures.

CHAPTER TWO

2.0 THE BUILDING MAINTENANCE POLICY AND MAINTENANCE BUDGETING

2.1 Definition of Maintenance Management

Maintenance Management is the organisation of maintenance within an agreed policy. This policy is stated in its maintenance policy, "The strategy within which decisions on maintenance are taken"[1]. This will involve a commitment to planned maintenance policy to prolong the effective life of the capital asset of the organisation by determining:

2.1.1 Expected life cycle for the assets of the organisation to help in the determination of total occupancy costs.

2.1.2 The standard of upkeep expected.

2.1.3 The criteria for judging the level of maintenance expenditure and priorities to be accorded to each maintenance operation.

2.1.4 The organisation and decision-taking bases for the maintenance function and the degree of control required through the maintenance management information system.

2.2 Objective of a Maintenance Management Scheme

The objectives of a building maintenance management scheme are:

2.2.1 To keep buildings, plant, equipment and services in a safe and efficient operating condition at all times.

2.2.2 To limit the rate of deterioration and minimise wear of premises, plant and equipment.

2.2.3 To reduce maintenance and replacement costs.

2.2.4 To organise maintenance labour efficiently and economically.

2.2.5 To ensure the proper operation of a comprehensive system of financial control and cost comparisons for maintenance expenditure.

2.2.6 To provide all the necessary information and statistics to assist the management in decision-making.

To carry out those objectives will require control functions:

2.2.7 To identify the extent of work necessary to achieve the required standards within the constraints laid down. The processes involved would include planned maintenance inspections, appraisal of user requests and assignment of maintenance job priorities.

2.2.8 To programme the maintenance workload so that the carrying out of the work is timed in accordance with the needs of the user and the available labour force. It will involve the preparation of long-term maintenance strategic plans, medium-term and short-term maintenance programmes.

2.2.9 To formulate a system of supervision of work during execution and by subsequent control inspections to detect latent maintenance defects.

2.2.10 To establish costs of maintenance using a budgetary control system including standard costing, material control so that it is possible to compare actual cost and performance level

achieved at a particular period.

2.2.11 To establish a good information feedback system by keeping records of costs of carrying each maintenance job for proper control and review purposes of management efficiency.

2.3 FINANCIAL CONTROL IN MAINTENANCE MANAGEMENT

The main instrument of financial control is the budget. This is a predetermined statement of management policy during a given period and it provides standards for comparison with results achieved. The Institute of Cost and Management Accountants defines a budget as "a financial or quantitative interpretation prior to a defined period of time, of a policy to be pursued for that period to attain a given objective"[4]. Thus in the most literal sense a budget is a document, containing words and figures, which proposes expenditures for certain items and purposes. The words describe items of expenditure (salaries, equipment, travelling) or purposes (prevention of collapse of a building through lack of maintenance, improving performance of a particular equipment, providing acceptable conditions of house repair to tenants), and the figures are attached to each item or purpose. It is the intention of whoever prepares the budget that there will be a direct connection between what is written in it and future events. Hence we might conceive a budget as Wildavsky puts it, "as intended behaviour, as a prediction. If the requests for funds are granted, and if they are spent in accordance with instructions, and if the actions involved lead to the desired

consequences, then the purposes stated in the document will be achieved"[5]. Thus the budget becomes a link between financial resources and human behaviour to accomplish policy objectives. But since funds are limited and have to be divided in a way or another, the budget becomes a mechanism for making choice among alternative expenditures.

2.4 THE MAINTENANCE BUDGET AND THE BUDGET PERIOD

There is no general rule governing the selection of the period of time for the budget which is decided by the particular circumstances of the organisation. For example, budgets for industries which are influenced by fashion or relatively short period changes in consumer demand require a different approach from that found in the industries involving long term expenditure with little change in product design. In maintenance it is recommended to use a long term budget for this will give a better picture of the cost of deferred maintenance costs since these appear after a lapse of time.

One year is a conventional period, and the management of an organisation, prompted partly by the publication of annual accounts tends to think ahead, and plan in terms of one year periods.
It is desirable for maintenance budgets to be related to the rate of deterioration of building elements, plant and equipment. This will require preparing maintenance budgets of long term, say five to seven year cycles especially for external and internal decoration.

These long term maintenance budgets may be supplemented by short period budgets of one year or even shorter term budgets covering one month. This is vital for the organisation if it will obtain the full benefit from maintenance budgetary control. It should be noted that the period of time covered by a maintenance budget, and the resulting comparative statement of actual and budgeted maintenance expenditure should be largely determined by the requirements and the outlook of the person whose activities it plans. For example, a maintenance foreman may need a weekly budget and report on certain costs because he exercises day-to-day control over routine maintenance expenditure, while the maintenance manager with his broader outlook may not be so much interested in short term budget fluctuations. Where a long term maintenance budget is possible, like in building defects with a uniform deterioration rate over a period of time, it becomes easy to plan for material requirements to be known for a long period ahead, enabling favourable purchase terms to be obtained.

Maintenance budgets should be prepared to adjust to current conditions for example:

2.4.1 Changes in the volume of work performed.

2.4.2 Seasonal variations.

2.4.3 Length of working period.

2.4.4 Bad working methods which it is planned to rectify but which must nevertheless be taken into account for the short term.

Thus maintenance budgets may need to be revised to allow for changes in external circumstances such as a national wages award and also correction of bad maintenance job planning methods which may appear later.

2.5 THE OBJECTIVES OF BUDGETARY CONTROL SYSTEMS FOR MAINTENANCE

The main objectives of building maintenance budgetary control are:

2.5.1 To plan and control building maintenance expenditure.

2.5.2 To act as an instrument of management policy, whereby the extension of the scheme to lower levels of management enables the top management to decentralise responsibility and centralise control of maintenance funds.

A budgetary control can be defined as 'the establishment of departmental budgets relating the responsibility of executives to the requirements of a policy, and the continuous comparison of actual with budgeted results, either to secure by individual action the objective of that policy, or to provide a basis for its revision'[5]. Thus a budgetary control system for maintenace starts with planning about the objectives of the maintenance organisation as stated in its maintenance policy; develops these plans through analysis and then translates them into maintenance budget requirements. The key principles of a budgetary control system are[4]:

2.5.3 The establishment of predetermined standards or targets of performance.

2.5.4 The measurement of actual performance.

2.5.5 The comparison of actual performance with the predetermined standard.

2.5.6 The disclosure of variances between actual and standard performances.

2.5.7 The suggestions of corrective action where examination of the variances indicate that this is necessary.

2.6 THE ADVANTAGES OF A MAINTENANCE BUDGETARY CONTROL SYSTEM

The use of budgetary control systems in building maintenance is for the following main purposes[4]:

2.6.1 To define the objective of the maintenance organisation as a whole.

2.6.2 To define the results to be achieved by the maintenance department and personnel thereof to the purpose of realising the organisational objective.

2.6.3 To reveal the extent by which actual results have been exceeded or failed to reach the defined objective.

2.6.4 To measure the magnitude and establish the causes of the variations as a basis of management action to correct adverse trends or secure benefits from advantageous conditions.

2.6.5 To secure the most economic use of labour and materials.

2.6.6 To provide a measure of the efficiency with which the activities of the maintenance organisation have been co-ordinated.

2.6.7 To provide a basis for future policy and if desired, revision of the current maintenance policy.

2.6.8 To facilitate centralised control in circumstances of decentralised activity in the field.

2.6.9 To facilitate stabilisation of industrial labour relations or other activities in conditions subject to seasonal

influences and to provide a basis for forms of incentive remuneration related to the results expected in a period of time[4].

CHAPTER THREE

3.0 MAINTENANCE MANAGEMENT STRUCTURE AND MAINTENANCE BUDGETING

3.1 Factors Determining Maintenance Management Structures

The main factor determining the type of maintenance management structure to be set up is the principal function of the parent-body which may be a government department (PSA/DOE), or a local authority (GLC), or a corporation (Milton Keynes Development Corporation). Maintenance departments operate within established organisation structure. For this reason they tend to be organised on the same lines as the parent organisation[6]. In setting up any organisation structure for maintenance management, the top management look into the following factors[7]:

3.1.1 The volume of the maintenance workload to determine the staff time required for inspections, estimating requirements, preparation of drawings and technical documents, programming and control functions.

3.1.2 The nature and complexity of the maintenance workload and whether predominantly building or engineering will determine the desirable qualifications of the maintenance supervisory staff.

3.1.3 The geographical area over which the workload is spread. The location and dispersal of maintenance work will influence the travelling time and hence the number of supervisors required to maintain effective control.

3.1.4 The responsibility of the maintenance department for minor new works.

3.1.5 The timing of the work and in particular, the need for certain work to be habitually undertaken outside normal working hours may demand some duplication of supervisory staff to ensure continuous control.

3.1.6 The skill and reliability of maintenance operatives will determine the amount of information which they require and the frequency of visits by supervisory staff to check progress and maintain quality control.

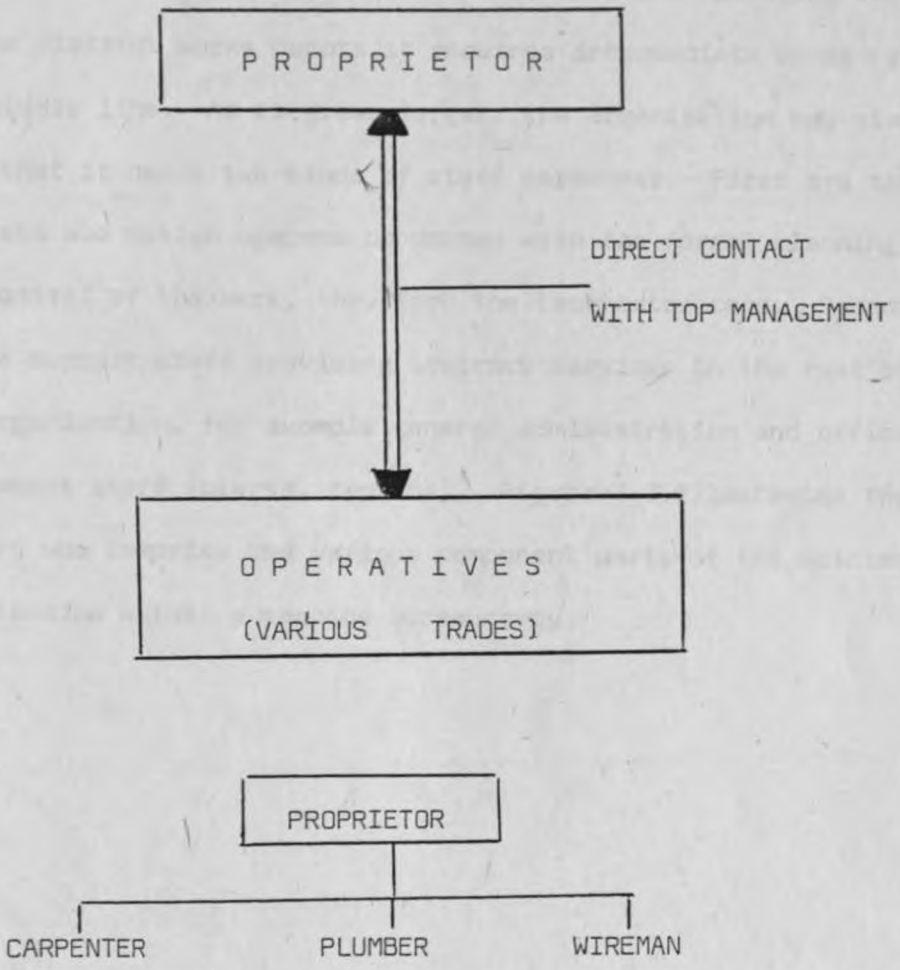
3.1.7 The method of executing the work, whether by direct labour or by contract.

3.2 COMMON ORGANISATION MANAGEMENT STRUCTURES IN MAINTENANCE MANAGEMENT

In small maintenance firms co-ordination is achieved by direct supervision. The owner of the firm normally gives orders and operates with a minimum of operatives who do the basic maintenance work. Little of its behaviour is standardised or formalised and there is minimal use made for planning or training of the firm's operatives. The owner retains highly centralised control but with direct contact with the maintenance operations, Fig. 3.1. This type of firm is suitable for small maintenance jobs which require skilled operatives. It is commonly used by firms engaged on small building maintenance jobbing contracts[7].

FIGURE 3.1

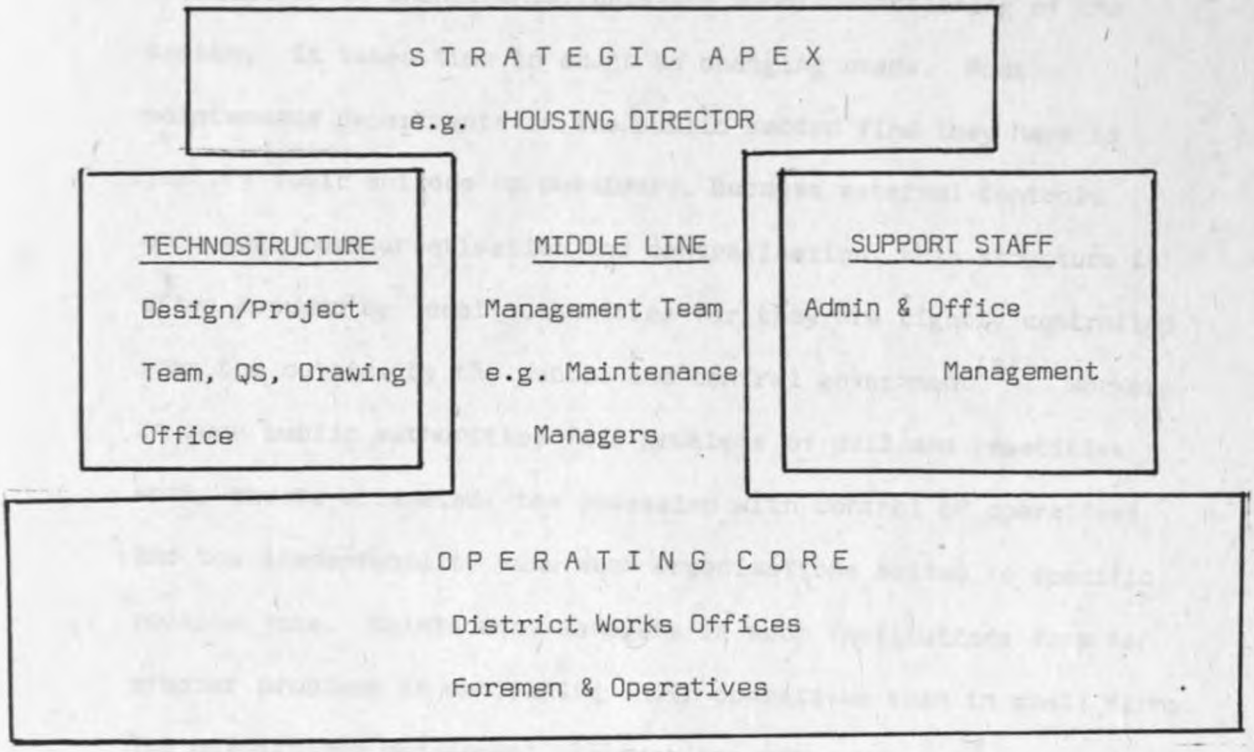
SIMPLE MANAGEMENT STRUCTURE OF A SMALL SIZED MAINTENANCE FIRM



In the large organisations of the public sector, maintenance management structures tend to require elaborate administration[6]. In addition to the top management in the strategic Apex and the people who do the basic maintenance works in the operating core in the district works depots it requires intermediate managers, the middle line. As it grows larger, the organisation may also find that it needs two kinds of staff personnel. First are the analysts who design systems concerned with the formal planning and control of the work, they form the technostructure. Second, is the support staff providing indirect services to the rest of the organisation, for example general administration and office management staff (clerks, typists). Figure 3.2 illustrates the members who comprise the various component parts of the maintenance organisation within a machine bureaucracy.

FIGURE 3.2

PARTS OF A MECHANISTIC MAINTENANCE MANAGEMENT STRUCTURE



3.3 FEATURES OF MACHINE BUREAUCRACY

It requires many analysts to design and maintain its systems of standardisation, notably those that formalise its behaviours and plan its actions, unlike the small maintenance firm. A large hierarchy emerges in the middle line to oversee the specialised work of the operating core, the district works forces and to keep the lid on conflicts that inevitably result from the rigid departmentalisation, as well as from the alienation that often goes with routine circumscribed jobs. The middle line hierarchy

(Maintenance management team) is usually structured on a functional basis all the way up to the top management, where the real power of co-ordination lies. Thus formal power is concentrated at the top. This type of organisation structure depends on stability to function as change interrupts the smooth functioning of the system. It takes time to adapt to changing needs. Most maintenance departments in the public sector find they have to justify their actions to outsiders, Because external controls encourage bureaucratisation and centralisation, this structure is often assumed by local authorities for they are tightly controlled from the outside by the public and central government[8]. Workers in such public authorities face problems of dull and repetitive work; become alienated, the obsession with control of operatives and the inadaptability make such organisations suited to specific routine jobs. Maintenance managers in such institutions face far greater problems in motivating their operatives than in small firms. The maintenance management hierarchites often adopted are illustrated in Figures 3.3a., 3.3b and 3.3c.

FIGURE 3.3a

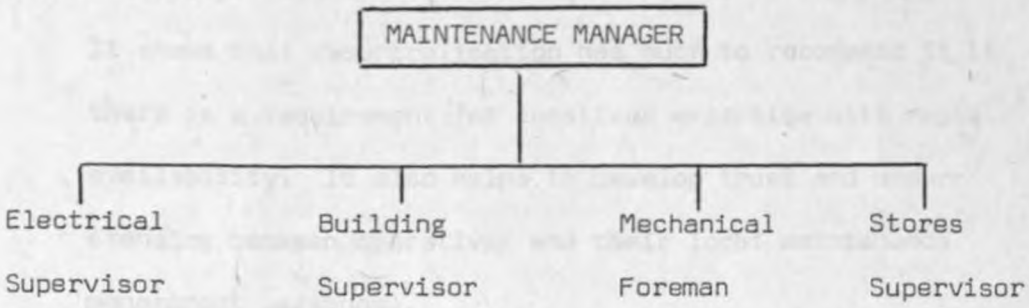


FIGURE 3.3b

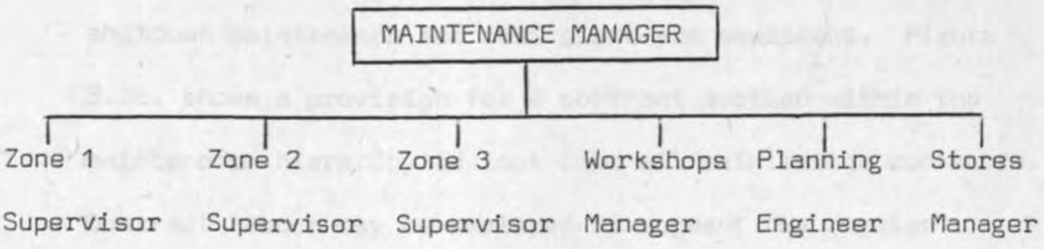
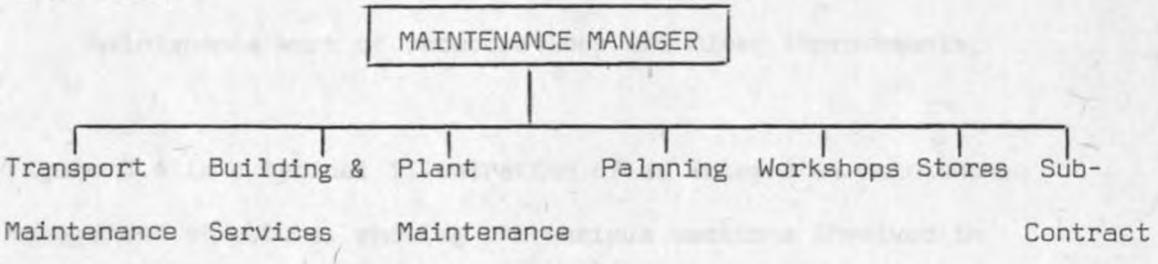


FIGURE 3.3c



NOTE:a. In Figure 3.3a the basic divisions of maintenance supervision are often in terms of trade and skills.

b. In Figure 3.3b the maintenance region is split on a zonal basis, each zone supervisor having foremen or chargehands in the various trade groups to supervise his zone labour force. Central workshops are provided for the overhaul and

and repair work and also for spare parts, refurbishing. It shows that decentralisation has much to recommend it if there is a requirement for localised expertise with rapid availability. It also helps to develop trust and understanding between operatives and their local maintenance management personnel.

c. It is important to remember the value of contract services, especially for preventive maintenance routines, plant inspections, overhaul and repair work, including annual shutdown maintenance for most plant and equipment. Figure 3.3c. shows a provision for a contract section within the maintenance hierarchy to look into all maintenance contracts. Contract labour may be employed to augment the regular labour force during plant shutdown for overhaul as well as in window cleaning, gulley rodding/cleaning and other planned maintenance work of redecorations and minor improvements.

Figure 3.4 is a typical illustration of an integrated maintenance management structure, showing the various sections involved in maintenance organisation and execution of maintenance operations.

3.4 FACTORS INFLUENCING MAINTENANCE BUDGET DECISION MAKING

These include:

3.4.1 The type of organisation structure. As seen earlier there is a great deal of rigidity in most local authorities because they are mainly bureaucractic and highly centralised system of control. This means once maintenance funds

ceilings are set, they are unlikely to be revised or adjusted upwards. These ceilings tend to be fixed at minimum acceptable levels. Attempts to request more funds tend to be frowned at. They ignore future maintenance requirements which may be due to increased building stock; higher acceptable standards required by users/tenants; or statutory requirements which make it mandatory for maintenance works for most plant, lifts, installations and equipment to be carried out.

3.4.2 The organisation's maintenance policy and its general outlook to maintenance. Most organisations which regard maintenance management as a key part of their goal to preserve the capital value of the properties commit more funds for their maintenance.

3.4.3 The competence of the maintenance in presenting skillfully the maintenance budget especially in predicting the consequences of various decisions to defer maintenance works by adopting life cycle costing techniques such that the management is aware of any proposed expenditure over the life of the maintenance programme.

Illustrations of typical district maintenance organisations of the Devon Area Health Authority, the PSA and the GLC are shown in the Appendices A, B, C and D respectively.

FIGURE 3.4

Integrated management structure

MAINTENANCE ORGANISATION	Governing body	Council		or		Board of Directors		
	Type of owner	Building owners B and D				Building owners A and C		
	Responsible officer	Chief officer(s)		or		Director(s)		
	Property management	Estate surveyor		or		Consultant agent		
	New building design	Design team directly employed		or		Consultant architect and engineers		
	Maintenance / Alterations \ in existing buildings	Maintenance manager						
	Main head of Expenditure	SECTION 1 BUILDING	SECTION 2 ELECTRICAL	SECTION 3 MECHANICAL (H & V)	SECTION 4 PLANNING METHOD STUDY	SECTION 5 ADMINISTRATION	SECTION 6 ANCILLARY SERVICES	SECTION 7 GROUNDS
	Professional and technical staff	Senior surveyor Surveyors Regional District Area	Senior engineer Engineers Regional District Area	Senior engineer Engineers Regional District Area	Estimators	Secretarial Clerical Wages Invoices Stores purchase Costing	Porters and cleaners Security-day Security-night Fire precautions	
	Supervision	Clerks of works	Clerks of works	Clerks of works				
EXECUTION OF WORK	Operational	Foreman/Foremen Carpenters Bricklayers Plumbers Painters Labourers Drivers	Foreman/Foremen Electricians Lift mechanics Bench fitters Lamp changers Lamp cleaners Mates Drivers	Foreman/Foremen Pipefitters/Welders Bench fitters Mates Drivers				

SOURCE : I.O.B. Maintenance Management : a guide to good practice, 1975.

PART TWO

CHAPTER FOUR; THE ORGANISATION OF A PLANNED MAINTENANCE SYSTEM

4.1. Features of a Planned Maintenance System

Planned Maintenance has been defined as maintenance organised and carried out with forethought, control and the use of records to a predetermined plan. Note; Preventive maintenance is normally planned. Corrective maintenance may or may not be planned[1].
It should be the policy of maintenance organisations to adopt planned maintenance system for it provides a means to determine priorities, allocate resources, organise labour and facilitate maintenance job costing. The planned maintenance system should be organised such that;

4.1.1 It is cost effective

4.1.2. It meets statutory or other legal requirements

4.1.3 It meets a particular clients need from an operating point of view.

4.1.4 It will reduce the incidence of running maintenance necessitating requisitions for work from the user and

4.1.5 There is a predominant incidence of work for operatives throughout the maintenance programme period.

Plant and Equipment should be maintained in accordance with a planned preventive maintainance programme. This has been defined by the British Standard Glossary of Maintenance terms in Terotechnology (1974) as "Maintenance carried out at predetermined intervals, or other prescribed criteria, and intended to reduce the likelihood of an item, not meeting an acceptable condition". Thus it should be aimed at extending the working life of the plant and to the prevention of failure or breakdown of a facility.

Similar arrangements are also suitable for building components which require regular attention or cleaning at set intervals. Maintenance can also be organised on a planned corrective basis. This means Maintenance work undertaken to restore a facility to the currently acceptable local standard.

4.2. Components of a Planned Maintenance System

White[9] outlines the components of a planned maintenance system to include the following

0.1. Assets Register.

A complete inventory of the buildings and plant/equipment to be maintained.

0.2. Maintenance Schedule.

A comprehensive list of maintenance works and its incidence with a schedule for inspection, lubrication and preventive maintenance of the items in the register. The schedule may also include planned overhaul periods.

0.3. Work specifications.

These may be in a form of a job ticket, instruction cards or documents which identify exactly the tasks to be undertaken within the planned maintenance system.

0.4. Maintenance Control System.

A trigger system which initiates the activities on the maintenance programme at predetermined intervals as listed on the maintenance schedule as shown on Figure 4.1. and Figure 4.2.

0.5. Labour Schedule.

A manpower allocation system to ensure that the sufficient

resources are available to implement the maintenance requirements of the assets and that optimum use is made of labour.

0.6. Maintenance Records.

A record of maintenance carried out and a system for reporting to the management should be introduced so that maintenance reports can be produced to show monthly performance trends and pending backlog maintenance build up.

0.7. Maintenance support organisation.

The organisation of technical information, spare parts and tools etc.

0.8. Liaison with clients.

An effective system of agreeing with the user management when maintenance work can be done.

0.9. Planned Overhaul.

Provisions for ensuring the planned overhaul of plant either on a regular basis in accordance with the maintenance schedule or in response to condition monitoring.

0.10 Costing System.

Costing procedures to ensure adequate cost control and opportionment of costs in the maintenance department.

Planned maintenance systems require necessary training of operatives and supervisors in the operation of the actual system.

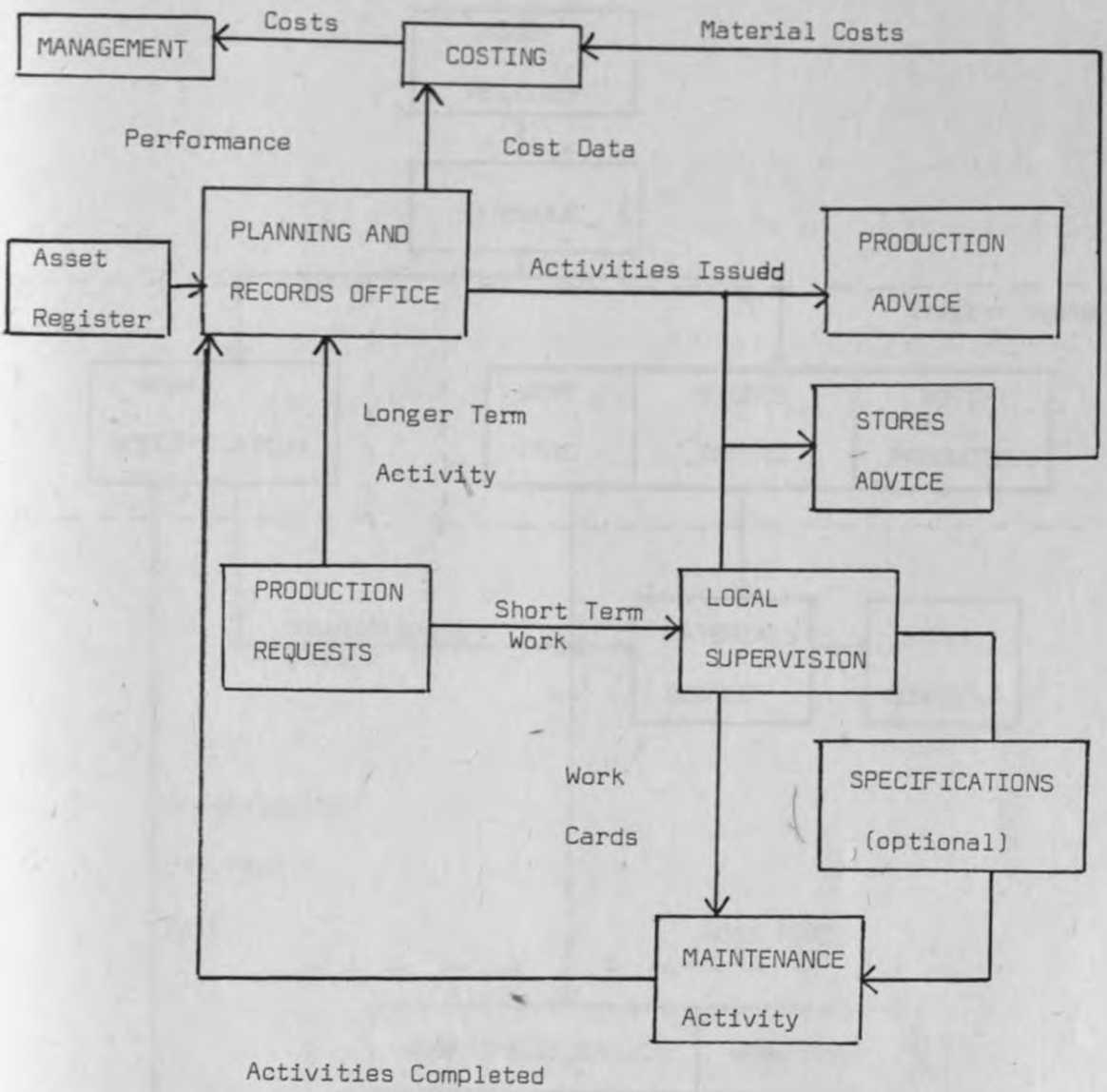


Figure 4.1. Typical Maintenance Control System.

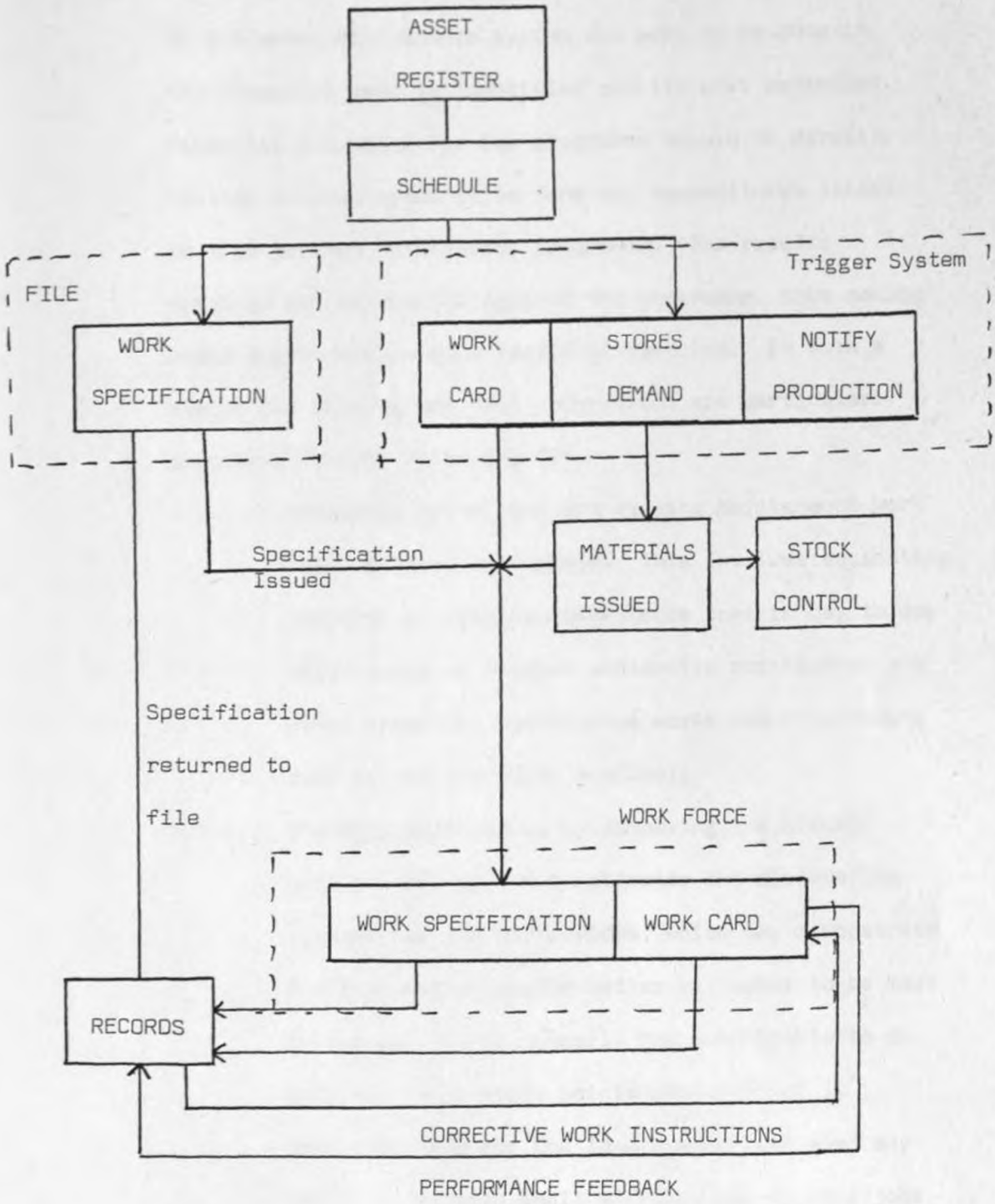


Figure 4.2. Maintenance Control with Trigger System

4.2.1. Job Costing and Cost Comparisons in Planned Maintenance;

In a planned maintenance system all work to be done in the financial year is identified and its cost estimated. Financial provision for the programme should be directly related to what needs to be done and expenditures linked to this defined maintenance programme. The results obtained can be checked against the programme, thus making budgetary control a more realistic exercise. In such a system job costing and cost comparisons are particularly important for the following (2);

4.2.1.1. Assessing priorities and fitting maintenance work into maintenance budgets. This involves estimating the cost of routine maintenance that is day to day maintenance or planned preventive maintenance and other essential maintenance works and programming them within the funds available.

4.2.1.2. Checking performance by comparing the actual cost of jobs with the estimates and discovering reasons for the differences, which may demonstrate inefficiency or enable better estimates to be made in future. It is clearly not practicable to do this for every small maintenance job but it should be done for the larger ones, and also any series of related small and possibly routine jobs which result in significant expenditure over a particular maintenance budget period.

4.2.1.3. Comparing the cost of doing jobs by direct labour and by contract.

It is essential that maintenance district management should arrange for a selection of jobs undertaken by direct labour to be costed and compare direct labour costs with outside contractors'. Such cost comparisons are essential if effective control over the spending of the money is to be achieved, See Chapter Five for more details on the procedures adopted in comparing the costs.

4.2.2. Financial Control in a planned Maintenance System.

Financial control can be achieved by listed the types of jobs involved and describing the cause of each maintenance defect. This will assist in;

4.2.2.1. deciding how the work should be executed

4.2.2.2. Identifying misuse and the full costs of design, material or workmanship failures, which should form an important part of a general process of feedback of information to the management.

4.3. Collection of Information for Maintenance Planning.

The first requirement in the production of a maintenace plan is a clear, orderly, but general appreciation of the buildings, plant/equipment and services which make up the entire building estate. This should include the present condition and the future function of the particular facility under inspection. From such an appreciation it will be possible to build up a framework of the various aspects of work to be carried out in the entire estate. This will provide a statement of the urgent major backlog items of maintenance expenditure required, listed in their degree of urgency.

This will reveal the items of high priority which need to be incorporated in a comprehensive planned preventive maintenance programme.

To obtain the full benefits of a planned maintenance management system requires a good maintenance control system. This is achieved by employing a good system of maintenance management information system to furnish maintenance reports necessary for maintenance management decision making. Content of these reports is outlined in Appendix F.

4.3.1. Types of Maintenance Works.

Maintenance work can be divided into three groups for purposes of scheduling. Emergency work orders; preventive maintenance work orders and normal work orders. Lee[7] describes planned maintenance in terms of two systems;

4.3.1.1. The Schedule System.

This covers items which tend to deteriorate at a more or less uniform rate and which do not have a high degree of urgency. The procedures take the following forms;

a. scheduling work to be carried out at pre-determined times. This applies where the incidence of failure can be predicted with some accuracy or where the periods are fixed by statute or contract e.g. the terms in a lease agreement requiring redecoration to be done at fixed intervals.

b. Scheduling inspections to be carried out at pre-determined times to detect failures or the

imminence of failure.

c. Scheduling work and inspections to be carried out at pre-determined times. This applies where it is possible to predict that certain work will be necessary at a particular time, but an inspection is necessary to determine the extent of any further work.

4.3.1.2. The Contingency System.

This entails a policy of waiting until a complaint is received from the user before taking action. Sometimes the maintenance department is called upon to carry out minor improvements, adaptations and alterations and other miscellaneous work which are associated with maintenance.

Figure 4.3. illustrates the schedule and the contingency systems of planned maintenance.

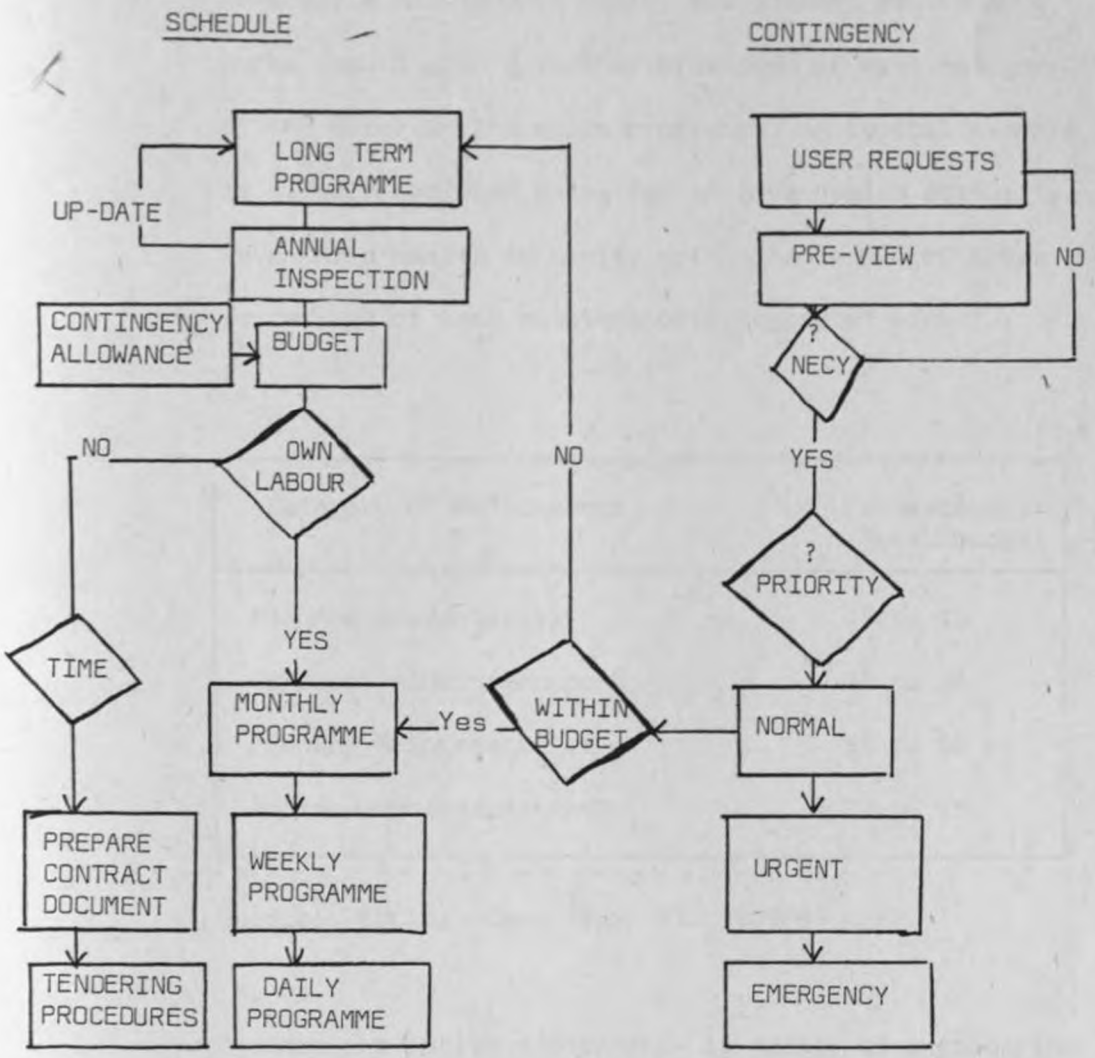


Figure 4.3. The Schedule and the Contingency systems of Planned Maintenance.

Normally a maintenance budget for planned maintenance works should give a further breakdown of each category of the works in the whole programme. A typical example is illustrated here below for an area health authority. Devon Area Health Authority maintainance budget shows the percentage of each maintenance catagory of work.

Catagory of Maintenance	Percentage of Total budget
Planned preventative	5 to 10
Corrective Maintenance	30 to 25
Running Maintenance	55 to 50
Improvement/adaptations	20 to 15

Source: BMCIS; Case Study 43. 1980/81 - 97.

Planned preventive maintenance is mainly to engineering services and equipment, statutory and high risk areas of maintenance. For example in a hospital this may include operating Theatres, Kitchens, engineering maintenance, specialist term contracts for lifts, X-ray equipment etc. Planned corrective maintenance includes larger items of maintenance work to protect the capital asset of the fabric and services including engineering plant and equipment replacement, most decoration and rewiring works. Running maintenance is based on user requests for maintenance works (contingency) and is sometimes called routine or day to day maintenance.

This includes emergency works.

The above three catagories of planned maintenance work cover all expenditure on maintenance based on inspection and work required for the preservation, repair and replacement with equivalent contemporary items of existing building components plant, services or equipment.

In addition to expenditure on the above, maintenance departments do minor works of improvements, adaptations and alterations. This is normally undertaken only if the work capacity exists and is not detrimental to the general maintenance function.

4.3.2. Survey of the Estate to Establish Maintenance Needs.

To plan and programme maintenance works properly, a survey of the estate will have to be carried out on a basis to establish the overall needs of the estate. This will identify maintenance operations required and the frequency they should be executed and also the relationship of such work to other operations or the time allowed to complete the operation. Usually it is the responsibility of the maintenance manager to specify the frequency of inspection for the equipment, plant and building works included in a planned preventive maintenance programme.

Optimum frequency is established on the basis of the following considerations (2);

4.3.2.1. Criticality of equipment.

The more critical the equipment the more preventive maintenance attention it requires.

4.3.2.2. Experience on similar plant and equipment.

This is an important aspect in determining the frequency of preventive maintenance operations on new items of equipment. Experience not only indicates the amount of experience that the maintenance depart itself has in dealing with similar items of equipment, but it also indicates how well the craftsmen are trained to perform the preventive maintenance programme.

4.3.2.3. Operating Characteristics.

Exactly similar items of equipment will be used for different types of service in different plants. Operating characteristics would include the severity of the service in view of the type of materials being handled, its specific gravity and phase, the pressure and temperature, and whether the equipment is operating on a continuous or an intermittent basis.

4.3.2.4. Age.

As the equipment becomes older the workforce better knows how to maintain it and in many cases has built out some of its weak spots so that the frequency preventive maintenance can be extended rather than decreased. But as the equipment begins to wear out and as its useful life is approaching an end, a drastic redefinition of the frequency of planned preventive maintenance work should be made.

4.3.2.5. Safety and pollution requirements.

Maintenance of equipment related to the safety and pollution aspects of the organisation especially in big industrial concerns and hospitals should also be considered in light of those programmes. Table 2 illustrates the survey procedure.

As shown in Table 2 the survey will start by identifying the maintenance operations required. These should be classified under building elements to conform with the Working Party on the Costing of Management and Maintenance of local authority Housing set up by the Ministry of Housing and Local Government Central Housing Advisory Sub-Committee[10]. In the report the building elements are grouped under eight headings;

i external decorating

ii internal decorating

iii structure

iv structural finishing and fixings

v water and sanitary services

vi other domestic services and appliances

vii external (site) works

viii ancillary and miscellaneous.

A full list of Maintenance operations is shown in Appendix 9.

MAINTENANCE OPERATION REQUIRED	FREQUENCY	RELATIONSHIP TO OTHER OPERATIONS OR THE TIME ALLOWED TO COMPLETE THE OPERATION
1.00 Painting and Decorating		
External		
1.01 Normal external painting of all property	5 years	including common staircases to high rise blocks of flats with lifts.
1.02 New property. External painting	3-4 years	After inspection if found necessary
Internal		
2.00 Main entrance to all blocks of flats, hallways, internal corridors, staircases, etc	2½ years	
2.01 House, Maisonette, Flat Bungalow	5 years	

Table 2. Maintenance Survey procedure and Maintenance Frequency.

The next step is to establish the relationship of such maintenance operations to other operations or to the time allowed to complete the operation to an acceptable standard. Once this is done, then the maintenance manager is left to establish the frequency of carrying out the works. Several additional factors influence the choice of determining such frequencies; These may include;

i. statutory requirements to keep both plant and equipment, lifts, etc, in sound operational standards in terms of periodic overhauls or routine servicing and lubrication.

ii. changes in user requirements in form of higher standards which may require most jobs scheduled for two year painting cycle to be done within six months intervals.

iii Also where a new component has been used in a new building for the first time; the manufacturers will normally supply maintenance service manuals specifying how often the new component requires maintenance attention to be functionally effective.

A more comprehensive maintenance survey procedure for establishing maintenance frequency is illustrated in Appendix G which outlines the procedure adopted in the maintenance branch of the GLC.

4.4. Preparation of Maintenance Plans

From the information collected from the maintenance survey, the maintenance manager should be in a position to compile the following;

- A comprehensive list of maintenance works required for the coming five years, listed in order of their priority with estimates of expenditure and any special factors affecting the way in which they would be executed.
- A List of major works required at irregular intervals over the ensuing five years listed in order of their priority, with detailed estimates of expenditure and any special factors affecting their execution.
- A schedule of works of alterations, adaptations or improvements for building and engineering plant/equipment listed in order of priority with estimates of expenditure and the method of execution either by direct labour or contract.
- Workload of backlog maintenance from previous years and a strategy to reduce such maintenance works.

4.4.1. Priority Ranking of Maintenance Jobs.

The criteria for ranking maintenance jobs is to achieve a compromise between the frequency of such jobs; the amount the maintenance budget allows to be spent on them, and the risks involved if no action is taken to carry then out. Normally due ;

statutory requirements for safety standards in most electrical and mechanical installations, lifts; all

works involving these installations are included in a planned preventive maintenance programme. Other maintenance operations, such as daily inspections of fire alarms, fire escapes, fire doors, dry risers and all fire fighting equipment will be given a higher priority in job planning. This is useful for it will reduce the chances of losing insurance claims in case of damages to the property for the maintenance department will show a case for good maintenance programme was in operation before the damage occured.

To rank the rest of other maintenance jobs which may either be repairs, improvements, alterations or replacements a comparison should be made using discounting methods to show which action will be most advantageous and cost effective in the long run over the whole life of the equipment/property.

4.4.2. The Management of Maintenance Plans;

Once the maintenance needs have been identified and long term and annual maintenance programmes set, it is necessary to devise a means by which the overall programme can be managed and to construct a framework for reviewing maintenance performance. Management of maintenance programmes will involve the following;

4.4.2.1. Decentralised maintenance management down from the regional headquarters to district works depots manned by professional and technical officers;

4.4.2.2. Undertaking the management of all maintenance work including inspection, organisation, execution, supervision and consultation in accordance with maintenance policies, and procedures of the organisation;

4.4.2.3. Defining the limits of each category of maintenance expenditure and procedure to be followed by technical officers in the field when authorising maintenance expenditure to be incurred on a particular job.

4.4.2.4. Monitoring of expenditure of resources (labour, material) by costing of both individual jobs identified in the long term and annual maintenance programmes, and work carried out against estimated lump sums in order to facilitate financial control of the annual estimate and to ensure that the proper order of priorities is maintained.

4.4.3. Organisation of Tenant-requested repairs.

Tenant requests for repairs and the response time taken to execute these reflect the general efficiency of the maintenance department. Delays can occur even before the job is ordered, due to the type of job ticket procedure adopted. Simple tenants' requests have to be recorded, ordered and costed before they can be carried out. Figure 4.4. illustrates the stages involved once a tenant requests for repairs.

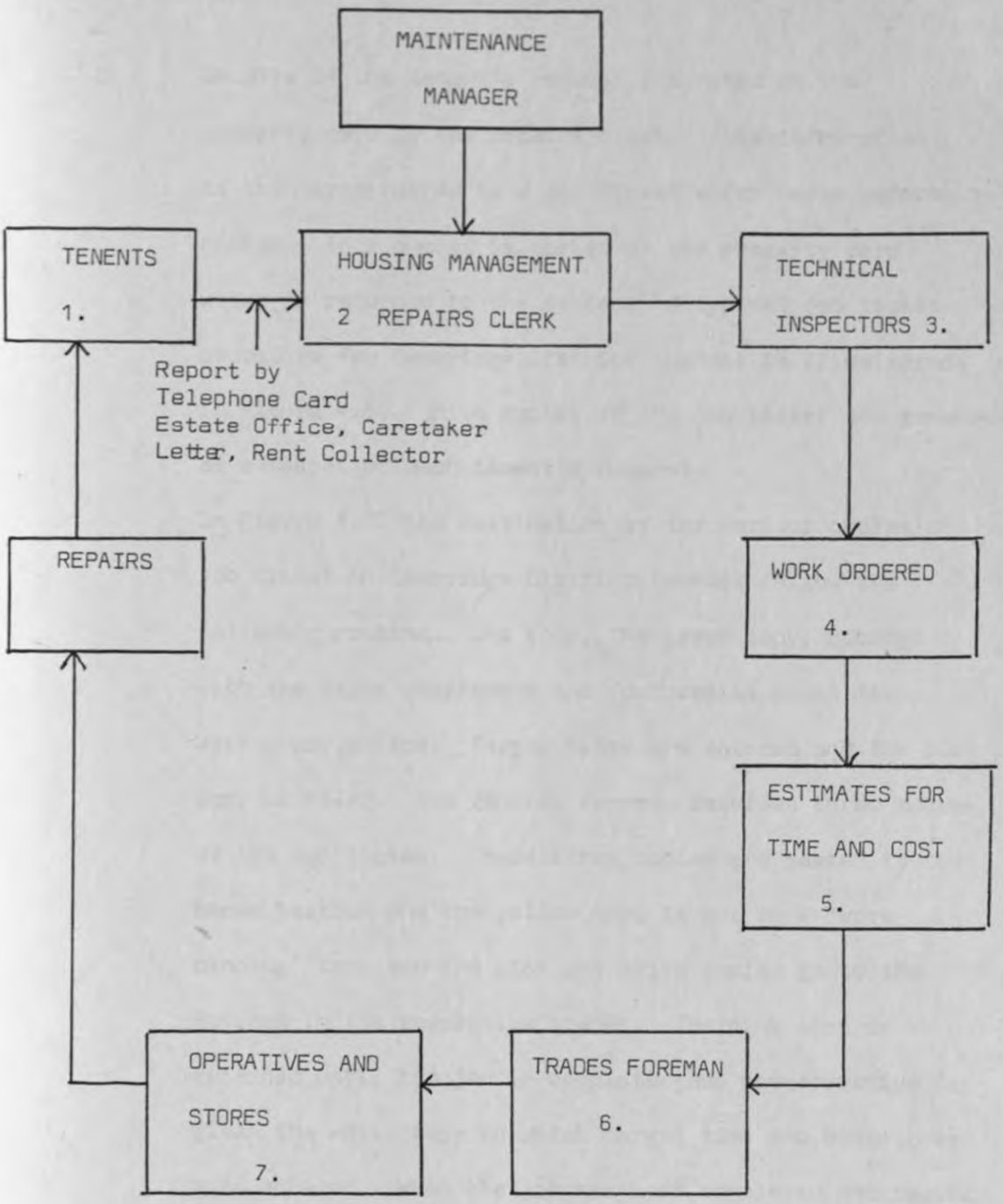


Figure 4.4. Stages involved in a Tenant's request for repairs.

Details of the tenant's request are noted on the property card by the repairs clerk. This information is then transferred to a job ticket which has a reference number. This number is marked on the property card which is returned to the system. A typical job ticket procedure for Cambridge District Council is illustrated in Figure 4.5. Five copies of the job ticket are generated as a result of each tenant's request.

In Figure 4.5. the destination of the various copies of job ticket in Cambridge District Council follow the following routine. One copy, the green copy, remains with the wages department and four copies go to the work study office. Target times are entered and the blue copy is filed. The general foreman receives three copies of the job ticket. These three copies are passed to the Bonus Section and the yellow copy is put in a "work-pending" tray and the pink and white copies go to the foreman in the respective trades. The pink copy is retained until the job is completed and the operative is given the white copy on which target time and bonus have been entered. When the job has been completed and passed by the foreman, the pink copy goes back to the bonus section. Both the yellow copy (from pending tray) and the white copies are sent to the treasurers department. The yellow copy is eventually returned to the repairs clerk indicating that the job is completed.

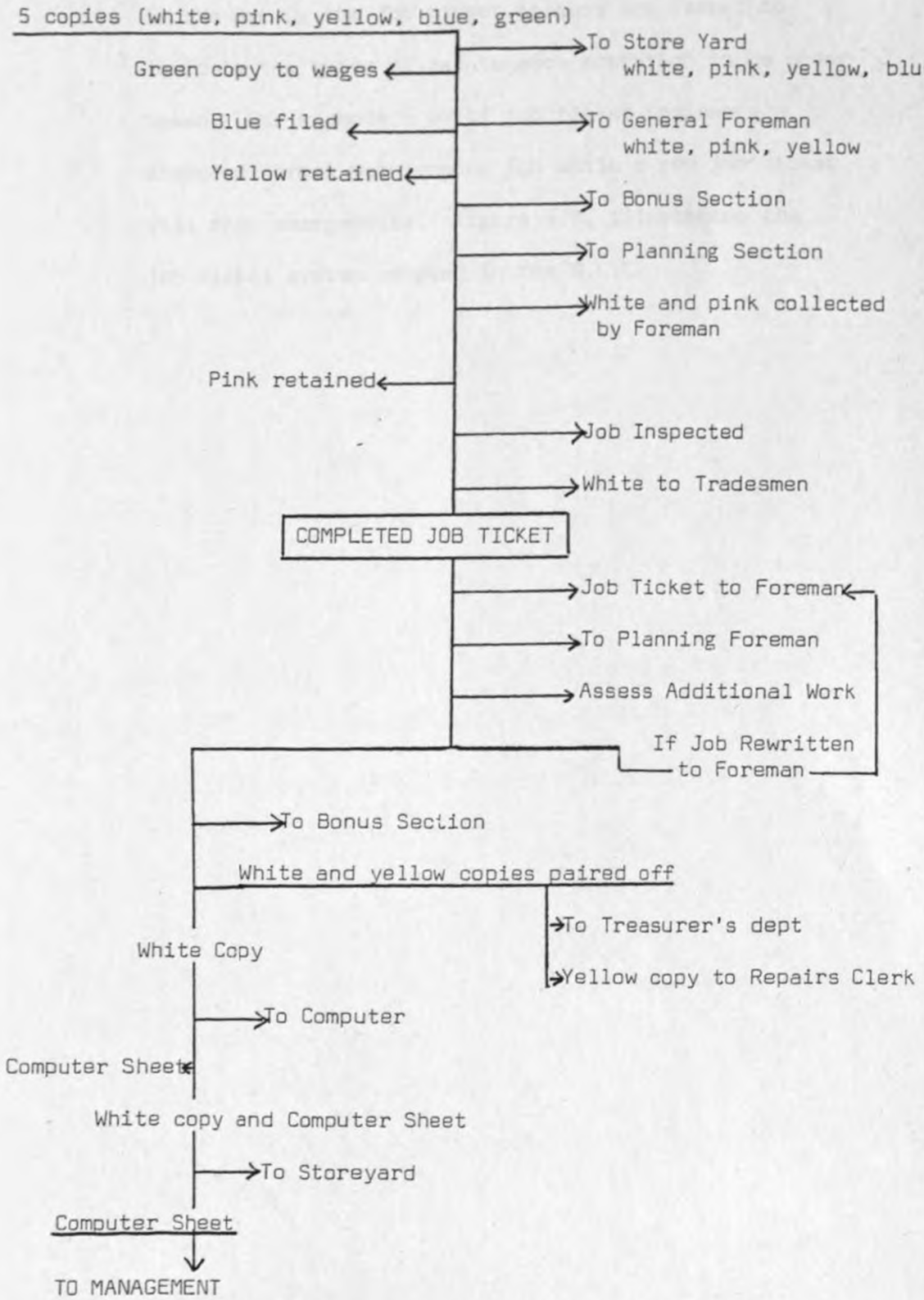


Figure 4.5. Cambridge District Council's repair job ticket procedure.

In the G.L.C. the job ticket colours are issued to indicate the types of maintenance operation to be undertaken. For example a white job ticket indicates a standard normal maintenance job while a red job ticket will show emergencies. Figure 4.6. illustrates the job ticket system adopted in the G.L.C.

CHAPTER FIVE; FRAMEWORK FOR REVIEWING MAINTENANCE LABOUR PERFORMANCE.

5.1. Procedure for Measurement of Maintenance Labour Performance.

In order to determine the effectiveness of planned maintenance programme, it is necessary to have some means of measuring performance so that before-and-after comparisons can be made. A carefully considered, approved and controlled planned maintenance programme provides a framework for reviewing performance at all levels and for improving maintenance management efficiency. Within such a framework, maintenance managers arrange to review progress and performance regularly. To achieve this they require a sound maintenance information system to provide management with reports on current maintenance backlog and performance record for comparison with the targets estimated in the maintenance budget. Appendix F explains various types of maintenance management reports. Such reports will assist the managers to;

- Seek approval for additional items of expenditure
- Consider the need for changes in the programmes to cater for more urgent works.
- To provide reports on expenditure and commitments in respect of the various catagories of maintenance works.
- To review methods of executing maintenance work including the efficiency of using directly employed labour and the progress of the planned maintenance programme.

Maintenance control indicators often used in evaluating the performance of maintenant management involve the application of the ratios of

labour cost to material cost expressed as an index over a period of time. Use of this index is based on the hypothesis that the material cost remains more stable than the labour cost and can be used as abasis for performance (2). But in the inflationary economic climate of today, it is quite likely to find the variation in material cost over some period far greater than the variation in labour cost and this ratio then becomes less valuable as an index.

Another common indicator of the status of maintenance function is the total cost of maintenance. This involves building up a set of ratios by dividing maintenance cost for a specific period by the total maintenance cost for some base period to illustrate the trend of maintenance cost.

The base period is usually some time when the maintenance department operated at a relatively stable level i.e. when labour unrest was at a minimum, labour productivity was considered satisfactory by management and there were no big variations in labour wages.

At times it is reasonable to establish a maintenance management level of operation and performance for each maintenance operation. But a satisfactory level of maintenance at one time might not be satisfactory in some future period due to changes in clients tastes and fashions.

In most maintenance works accurate comparisons are difficult to obtain because;

a. There is no standard unit of production agreed upon by Maintenance management organisations to measure effective performance. Where a work study based scheme is in operation it is necessary to establish the number of productive

standard hours of work for each maintenance job based on the performance of operative per each manhour he works.

b. Most maintenance jobs are done on varied conditions every time they occur, such that each individual operation is unique, and bears hardly any direct similarities which a previous maintenance job done under conditions which no longer prevail in the same location.

c. Even where some form of measure exists its usefulness depends largely on the interpretive function in which it is utilised. Maintenance managers should aim to put more use of such measures to the extent that they include the nature of errors in past decisions and suggest remedial action.

5.1.1. To Convert the total workloads in terms of Productive Standard Hours it is necessary to establish the number of productive standard hours of working which can be produced per man hour worked. Information of such calculation is derived from the results of a workstudy scheme. Calculations to assess effective performance can be calculated on weekly basis for each main trade in each district as follows;

$$\text{Effective Performance} = \frac{\text{Productive Standard Hours}}{\text{Gross Hours worked}} \times 100$$

Records of this information should be kept and from such records an accurate maintenance performance level can be forecast for entire maintenance budget period.

Such a forecast will have to take into account the following;

5.1.1.1. Actual results achieved during previous years as shown in the maintenance backlog report in Figure 5.1.

5.1.1.2. A Workstudy based budget effective performance which represents an "actual" level of efficiency.

5.1.1.3. An objective target which calls for the highest level of managerial ability and against which each maintenance manager is assessed.

5.1.2. In calculating the numbers of direct labour operative and supervisory staff which are required to carry out the total maintenance workload, provision must be made for absence due to sickness and holidays. On average 20% of the available gross hours are lost for these reasons and this allowance should be included in final manpower calculations. In assessing the cost of direct labour the following factors are taken into consideration (11);

5.1.2.1. Basic wage plus bonus, including performance trend of each trade team.

5.1.2.2. Overhead charges

5.1.2.3. Establishment and staff on-costs

5.1.2.4. Material costs.

Usually the first calculation is made about nine months before the commencement of the financial year then subsequently revised to take account of pay awards, perfromance trends in trade teams, varying trends in overhead charges and increased cost of materials.

Trade	Average weekly available hours	Productive standard hours backlog	Actual hours backlog at 80% effective performance	No of days backlog	Actual Hours backlog for previous months based on 80% effective performance
Carpenter Plumber Wireman etc.					

Figure 5.1. Maintenance Backlog Report (Sample)

The maintenance manager should provide management with accurate details of anticipated costs of executing maintenance jobs using direct labour. In addition to this, a detailed report should be prepared to show which jobs are to be executed by using contracts and what type of maintenance contracts will be used either term contracts or competitive lump sum contracts.
Financial control of contracts is left in the hands of District Works managers who supervise the jobs with the help of clerks of works. Omissions and additions to contracts must be fully documented and all site measurements and calculations must be recorded, signed and dated on dimension and bill paper and retained for audit. All contract variations must be covered by the issue of a variation order. The rates in the contract provide the basis for adjustment. Where items are not covered by the contract rates, a quotation must be obtained from the contractors for agreement before acceptance.

Excess Costs

If the sum of variations are likely to cause the contract sum to be exceeded, an immediate report must be prepared to the maintenance manager giving reasons and detailed estimate. This is a very crucial point in the management and control of maintenance contract jobs for failure to follow the laid down procedures may lead to commit the Department into fairly high expenditure. Usually the contractor must not be instructed to proceed with such additional work until the necessary authority has been received

from top management.

5.2. Procedure for comparison of DEL costs with Contractors Lowest Tender Prices;

One of the methods of establishing the cost effectiveness of directly employed labour is to compare actual direct labour costs with contractors' lowest tender prices. There are a number of ways by which this can be achieved but the most reliable comparison is one based on maintenance workstudy data. The main advantages of such comparison are;

- The direct labour resources can be directed at those areas of work where they are most cost effective;
- Contractors can be invited to carry out that work which they because of their different type of organisation such as smaller scale, location and other factors, can do more economically;
- The comparison can highlight areas of work where direct labour costs need improvement and thus enables the appropriate corrective action to be applied where it is most needed;
- The comparison can substantiate that the directly employed labour force is the most economic means of providing an effective housing maintenance service.

5.2.1. The Basis of Comparison.

An overall cost per productive standard hour (PSH) is derived from the use of a work study based incentive scheme to promote the motivation of maintenance operatives.

This takes into account all maintenance costs involved for each maintenance trade. Appendix J.1. shows analysis of overall cost per productive standard hour of a maintenance district in the G.L.C.

For contract work, contractors are invited to bid anually against pre-priced term contract schedules which cover the majority of work undertaken. The basis of tendering is normally for contractors to bid overall percentage above or below the priced schedule. Upon acceptabce the basic schedule, adjusted by the agreed percentage, becomes the contractor's standard price payment for the term contract. Accepted contracts are then forwarded to a cost control section where calculations are made of the contractor's price per PSH using the method described below.

The difference between the total directly employed labour cost per PSH and the contractor's price per PSH can then be easily assessed. If this is multiplied by the number of PSH's produced by the DEL during the financial year, it represents the savings (or losses) made as a result of operating the DEL as shown in Appendix J.5.

5.2.2. Calculation of DEL Cost per PSH.

The total cost of DEL is built up in the following way;

5.2.2.1. Basic direct labour cost. This includes direct trade labour, associated mates and first line supervision wages, allowance and bonus payments produced weekly as a cost per PSH. Appendix J.2.

5.2.2.2. Direct Labour on cost includes holiday and sick pay plus emergency overtime, call out and allowances added as fixed percentage on direct labour cost currently at 41%, re-calculated at the beginning of each financial year.

5.2.2.3. Material cost. A material cost per PSH is established by reference to a two-weekly computer materials issued listing. The value of issued material by trade is decided by the PSH's produced by that trade. A calculated 20% is added to cover storekeeping, plant and equipment costs. Appendix J.2.

5.2.2.4. Vehicle Cost. Initial purchase maintenance and serving and operation of all types of vehicles are calculated each month on the numbers and types of vehicles used by each trade for each district. The total vehicle cost for each trade group is divided by the number of PSHps produced by that group to give the vehicle cost per PSH. Appendix J.3.

5.2.2.5. Direct overheads. Trade supervision excepting first line supervision, general labourers, depot clerks, drivers etc are calculated each month on the numbers and types of staff in past using an average cost per man established at the beginning of each financial year. This cost per man includes direct on cost and an element for inflation. The total direct overhead cost is

divided by the total number of PSH's produced to give the cost per PSH. see Appendix J.2.

5.2.2.6. Miscellaneous and Establishment charges.

Central office staff, all accommodation depots, rent, rates, fuel, other service costs etc - the total annual estimate is divided by the anticipated annual PSH output (for all districts and trades) to produce a fixed cost per PSH.

All the above costs are then added together to produce a total DEL cost per PSH. To establish the total DEL cost per PSH for all districts, the results are normally straight averaged. Appendix J.6. shows a typical district build up of overall DEL cost per PSH for each trade.

5.2.3. Calculation of Contractors Price per PSH.

This requires establishing a "Model" of typical work of each trade. This may range from 30 to 40 most frequently used items from maintenance term contract schedule. Each item is weighted according to the frequency with which it normally occurs, and each model represents over 60 man weeks of work. By an analysis of figures contained in the model the total productive standard hours of work of a given period can be calculated. An example of a typical model is given in Appendix J.4. The steps followed in calculating the contractors prices per PSH are as follows;

5.2.3.1. The standard prices are applied to the model to give an overall figure, and this is adjusted by the contractors percentage as tendered;

5.2.3.2. The resulting contractor's tender is then adjusted by a percentage (currently 11.75%) to cover the cost of the technical services, contract administration and supervision in respect of contracts let to contractors (11);

5.2.3.3. The adjusted tender is divided by the total PSH's contained in the model, and this gives the contractors cost per PSH.

Cost Comparison

This can be easily done by calculating the difference between the total D&L cost per PSH and the contractors price per PSH. The procedure followed is illustrated in the following worked example and also in Appendix J.5. which shows cost/PSH comparison of DEL with contractors for the G.L.C.

Cost Comparison - Worked Example.

The following worked example showshow the Direct Labour and Contractors' costs are compared and how the overall saving (or loss) in using Direct Labour is calculated :-

A. Contractor's Cost per P.S.H.

a. Council's standard priced model	£45771.		
Add Contractor's tender, say + 10%	4577.	= £50348.	
b. Add for Technical & Contract Services, + 11.75%		5916.	= £56264.
c. Divide by total PSH in model			2691.
CONTRACTOR'S COST PER PSH			= £20.91.

B. Direct Labour Cost per P.S.H.

As Appendix"A" (See Appendix J 1,Trade 13,Col.13.)	= £12.90.
DIRECT LABOUR COST PER PSH	= £12.90.

C. Saving (or loss) Using Direct Labour.

a. Calculate cost difference per PSH:-

Contractor's Cost	£20.91.
Less D.L. Cost	£12.90.
Difference = Saving Of	£8.01.

b. Multiply difference by number of PSH worked by D.L. in year :-

£8.01. x 220,000. PSH's. = £1,762,200. annual saving using D.L.

NOTE .

The above calculation is purely an example relating to the carpentry trade only, and the Contractor's "plus" percentage has been taken at 10% whereas this could be substantially different. Also,the number of PSH's worked is an approximate estimate of current production, i.e. subsequent to the Transfer of Staff and Estates in April, 1980,and this accounts for the lower saving shown in the example as compared to the actual figures given for the year 1979/80 and shown in Appendix J5

SOURCE : THE GLC - AN APPRECIATION OF THE WORK OF MAINTENANCE BRANCH FEBRUARY 1980

5.3. The Relevance of Cost Comparison and Maintenance Budgetary Control.

Cost comparison between costs of direct labour and contractors lowest tender prices help to show the maintenance manager whether value for maintenance funds allocated is being realised.

By showing the differences in overall cost per productive standard hour of each trade using the DEL or Contract, management decisions can be made to use the more cost effective method. Calculations depicting extra maintenance expenditure being incurred due to exclusion of maintenance works by contract will certainly help to convince the management of the need to execute more work using direct labour.

CHAPTER SIX; PRESENTATION OF THE MAINTENANCE BUDGET AND VARIANCE REPORTING.

6.1. ESTABLISHING THE MAINTENANCE BUDGET.

An important source of basic maintenance information in preparing maintenance repair budget is cost experience. Past performance is of great value in predicting future costs if its use is tempered by consideration of variables whose effect is changing or new variables that can be foreseen. Among these factors are the level of maintenance activity, the age of the building and/or equipment; and trends in the cost of labour and maintenance supplies (2).

If a maintenance budget is to be based entirely on past performance building and labour cost indexes must be apllied to approach a realistic forecast; correlation should be drawn between cost history and concurrent production levels in case of commercial factories. Accuracy of the budget will be increased with the amount of detail in examination of historical facts. For instance, the repair expense for pumps can be adjusted for variation in amount of usage, age of the pump, etc, in arriving at an anticipated cost for pump maintenance. A summation of such cost elements for major equipment catagories will result in a more nearly accurate budget than one evolved from across-the-board adjustments to last year's performance.

Another approach starts with a comprehensive study of a pla med programme of maintenance repairs. In this type those cost elements which are reaonably uniform, such as lubrication and inspection and replacement of equipment with fixed life, are segregated.

The remaining repair cost items are then studied individually, usually by equipment type. By considering all variables that may affect this cost, such as age, expected utilisation, and repair history, a detailed forecast for maintenance cost can be determined. This approach requires the availability of many historical data on performance of equipment and help from the client users in anticipating variation from past use of this equipment.

The amount of detail and study put into preparation of a budget should be controlled by the expected improvement in forecasting accurately and the real value of such an increase to the maintenance organisation. The agreed general policy in preparation of maintenance budget is that the accuracy and detail entering into budget preparation should be limited by the anticipated ability to perform within it.

The maintenance budget should be prepared in a suitable form such that it will assist management, as a tool in decision making. This will require breaking down maintenance requirements for the organisation over a period of time. The normal procedure is to prepare long term maintenance programmes and show the expected expenditures over the whole programme. Such programmes for example, decoration cycles are for a period between five to seven years.

6.1.1. Most Maintenance budgets are catagorized according to labour, material and equipment. To achieve such broad catagoYization, all maintenance budgets require a common unit of expressing the volume of the work content in terms of manhours per each job. This will be useful for direct labour where forecasts can be made of the total number of manhours required in a particular period to cover all the

proposed works in a budget. In job planning, the total number of manhours currently involved in maintenance must be adjusted according to the anticipated increase or decrease in productivity and in demands made on maintenance through the buying of new equipment and plant or the scraping of old equipment. To achieve control of maintenance funds, the maintenance manager requires a set of maintenance standards be to achieved with definite financial limits set upon each area of maintenance expenditure.

For the management to see the need for maintenance expenditure, the maintenance budget should be realistic, and backed up with accurate projections of the proposed future expenditures (2). The budget forecasts should reflect what will likely happen rather than what the management would like to happen. This calls for an adequate basis of the calculation of maintenance costs and concise presentation of the budgets. The proposed maintenance expenditure should be subdivided in various ways to indicate the nature of proposed maintenance work and the associated costs. Possible classification may be as follows (7);

6.1.1.1. By catagories of maintenance work. This will show expected expenditures for minor improvements, planned preventive maintenance, corrective and routine maintenance and contingency expenditure for emergency works.

6.1.1.2. By type of work

6.1.1.3. By location of where the maintenance work occurs.

6.1.1.4. By the method of execution; Either by direct labour where each job is broken into manhours per trade, materials and plant OR Contract indicating the type of contract.

6.1.2. Cost Classification to be adopted.

Maintenance costs may be classified in a variety of ways. Edward and Ray (13) distinguish these costs into three catagories as follows;

6.1.2.1. Committed costs which represent the after effect of irreversible decision taken in the past. Such costs have a mandatory character and include those incurred in compiling with the terms of a lease or statutory requirements especially for mechanical and engineering plant and equipment.

6.1.2.2. Variable or engineered costs which can be directly related to the volume of the primary activity of the organisation. For example products manufactured or sales;

6.1.2.3. Managed or discretionary costs which require specific decisions in each budget period. These are normally estimates compiled of percentage increases on historic costs. No proper method of calculation is adopted and are purely based on personal judgement of each financial period. For such costs to be of use in calculating the budget it is vital that the probable rates of deterioration of the properties are estimated; followed by a detailed inspection to assess

maintenance requirements and a strategy to remedy the causes of defects worked out.

6.2. Presentation of the Maintenance Budget.

6.2.1. By Work Type.

Maintenance works fall into two main catagories.

6.2.1.1. Minor items which individually are of insignificant cost but in total account for a significant proportion of the total maintenance workload. They occur infrequently through user requests. These are normally allocated a lump sum figure in the budget for each financial year. Financial control of such minor jobs is achieved by sub-dividing the lump sum budget allocation according to trades, cost range of jobs and their frequency. The basis of such allocation is on past historic costs and with constant reviewing a trend is likely to be established over a period of years to determine an overall pattern of expenditure for such works.

6.2.1.2. Major maintenance works include cyclic work such as external/internal decorating and replacement or renewals to eliminate high maintenance cost areas. These costs can be predicted well in advance and the budget allocation for each financial year is normally a single item within a broad maintenance budget over five to seven years.

Financial control of such works is achieved by determining financial limits for each long term programmed jobs and maintaining an even distribution of funds flow during each financial year.

In cases where a planned maintenance system operate budget presentation may be simplified by breaking down the overall maintenance budget for the whole period into various percentages for each catagory of planned maintenance programme as shown below.

Planned preventive	5 to 10%
Planned corrective	30 to 25%
Routine/Emergency	55 to 50%
Improvements	10 to 15%
	100% 100%

Source: BMCIS ; Case Study 43.

6.2.2. Presentation of Maintenance Budget by location or Cost Centre.

Where a maintenance department covers a large geographical region, it is sometimes common to allocate budgets on location basis. Even in most process engineering firms the maintenance budget is divided among cost centres. A cost centres is a goegraphical portion of the plant usually represented by a homogeneous production unit(2). Each centre is thought of as operating its own operating budget, a portion of which is for maintenance.

This system of budgeting is not suitable for maintenance costs are merely calculated as a percentage of total turnover. Proper budget presentation requires estimating realistic times for maintenance jobs and setting of maintenance standards based on the local knowledge of the capabilities of the operatives and calculating estimated labour hours required to carry out maintenance jobs proposed in the budget.

6.2.3. Presentation of the budget by method of executing maintenance work.

An adequate maintenance budget will show the volume of the work content and the total number of manhours required to do such work. Careful calculation of work content is vital in breaking down the various jobs into familiar work units and calculating job times for each element based upon past performance. This is particularly so where most of the maintenance work is done by direct labour. A detailed time study to establish norms for such jobs as cleaning and the application of work synthetics where work study based incentive schemes are used is essential in compiling of a maintenance budget (7). Where maintenance work is to be executed by outside contract it is vital to earmark such jobs and state the type of contract to be used for each contract job. For maintenance jobs the usual contracts are outlined by Lee[7] as follows;

6.2.3.1. The lump sum contract where the contractor quotes a lump sum price for carrying out the work shown

in the tender documents which will be defined by written description, specification, drawings and/or bills of quantities. For proper budgetary control purposes a financial limit is set for each job to be done using this form of contract.

6.2.3.2. Measured Term Contracts involve organising work within pre-arranged rates, arrived at competitively, and the contract remains in force for up to three years and so provides facilities for rapid execution to works order of a series of jobs which otherwise might require a succession of small separate contracts. This will be allocated funds in the budget to whole period with options for additional funds depending on local work requirements. Annual maintenance programmes for each of the three years are prepared and given to the contractor.

6.2.3.3. Specialist term contracts for specialised engineering services form a major item of term contracts. Especially for Area Hospital Authorities maintenance budgets should identify how much is required in the following financial year to meet the services of such specialist term contract.

6.2.3.4. Day Work Term Contract and small jobs and Jobbing arrangements are suitable for occasional work on small buildings or isolated sites. An element in in the budget should be allocated for such works so that the management is made aware of precisely

where the money requested is going to be spent and how it will be spent.

6.2.4. The Maintenance Budget expressed in Productive standard Hours.

Work measurement consists essentially of breaking down a job into its constituent elements of work and repeatedly timing the execution of these elements. The unit of work normally employed is the Productive Standard Hour (PSH). This is the amount of work that can be performed in one clock hour by a worker of representative skill and experience, motivated by an appropriate incentive and who takes the amount of rest necessary during the course of his work to avoid undue fatigue (14). The PSH is made up of a proportion of isolated work carried out at an incentive motivated level of performance together with a proportion of rest. This incentive level of performance is known as standard performance and is represented by 100 on the British Standard Rating Scale. The Standard Performance is one third higher than normal performance which is represented by the figure 75 on the British Standard Rating Scale and which is defined as the performance achieved by a worker of representative skill and experience working under effective supervision but without the motivation of an incentive (12). The observed times are adjusted to give the corresponding times for a rate of working of 100P and the result is called the Basic Times (7).

$$\text{Basic Time} = \text{Observed time} \times \frac{\text{Rated speed of working}}{100}$$

Allowances for personal needs and for working conditions are added to the basic time to give the "inclusive standard time" (IS).

Once the basic overall cost per PSH for each trade (painters, bricklayers, carpenters, plumbers, electricians, etc) has been established as shown in Appendix J1, it now becomes possible to prepare the total budget for all the works proposed to be executed in the coming budget period.

It is essential for the management to set up monthly PSH output levels for each trade. To present a budget for a particular financial year, a forecast of the number of PSH expected in the whole period is established by analysing the workload content identifying the volume of PSH required for each trade, then multiplying by the overall cost of PSH of that trade. Thus to get a budget figure for the coming financial year you require:

6.2.4.1. Forecast number of jobs per week

6.4.2.2. Forecast maintenance work content per job in PSH's.

6.2.4.3. Forecast effective performance

6.2.4.4. Percentage for sickness and leave

6.2.4.5. Conversion element to man years at 40 hours per man week for 52 weeks per man year (=2080).

However the main drawbacks for formal time study on maintenance work are the length of time required to achieve satisfactory coverage of work for the application of work study schemes. Also there is no similarity in maintenance

jobs such that experience gained in one job can be used as a basis for calculating the cost of another job. Each job is unique and conditions vary each time a maintenance defect occurs.

Establishing maintenance budgets using PSH's is only suitable for large public corporations and local authorities with a big proportion of directly employed labour force. The small maintenance firm employing less than forty operatives would incur high administrative costs if work measurement schemes are introduced. Large local authorities for example the Greater London Council are likely to benefit from the publication of a national library of output values and other work synthetic data (15). But variations from job to job and from region to region may make such data highly unreliable unless adjusted to suit local conditions.

6.2.5. Total Occupancy Costs and Maintenance Budget presentation.

Other ways of calculating the maintenance budgets include using total occupancy costs of the building properties. This requires establishing the life cycle costs of the property. Life cycle costs are the total cost of an item throughout its life including initial, maintenance and support costs (1). It involves establishing the costs in use of the properties; the total costs of the operation, maintenance and modification of a building during its useful life excluding the capital cost of any external additions (18). This is based on Historic costs of the properties established over a period of time.

Annual property costs are analysed and their average total occupancy costs per every one hundred square metres of floor area are calculated. A typical financial statement gives breakdown of maintenance expenditure (Appendix K) according to the following elements as proposed by the Building Maintenance Cost Information Service (BMCIS).

	% Total occupancy cost
0. Improvements	-
1. Decoration	3%
2. Fabric	4%
3. Services	7%
4. Cleaning	13%
5. Utilities	18%
6. Administrative Costs	24%
7. Overheads	31%

Source: BMCIS Cost Survey (1979).

While the BMCIS encourages subscribes to send financial statements for maintenance expenditure incurred in the past years under the above elements, there appear to be no general guidelines as to how to calculate and record such maintenance total occupancy costs. It is essential to calculate maintenance costs for each job and break it down to show its volume (total manhours) for each period. This may be expressed in PSH and then work out the total number of PSH required by each trade and the cost of

labour, materials and overheads. Calculation of maintenance overheads may be done by agreeing at the beginning of each financial period a percentage to be charged of the total maintenance cost. This also will have to be established on careful observation and analysis of how many supervisory staff are involved in maintenance works, and, the amount of time they are involved in duties for maintenance management. A case to use past Historic overhead costs may arise where there has been such procedure to allow for these costs in the maintenance budget. However a number of problems arise;

6.2.5.1. The use of past historic financial statements assumes that there is a standard common procedure followed by all maintenance organisations in recording and calculating maintenance costs of the jobs carried out by the organisation;

6.2.5.2. Even if organisations adopted similar methods of presenting the budget, there would arise differences in how each firm calculates its costs of maintenance overheads giving different percentages for each financial year.

6.2.5.3. It is supposed that giving a consolidated financial statement of past maintenance expenditures covering a number of years will help to establish a pattern of maintenance expenditure which can be used as a basis of calculating future maintenance costs and hence the budget (Appendix K1). This is hoped would be used to present a maintenance budget

for the coming financial period. But it is quite unlikely in practice because it is based on the assumption that maintenance costs will show a normal distribution pattern over the whole period. Variations occur in each year and there is no pattern which can be traced. Sometimes a general trend is likely to occur showing a general rise in the cost of each element per every 100 square metres of floor area. But the problem arises as to the cause of such rising cost trends and for how much longer the trend will continue.

Sometimes costs may rise due to a general rise in price level for labour and maintenance supplies, or perhaps due to inefficient management techniques in organising maintenance labour and methods of executing most jobs.

6.3. Problems arising from inter-maintenance Organisation Comparisons

It is said that there are hardly no advantages in using other firms figures in compiling maintenance budgets. Various problems are quite evident.

- In many organisations it is difficult to find out where work has been undertaken especially where it has been undertaken by outside contractors. This detracts from the usefulness of maintenance accounting information.

- When exactly was the work undertaken and in what conditions? The timing of the work can make considerable difference to its cost and the conditions under which it was carried out will also influence cost and the useful life of the maintenance work.
- Is the description of the expenditure comparable by the firm? The same job may well be put into a different work classification now from in the past which makes comparison of totals under different headings very difficult. Also problems may arise as to whether the work description and expenditure is compatible with that used by other firms. Unless the classification systems used are similar it is difficult to make comparisons of similar buildings used by similar firms in similar locations.
- Methods of allocating overheads related to occupancy to cost centres vary from firm to firm and so do the methods of applying overhead rates to labour. Differences in procedures and convention will produce differences in cost where none exist in reality.

6.3.1. Establishing Universal Maintenance Standards. (UMS);

In his 'Industrial Engineering Handbook' Maynard[19] advocates the use of universal maintenance standards (UMS) to solve the work measurement problems of non-repetitive jobs in maintenance operation. It is said that setting accurate maintenance standards is too costly to be practical requiring almost a one-to-one ratio of time study man to maintenance man. Standard Data or time formulas, based on time study, offer a better solution.

It has been extensively used in the United States mainly where the high cost of maintenance operations has resulted in rendering maintenance standards economically feasible. The techniques of time study, standard data, and historical records have been used in an attempt to develop accurate standards to represent more exactly the time required to do a given job. However, it is not practical to expect every maintenance worker to do a given job with exactly the same motion pattern and in exactly the same time. Therefore it is difficult to set a standard in advance that will be exact for each maintenance job. It is more feasible to set a standard based upon a range of time. Whereas most maintenance operatives will not accept as a fact, that a standard for replacing a valve in a pipeline, for example, is 28½ minutes, they will agree that such a job can be performed in, say, between 20 and 40 minutes. Thus one can follow this principle to set a reliable standard in advance based upon sound maintenance experience data. This is the basis of introducing UMS in any organisation and will assist the maintenance manager in preparation of the maintenance budget in that the standards required for each job are already established and eliminates the possibility of under estimating.

6.4. Maintenance Budget Variance Reporting.

Variance reporting is a system of reporting at regular intervals of any difference between actual costs and those forecast of

maintenance operations, ascertaining the reasons for such deviations and corrective action taken based on the reports (4). Examples of causes of variances in maintenance include the following;

- Price Variance, which arises from the payment of prices higher or lower than the standard for materials and labour.
- There might be causes of increased volume of maintenance workload at a particular period of time or decrease in volume of such work which will cause variations on the protected levels of maintenance workload in the budget.
- Quite often conditions change and maintenance budgets require some revisions to incorporate the new conditions not taken care of in the initial formulation of the budget, such as a rise for example from a national wages award.
- Another source of variances from the actual budget is sometimes due to conditions of working being below the standard laid down in the budget which is mainly due to inefficient organisation and job planning resulting in fairly low material usage efficiency and lower output during productive time. This is a controllable variance which depends largely on the skill of the maintenance manager in introducing scientific management principles in planning and execution of all maintenance jobs included in the budget (20).
- Some maintenance jobs are executed by contract. Variances between the estimated tender figures and the contractors lowest tender prices usually over and above the estimated contract figures may be due to (7);

i. inaccurate estimates

ii Unforeseen increases in wage rates or material prices

iii Changes in market conditions affecting tendering climate

iv Delay in starting the work resulting in tenders being invited at an unfavourable time.

The nature of maintenance defects makes it difficult to spread maintenance expenditure evenly over the budget period. This is partly due to users requirements which dictate when to execute a job and partly due to experienced maintenance manager's skills in strategically planning and timing most of the maintenance jobs by contract to be done at such periods when there is a downward trend of contractors lowest tender prices due to increased competition.

6.4.1. Variance Reports.

For the variance reports to be useful, the maintenance manager should present these in a form of summary to the management. An explanation should be made to decide whether further items can be executed without ultimately over-spending the budget and it may be necessary to know in addition, the value of outstanding orders for items not yet started and for which no financial entries have been made in the accounts. After careful consideration of the results shown by the budget and actual comparison summary, decisions may be taken as follows;

6.4.1.1. To take corrective action with regard to maintenance expenditure where the budget standard has not been achieved.

6.4.1.2. To investigate cases where the maintenance budget allocation has been exceeded by an appreciable margin and to consider the implications of such results;

6.4.1.3. To adjust the maintenance budget to

i. correct errors made in its compilation

ii. allow for the introduction of improvements in job methods not anticipated in the initial setting of the budget, or for any other changes which might have occured in the entire maintenance organisation;

It is important for the manager to keep a statistical record of the variances in terms of their size and their incidence for each budget period. Such statistics will form a base for the manager to explain more convincingly to the management of the need for more funds for maintenance[21] Variance reports should be prepared from financial control reports on labour, material and equipment costs. Every manhour spent on maintenance work must be accounted for. Even maintenance tasks too small tc warrant a separate work order should be accrued on an open or blank work order number. All labour costs should be entered in both monetary and manhour terms.

CURRENT WORK ORDERS 1981

Cost Centre	Work Order Number	Description	Equip. No.	Estimated		Spent to date	
				Material £	Labour manhours	Material £	Labour manhours
526	35992	Replace ball valve		25	2	25	1
526	35996	Replace Steam Trap		20	2	20	2
662	35841	Repair Wall cracks		10	8	10	6
683	35850	Replace rotten floorboards		150	14	150	0
701	35872	Remove airlock in hot water heater		0	8	0	2

Figure 6.1. Material and Labour Cost Report.

All costs should be attributable to a cost centre and when relevant to an identifiable item of equipment[2]. Figure 6.1. illustrates one type of report in which labour and material costs are reported by cost centre and work order number. It can be issued as often as desired. Normally it is convenient to print out a monthly labour and material report which shows monthly and cumulative annual costs for any cost centre or equipment. This is possible especially where the use of a main frame computer is incorporated in financial control of maintenance costs. The cumulative yearly report can be filed and referred to for historical analysis. It should be constantly searched for trends that could indicate increasing maintenance costs. The cumulative report is useful for budgetary purposes to discover areas that require future maintenance expenditure. The major advantage of monthly print outs is to locate areas either by expenditure or by trend, which indicate that they will require amounts of resources other than those that were budgeted. A compilation of several monthly trend reports could identify longer trends.

In order to appreciate long term changes in maintenance costs it is necessary either to plot the monthly increases or decreases, or printout a year end report.

Whenever a trouble area is located by the trend reports the folldw up investigation should include comparison of accumulated man-hours versus accumulated required manhours. It is the role of the maintenance manager to ascertain the reasons for any large differences between the two. Frequently such a review would result in a revision of the maintenance standards or a realisation that the equipment is being employed to a greater or lesser extent than was planned when the maintenance budget was formulated. Figure 6.2. illustrates a material and labour Cost Trend Report.

MONTHLY TREND REPORT						
Cost Centre	Equip No.	Costs this month		Average Costs		% Decrease (-) or Increase (+)
		Labour	Materials	Labour	Materials	

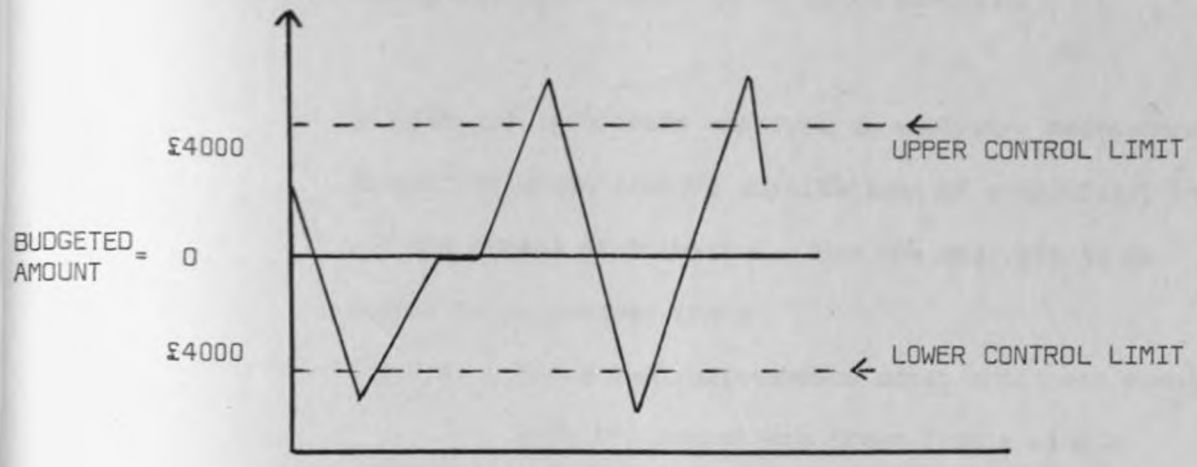
Figure 6.2. Material and Labour Cost Trend Report.

6.4.2. Tools for Variance Analysis.

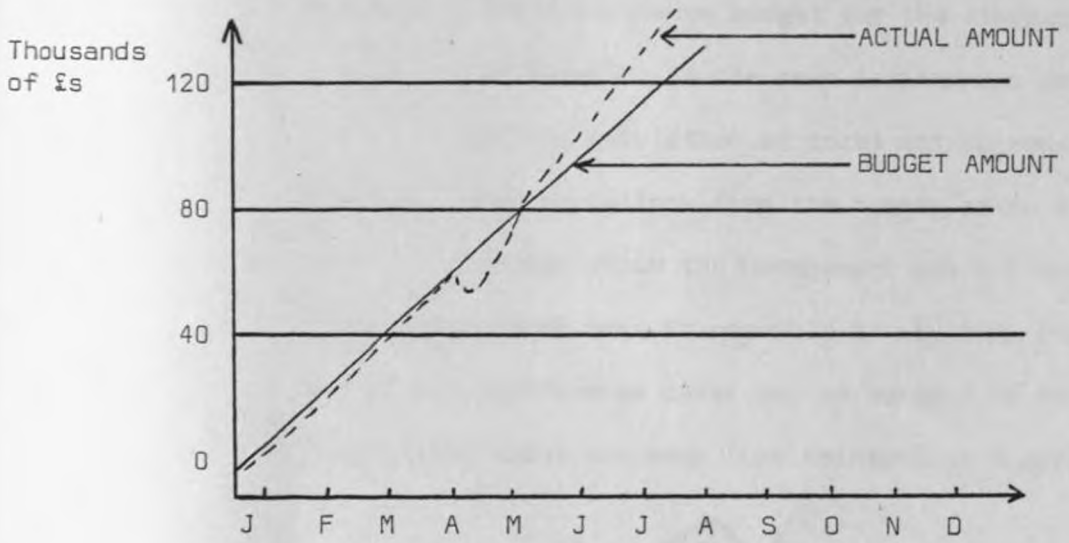
Statistical control provides an excellent device for interpretation of deviations from the established budget. If demonstrated and proved to top management, application of statistical methods for explanation of cost variance can appreciably reduce the time spent on variance reports without a loss of control. This approach is particularly applicable to cost centres where it is frequently necessary to defer expenditures or to incur abnormal expense during a particular reporting period. If three standard deviation or two standard deviation limits are accepted, and if reported variances fall between these limits, indicating that expenditures are within the accepted control limits, further investigation and explanation are eliminated. A variance outside the established control limits, however, can be observed immediately and indicates the need for further investigation. For more complete interpretation of the performance of the cost centre, a control chart covering year to date performance is of considerable value as Figure 6.3. illustrates.

6.4.3. Maintenance Budgets and 'Significant" variances.

In a maintenance budget, variances of different magnitudes will arise randomly from period to period since it is difficult to budget with absolute accuracy. It therefore becomes necessary to decide whether or not a particular variance is 'significant'. For some costs each budget period can be considered in isolation and the judgement as to whether the budget variance is 'significant' can be made without reference to variances of previous periods. At times the trend of past variances may enable a 'significant' variance in the budget to be anticipated. The usual procedure is to express the significance of the budget variances as a percentage of the budget. Usually the management will decide what percentage in excess of budget will be regarded as 'significant' and then the procedure to investigate the cause. Repairs and maintenance costs may be represented as an average cost expected over the whole financial period in the budget. But the incurrence of such costs is normally uneven during the whole financial period. So it is the management's duty to decide when each variance occurs whether it is statistically significant to warrant immediate action. Any maintenance cost variance will be statistically 'significant' if it is of such a magnitude that it is unlikely to have arisen purely by chance; for example, where costs are incurred probably due to breakdown of an essential equipment for instance a boiler or kitchen equipment in a hospital complex.



MONTHLY VARIANCE



CUMULATIVE VARIANCE FOR ONE YEAR

Figure 6.3. Monthly Variance and Cumulative Variance Report Programme.

6.4.4. Statistical Techniques in Variance Analysis.

Statistical techniques employed in analysing maintenance budget variances involve applications of probability theory and the normal distribution. For the analysis to be useful it is assumed that;

6.4.4.1. The actual maintenance costs which are compared with the budget are drawn from a single homogeneous population comprising of all maintenance costs of the organisation;

6.4.4.2. The Maintenance budget for the financial period in question is the mean (arithmetic average) of the population of total maintenance costs[22].

6.4.4.3. Any variations from the busget arise from causes which the management can act upon to rectify.

These assumptions make it possible to say that the total sum of all maintenance costs may be assumed to be normally distributed about the mean (the maintenance budget).

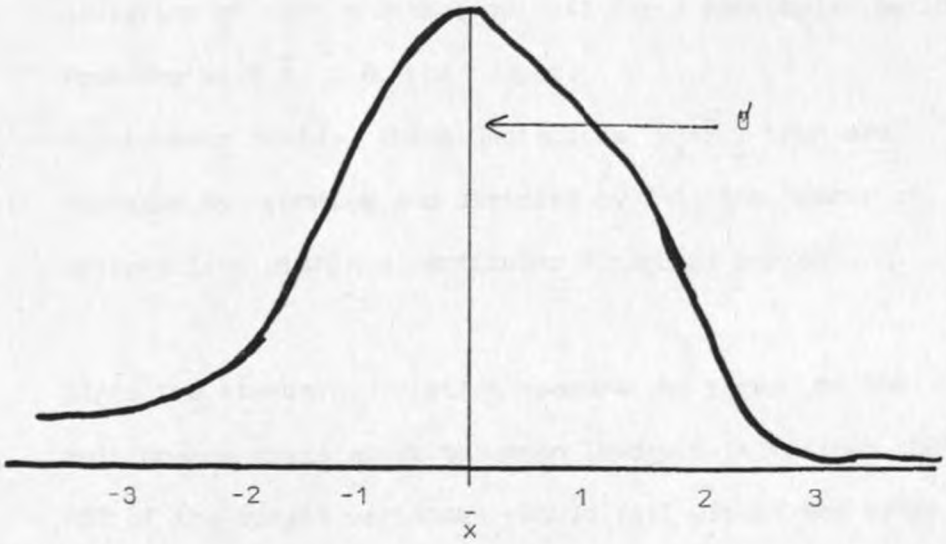


Figure 6.4. Normal Distribution for Maintenance Costs.

σ = The Standard Deviation

$\bar{X}$ = The mean (The budget).

The standard deviation is given by the following formula and denoted by the symbol "S" (22)

$$S \triangleq \sqrt{\frac{1}{n-1} \sum_{i=1}^{n} (x_i - \bar{x})^2} \qquad (22)$$

Variance is therefore

$$S^2 \triangleq \frac{1}{n-1} \sum_{i=1}^{n} (x_i - \bar{x})^2 \qquad (23)$$

therefore the standard deviation is;

$$S \triangleq \sqrt{\text{Variance}} \qquad (22).$$

The standard deviation is found by calculating the deviation of each maintenance cost for a particular period from the mean $\bar{X}$ i.e. the budget.
Maintenance costs; these deviations $(x_i - \bar{x})$ then are averaged by summing and dividing by "n" (the number of observations within a particular financial period).

Since the standard deviation measurs the spread of the maintenance costs about the mean (budget) it follows that 95% of the budget variances should fall within the range of the mean (budget) plus or minus 1.96 standard

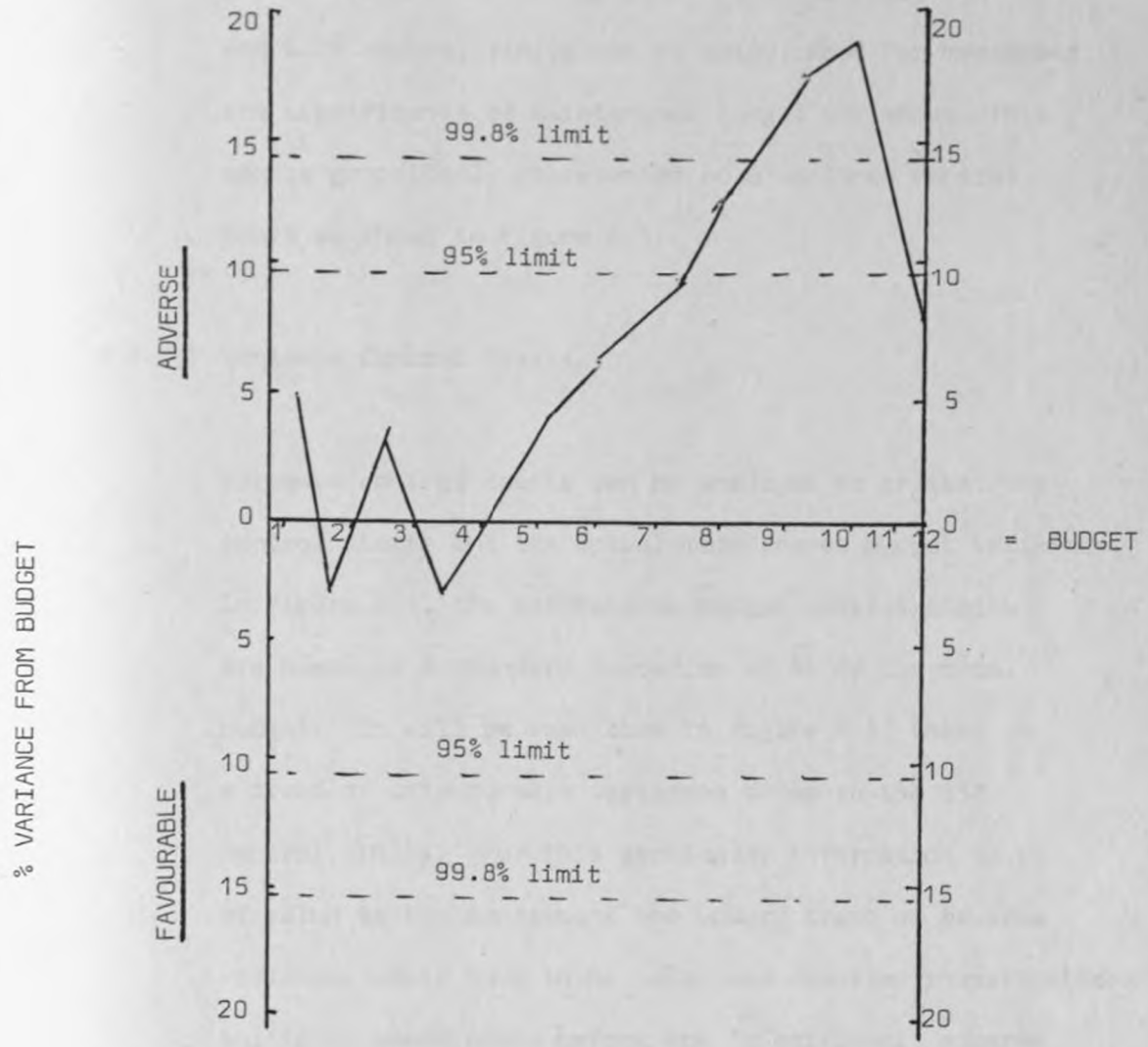


FIGURE 6.5 : Variance Control Chart for Maintenance Costs

deviations; and 99.8% within mean (budget) plus or minus 3.09 standard deviations. On this basis 5% and 0.2% control limits can be established for measuring the significance of maintenance budget variances. This can be graphically represented on a variance control chart as shown in Figure 6.5.

6.4.5. Variance Control Charts.

Variance control charts can be employed to present the control limits and the actual maintenance budget variances. In figure 6.5. the maintenance budget control limits are based on a standard deviation of 5% of the total budget. It will be seen that in figure 6.5. there is a trend of unfavourable variances close to the 95% control limits. For this particular information to be of value to the management the upward trend of adverse variances would have to be noted and detailed investigations initiated immediately before the 'significant' adverse variations occur. The particular use of this variance control chart is to enable the maintenance manager to isolate significant maintenance cost variances and to some extent help to identify possible future 'significant' variances to be anticipated.

The principal indications of 'significant' maintenance cost variances are;

6.4.5.1. The variance is outside the control limits as in period 9 and 10 in figure 6.5.

6.4.5.2. Several Variances especially if following one another consecutively near the control limits;

6.4.5.3. An undue number of variances above or below the budget. In both cases six of the first eight variances are above the budget, but a significant' variances does not occur in both cases until period 9.

6.4.5.4. A trend in the variances, as in periods five to eight in Figure 6.5.

It is important to adopt different control limits for the various categories of maintenance costs. For example, a 3% variance from a budgeted cost of £100,000 is more critical than a 10% variance from a budgeted cost of £1000. In other words, there is a need to consider the 'absolute' as well as percentage variance when establishing control limits.

It is advisable for good maintenance management policy to establish 90% control limits (i.e. 1.64 standard deviation from the mean (budget) for major maintenance cost items. But for minor maintenance items of maintenance costs 100% control limits (i.e. 3.9 standard deviations) may be considered quite satisfactory.

6.4.6. How reliable are statistical techniques in establishing variance control limits for maintenance expenditure.

The use of the statistical techniques outlined requires the calculations of standard deviations to determine the variance control limits. This can be done by analysing

records of actual past performance levels, provided the causes of deviations from past expected levels have also been recorded. However it pre-supposes what happened in the past period is necessarily representative of the future. This may not be the case for the following reasons;

6.4.6.1. Standard deviations of past maintenance costs are likely to be unsuitable for establishing control limits for determining whether or not future budget variances are statistically 'significant'. Where there have been changes in such factors as the method of preparing budgets; organisation structure and overall managerial policy towards maintenance;

6.4.6.2. Calculation of the standard deviation is based solely on the likely level of the causes of such deviations. There is hardly any objective method to establish them. All the calculations for such deviations are based on the practice of examining variances plus or minus a fixed percent figure of standard maintenance costs based on past experience.

Even though the above points try to invalidate their usefulness, variance control charts can still be of considerable value to management for they depict trends in maintenance costs in a particular period regardless of how their control limits were established. It should be emphasised that the main purpose of setting the control limits is to determine whether the trend is significant. This is what is vital to the management for it will take

into consideration in future decision making policies, the results shown by reports compiled using the results of variance control chart.

PART THREE

CHAPTER SEVEN

Budgetary control procedures for maintenance funds in the Property Services Agency (PSA) in the Department of the Environment (DOE) and the Greater London Council (GLC)

7.10 Budgetary control procedures for maintenance funds in the PSA:

Objectives of the PSA

The PSA's general aim is to meet its client's requirements effectively, economically and in accordance with the Government's policies for the conservation and improvement of the environment. In the light of these policies the PSA aims to advance standards of design in new buildings and existing properties by providing advisory and specialist facilities to central DOE on the policy issues, design, technical and industrial developments and other matters affecting the construction industry. The PSA's territorial organisation in so far as work services are concerned, is organised in three management levels at[23]:

(i) Territorial Headquarters,

(ii) Area Offices, and

(iii) Distric Works Offices (DWO).

It is at the DWO level that repairs and maintenance, operating services and some minor new works, alterations and additions are programmed and carried out, as well as some site control services for other levels of the organisation. Typical area office and DWO organisation structures are shown in Appendix B and C respectively.

The DWO is the principle point of contact with PSA's clients within his district. He is answerable to the Area Officer for overall efficient management of his district and is expected to maintain a critical review of the various methods made available to him for executing work. His responsibilities will generally include[23]:

7.10.1 The management and economic use of the properties, resources and services within the district.

7.10.2 The administrative, financial and technical control of all work delegated to him and the subsequent allocation of priorities in jobs and in staff time to his supporting staff and oversight of the detailed work produced by their activities.

7.10.3 The preparation of annual estimates, exercising financial control of the bulk allocation of funds to the district within current delegations, maintenance of financial records and compilation of financial and progress returns.

7.10.4 Overall supervision of the Building and Civil Engineering (B & C E) and Mechanical and Electrical (M & E) planned maintenance systems throughout the district.

7.10.5 Management, supervision and control of the district direct labour force (DEL); oversight of the DEL planning and control scheme and productivity scheme; the maintenance of an appropriate standard of workmanship and output; and control and economic utilisation of the districts' motor transport vehicles through one of his supporting officers.

7.11 The day-to-day maintenance and operating services throughout the government estates are carried out by contractors or DEL. The PSA's policy for the use of DEL is the DEL should be employed to undertake maintenance work and minor works in two categories:

7.11.1 Where work has to be done by DEL for security reasons or to meet other special client requirements, for example when shift working or rapid response time is essential;

7.11.2 On work at places where contractors are not available or cannot provide a regular service.

Procedures for the planning and execution of the work and for controlling performance are laid down in the 'Planning and Control of Directly Employed Labour, Manual of Procedures'. The procedures require that the time for all DEL work be pre-measured and the work planned to ensure that the most effective use is made of the workforce and that the necessary support services will be available. The DEL manager, who is normally a professional and technical officer responsible for

the DWO, controls the productive and support labour force and is responsible for the planning and execution of the work carried out by DEL. Control documents provided to enable management to monitor DEL management are:

7.11.3 Weekly DEL load statement (Form W 2271), prepared by the planner to advise the DEL manager and higher management of the quantity of work overdue from the past week, the labour capacity and work issued for the current week and work planned for future weeks. This form merely acts as a trend indicator with a view to foreseeing future maintenance problems.

7.11.4 Labour control summary (Form W 2272). Compiled by the line supervisor each week from the work dockets for work not started during the current week but which will be started during the following week. Work dockets for work should be returned to the planning foreman for re-programming. Totals from the forms are entered in cards and on the weekly DEL load statement.

These documents provide sufficient information for performance to be assessed and the problem areas identified but it is the maintenance manager's duty to locate the causes and take the appropriate remedial action.

For budgeting purposes DEL is divided into three groups: Productive, Support and Static. Productive DEL are those directly engaged full-time or almost full time on the execution of maintenance work services. Support DEL are those not directly engaged on work services but whose support is essential to the proper execution of those services. These include apprentices, storemen, storekeepers and their assistants, drivers of transport and plant. Static DEL are those engaged full time on services of one type, for example operating services, usually charged against a single cost code.

7.12 MAINTENANCE BUDGETING AND INCLUSIVE LABOUR RATE

The inclusive labour rate is an hourly rate which is applied to the actual hours worked by Productivie DEL. A close review of the rate is kept after its initial calculation and adjustments made whenever necessary. The inclusive labour rate may be applied on an area organisation or DWO basis. The stages by which the inclusive labour rate is calculated are as follows:

7.12.1 The total cost of Productive and Support DEL in a financial year.

7.12.2 The total productive hours of productive DEL during a financial year (this can be obtained from work dockets W 1933 produced during the year).

7.12.3 Divide 7.12.1 by 7.12.2 equals labour element of new inclusive labour rate.

7.12.4 The total cost of stores purchased and plant for a financial year (this is obtained from the suspense account returns).

7.12.5 Divide 7.12.4 by 7.12.2 equals stores element of new inclusive labour rate.

7.12.6 Transport element is calculated by the DWO by dividing the hire charges of vehicles allocated for DEL purposes by the regional transport offices by the forecast number of Productive DEL docketed hours.

7.12.7 Then 7.12.3 plus 7.12.5 equals the new inclusive labour rate for financial year.

It is on the basis of this inclusive labour rate that the DWOs compile their maintenance manpower budget for the DEL in the district.

7.13. EXECUTION OF MAINTENANCE WORK IN THE PSA

Execution of maintenance works by use of the DEL accounts for only 30% of total maintenance workload in a PSA District Works Organisation. The rest of the work is done by use of contractors. Today the total cost of maintenance operations to the PSA is between three and four million pounds per annum. A typical DWO normally operates with a two million pound maintenance budget. In addition to using

the DEL, the DWO execute most maintenance jobs by arranging specific contracts for major items with contractors, by raising jobbing orders for smaller items on local firms and very commonly by raising orders on a building contractor at fixed rates subject to subsequent measurement by a quantity surveyor. This is a measured terms contract. A typical measured term contract works order is illustrated in Appendix M. The contractor is employed, after tendering in competition, to carry out work ordered by PSA within a defined geographical area and financial limit for a fixed period of years. The method offers significant advantages in cutting down the time required to commence work as it is not necessary to invite tenders for each job. However, considerable PSA staff resources are necessary in ordering, measuring the value of the work done and processing payments.

A disproportionate amount of effort is involved when the work comprises small value repetitive minor maintenance items. These small recurring items are reasonably predictable and on that basis the PSA have developed a method of incorporating into the contract a lump sum element whereby the contractor agrees to undertake a range of minor maintenance jobs for a fixed sum of money which is paid to him by monthly installments[23]. The significant advantage of the method is that it provides a substantial administrative saving to the PSA for the inclusion of the lump sum maintenancne element, obviates the need for PSA to raise orders to the range of minor maintenance or subsequent measurement and separate payments for individual items. The range of work covers such items as

defective door locks, broken glass, leaking water pipes which do not require a high level of technical expertise to identify and for which therefore PSA staff involvement is unnecessary unless problems arise. The only major snag with this kind of arrangement is the contractor meeting certain response times and various priority jobs. Financial control of such contracts is limited up to any single item not exceeding £250 (at 1980 prices). Quality control of such works is necessary in the sense that there is an overriding requirement for the contractor to maintain the properties to an acceptable maintenance condition. A typical specialist term contract draft order is illustrated in Appendix N.

7.14 Funding of maintenance work is done on annual allocations for each DWO. Each year the DWO submit their budget proposals to the area organisation showing their proposed budget for that year. To give a concise budget they require initial inspections of all properties in the district and then plans are drawn up based on the various conditions of the properties. Some priority classification is adopted in deciding which jobs should be included in the maintenance programme.

Elaborate budgetary procedures in the PSA are not adopted. Most district works officers submit their bids on the basis of analysis of past allocations. Usually a five year period is taken to establish some past trend and this is then used to project future maintenance requirements. Each budget allocation is essentially similar with slight increases to cater for additional stock of properties to be maintained and increases in prices (for inflation).

7.15 Maintenance control procedures on work priority classification, response times, performance standards, etc., for DEL and contract work is left in the hands of the site supervisors and DWOs and contractors. It is the effectiveness of such control procedures which culminate in reducing ineffective costs of maintenance. Planned maintenance systems for Mechanical and Electrical Services are adopted in the PSA. Appendix L illustrates planned maintenance systems for M & E Services in the PSA. However, the actual implementation of these procedures is left in the hands of DWO. This assumes that they are well aware of management skills required to supervise and manage the DEL force. A need for short term refresher courses in organisation of planned maintenance systems is vital for such officers if they expect higher productivity levels of their tradesmen.

It is commonly accepted that in as much as making good effects of neglect, improper maintenance and misuse of the building, the vital point to reduce maintenance costs is at the design stage where design defects can be avoided. There appear to be little or no involvement of the DWO in the design team of new works within the entire PSA set-up. This will inevitably lead to higher maintenance costs due to lack of design feedback from the field on the performance and behaviour of certain building materials.

7.16 Why are DEL maintenance costs high in the PSA? Maintenance costs for DEL in the PSA tend to be rather high due to a number of reasons. These may be:

7.16.1 A lot of non-productive time caused by excessive travelling from job to job; waiting for instructions and/or materials; and failure to gain access to premises.

7.16.2 Improper work methods resulting in more time being spent on the job than necessary and/or waste of materials.

7.16.3 Lack of motivation on the part of the operatives.

7.16.4 Changes to the nature and scope of maintenance works after commencement.

7.16.5 Lack of an efficient system of recording and controlling costs.

Though productivity schemes have been tried to improve DEL efficiency, there is no substantial improvement and most of the maintenance jobs are mainly being given out to contractos. However, executing jobs by contract is not a better substitute for DEL if the only criteria for doing so is to reduce costs. Increased maintenance costs are likely where:

(i) Inappropriate tendering procedures and contract arrangements in relation to the type of work and prevailing market conditions are adopted,

(ii) Improper execution of work due to lack of proper supervision, and

(iii) Where there are no adequate safeguards in the contract to ensure that the work is carried out in accordance with instructions and the provision of suitable remedies in the event of non-compliance.

Hardly any efficient costing system of maintenance works is done due to this swing to let out most of the works to contractors. Maintenance job costing is vital for budgetary control purposes for it provides a basis to compare DEL costs and their efficiency levels and also to highlight its usefulness to the management in maintenance organisation. However, it is vital to point out that a low tender may be the result of inaccurate estimating or a deliberate low pricing with the intention of cutting down the quality of the work. Cost comparisons are even more difficult for no two maintenance jobs are absolutely similar; differences in the nature of the job and conditions under which each job is executed make it fairly difficult to adopt cost comparisons in the PSA

7.20 Maintenance Budgetary Control Procedures in the Greater London Council, Housing Department, Maintenance Branch

The production and cost control section of the maintenance branch forecast the direct labour manpower budgets by trade and district in advance of the preparation of annual estimates in July each year. The manpower budgets are subsequently reviewed during the following January and are adjusted in the light of the latest work trends prior to operation for the financial year commencing from the 1st April each year. Appendix D and E show central office organisation structure and a typical district maintenance management structure in the GLC.

7.21 The Basis of Calculation of the Maintenance Budget in the G.L.C.

The cost control section maintains records of incoming numbers of repairs requests and estimated workloads. The records covering a number of years give a reliable indication of the trends past and present and thereby the likely forecasts for the future. Greater weighting is given to more recent results of performances and any sizeable trends carefully investigated. The budgeted number of jobs for the following year must also take into account the following factors:

7.21.1 Changes in numbers and types of dwellings in the estate for example the purchase of scattered older general properties will increase the number and size of jobs.

7.21.2 Maintenance service standards prepared for the financial year. See Appendix H. These standards specify the average job completion times in each trade discipline and the maximum acceptable job completion periods. Changes to these standards could affect the likely number of jobs to be completed each week.

7.21.3 Variations in incoming number of jobs. There are weekly variations in the number of incoming jobs requested by tenants and from other sources due to seasonal fluctuations, and emergency situations. Low input can be offset by adopting planned maintenance programmes for routine maintenance as well as planned preventive maintenance. Peaks of work which cannot be economically programmed for a fixed direct labour force can be covered separately by using term contractors. Normally all annual estimates include a provision for this situation.

7.21.4 Work arising from pre-painting surveys. District technical staff undertake a survey of property in the year prior to the year when external painting is programmed. The survey identifies all maintenance and repairs required to bring the property up to the council standard before painting is carried out. The work is detailed on job tickets which are fed into the planned maintenance programmes. Figure 4.6 in Chapter Four illustrates the job ticket system for the GLC Housing Maintenance. All work must be completed by the 1st

April before commencement of the current external painting programme. The budgeted number of jobs takes account of the known requirements of the pre-painting repairs.

7.22 Maintenance service standards set out a number of routine maintenance programmes which must be completed each year. All districts maintain records of the number of units covered by each programme. These are checked by the central technical division and used by the production and cost control section to establish the number of jobs for routine maintenance work. Appendix E shows a typical District Maintenance Organisation Structure. The Branch Workstudy based incentive bonus shceme measures the work content of all jobs completed each week. Records show the average work content per job for each trade in terms of productive standard hours (PSH) per job. Using the records plus a careful examination of anticipated trends, an accurate work content figure can be forecast for both repairs and routine programme work. Total workload is calculated by multiplication of the forecast number of repair jobs for each trade and district and the numbers of routine programmed jobs, by the forecast average work content per job produces the total workload in terms of PSHs. This is normally calculated as a weekly figure. Appendix J1 illustrates an analysis of overall cost per productive standard hour in the GLC.

7.23 The painting and decorating work load is calculated from four areas of work:

7.23.1 External painting programme is based on five to six years cycle. Districts maintain records of the dates when each property was last externally painted. From these records the district staff list all properties due in the budget year programme. The total number of all dwellings to be externally painted during the budget year is forwarded to production and cost control section by the District Works Manager.

7.23.2 A high proportion of dwellings which have a change of tenancy are redecorated before reletting. The control prodcution and cost control unit maintains records of the number of dwellings redecorated as they empty in each district each week. These records, suitably adjusted for any policy changes in respect of rehousing, provide a reliable indication of the numbers of empty redecorations likely in the budget year.

7.23.3 Internal programmed redecoration. Districts maintain records of the dates when each dwelling was last redecorated and from these prepare a list of all dwellings due in the budget year.

7.23.4 Some redecoration arises each year as job ticket work, usually associated with other trade repair work, for example repaint new windows. The maintenance branch is also responsible for redecoration of communal areas and facilities, for example drying rooms, laundries, clubrooms, entrances, lobbies and common staircases.

Total workload for painting and decorating is calculated in terms of PSHs per week per trade. Using these records plus a careful examination of anticipated trends for the budget year, an accurate maintenance work content can be forecast. See Appendix J6 for a typical district overall cost per PSH illustration in the GLC.

7.24 CALCULATION OF DEL MANPOWER BUDGET

In calculating the numbers of direct labour operative and supervisory staff which are required to carry out the total workload, provision must be made for absence due to sickness and holidays. On average 20% of the available gross hours are lost for these reasons and this allowance is included in the final Manpower Budget calculations. The main trades manpower budget in the council is calculated from the following formula[11]:

$$\text{Number of men required} = J \times W/c \times \frac{EP}{100} + \frac{S}{L}\% - G \quad (= 2080)$$

where

J = Forecast number of jobs per week

$W/_c$ = Forecast work content per job in PSHs

EP = Forecast effective performance

$$\text{NOTE EP} = \frac{\text{PSH}}{\text{Gross Hours Workd}} \times 100$$

S/L = Percentage for sickness and leave

C = Conversion to man years at 40 hours per man week for 52 weeks per man year = 2080

In addition to the main trade budget provision has to be made for indirect staff that is first line supervision, mates, general labourers, stores, etc. A detailed main trade manpower budget is established for each district and indirect staff are added either as a ratio to main tradesmen or according to the number of depots, stores, etc. and general geographic size of the district. See Appendix J1.

7.25 Calculation of total cost of DEL after determining the manpower budget required to carry out the estimated work load for the following financial year, the cost of this labour force is calculated and the following factors are taken into consideration:

7.25.1 Basic wage plus bonus including performance trend of trade team;

7.25.2 Overhead charges;

7.25.3 Establishment and staff on-costs;

7.25.4 Material costs.

The current weekly wage, including average bonus earnings for all operative trades is calculated by the cost control unit. The cost of indirect support staff is added to each trade in proportion to the support rendered. Appendix J6 shows a typical district overall cost per PSH for each trade. To obtain the basic annual cost of each class of operative, the weekly cost is then multiplied by the estimated number of weeks of productive work that is excluding annual and sick leave and public holidays in the year. This figure is currently at 42 weeks.

Overhead charges are added to the labour costs, as a percentage addition. In addition to costs included in overhead charges, a further percentage addition (currently calculated at 10% of labour costs) is made to cover the salaries of administrative, professional and technical; executive and clerical staff employed on maintenance activities.

The estimated cost of materials is calculated in conjunction with Finance Branch on the basis of current expenditure. The total cost is spread over the various trades in proportion to the estimated volume of material usage per trade.

The basic cost per year of each trade, with the addition of overheads, on-costs and material costs, is multiplied by the numbers of staff in the manpwoer budget to produce the total estimated cost of the DEL.

7.26 The DEL is responsible for about 75% of the overall workload. The remainder is put out to contractors. Contract work may be term contracts based on a schedule of rates for which competitive tenders are invited annually, mainly for specialist works and also trade support. District works managers control their day to day operation and are empowered to invite tenders and arrange small contracts up to a limit of £2,000. Other contracts cover mainly major maintenance, remedial and improvement works, which, by virtue of its scale or specialist character cannot be dealt with by DEL. Each district manager is required by July of each year to submit their contract

requirements for the next financial year.

7.27 After final adjustment meetings to review estimates with works managers have been held, and the money actually available for the ensuing year is known, allocations are made on all activities to the districts to ensure that standards are met and to cover:

7.27.1 Cost of the required direct labour force.

7.27.2 Cost of the contract work which has been agreed as necessary to cover the priority jobs in the works programmes.

Expenditure for direct labour is charged by applying a standard rate for each trade in each district to the number of standard minutes worked on a particular job. This is shown in a job ticket. Expenditure for contracts is charged against relevant quotas in accordance with contract orders issued. The expenditure committed up to and including the month concerned is determined by the date of the order, the amount of the order, and the completion period indicated on the order.

7.28 Budgetary control of maintenance funds is achieved by keeping a constant check on expenditure as shown on monthly priorities from the computer and maintaining a record of contract expenditure against quotas using the copy of all orders issued by districts showing running totals of local expenditure against the various quotas. Where financial provision is not sufficient reference is made to works managers to cover it by savings elsewhere within the budget

of the district concerned. Omissions and additions to contracts must be fully documented. All site measurements and calculations are recorded, signed and dated and retained for audit. All variations must be covered by the issue of a variation order. If the sum of variations is likely to cause the contract sum to be exceeded, an immediate report is made to the senior Assistant Director.

7.29 There is a strong emphasis for use of DEL in most of the GLCs maintenance works. They have over 226,000 dwellings comprised of some 134,000 flats, 77,000 cottages and 15,000 miscellaneous properties (mobile homes, prefabricated bungalows and general properties). Each repair is entered onto a job ticket. Work arising from over 800,000 job tickets is completed annually. The maintenance branch has a current expenditure of well over £60 million per year. There are over 4,000 operatives of all trades, supervisory and technical staff in 18 districts. About 85% of all job tickets repairs are carried out by directly employed labour. In an effort to retain operatives and improve efficiency the GLC management introduced a work study based bonus scheme. This they claim has led to improved output as shown in Figure 7.1. To aid the maintenance branch in assessing further the efficiency and the usefulness of their large directly employed labour force, cost comparisons are done between cost of executing maintenance jobs using DEL with contractors' lowest tender prices. It is claimed that "figures audited by the Treasurer for 1977/78 show that it would cost the GLC an additional £9½m per year if the housing maintenance work now done by direct labour were to be placed with term contractors at the lowest tender rate[11]".

However, the overall efficiency of a direct labour force cannot be judged on the basis of the result of an individual competition[8]. A direct labour force is not able to balance gains on one contract against losses on another and the single criterion of cost can be misleading unless it takes into account all the benefits. Another point to take into account is the fact that planned maintenance requires continuous work for the operatives so that there are no major fluctuations in job availability. It would be difficult to evaluate efficiency of such operatives on each and every job by tendering in open competition with outside contractors. This would result in disrupting maintenance planning and the flow of all jobs scheduled in a maintenance programme.

TRADE	EFFECTIVE PERFORMANCE (E.P.)		INCREASE
	REFERENCE PERIOD 1965/66 Traditional Bonus Scheme	CURRENT SCHEME WORKSTUDY BONUS SCHEME	
Painters	56	107	91%
Plumbers	38	103	171%
Bricklayers	25	104	316%
Carpenters	26	100	284%
Electricians	37	108	192%

	REFERENCE PERIOD 1965-1966	ANNUAL LEVEL 1979-1980	INCREASE
PRODUCTIVE STANDARD HOURS (PSHs)	4,022,250	4,075,957	Average increase in output per operative = 200%
LABOUR FORCE	6,250	3,236	
OUTPUT/ OPERATIVE	643 PSH	1260 PSH	

FIGURE 7.1 Typical improved output resulting from introduction of workstudy and allied management techniques for the main building trades in the GLC

SOURCE : GLC Housing Maintenance : an appreciation of the work of Maintenance Branch, February 1980 Edition).

CHAPTER EIGHT

CRITICISMS AND RECOMMENDATIONS

In this final chapter of the study I will outline the general grounds in building maintenance budgetary control systems which call forth a great deal of criticism. I will describe ways to improve the present building maintenance budgetary control systems. Such descriptions of the various improvements will form the basis of the recommendations and conclusions of this study.

8.10 CRITICISMS

In describing the budgetary process for maintenance management, a number of basic characteristics have been identified as the major sources of criticism. They include the following:

8.10.1 Arbitrary Aids to Calculation of Maintenance Costs

The aids to calculation of maintenance costs are said to be arbitrary and quite often irrational. It is pointed out that even when statistical methods are applied in forecasting maintenance costs for future budgets are applied - the costs of collecting the maintenance data required to aid in such calculations outweigh by far the benefits accruing from such an exercise. It is further argued that at times it is safe to accept the status quo - to allocate budgets solely on historic costs with an increment for general rise in price level allowed every budget period.

8.10.2 Lack of Co-ordination of Various Objectives Within the Budget

There is usually a lack of co-ordination of various maintenance objectives within the maintenance budget and this normally results in the total neglect of the consequences of deferred maintenance jobs. This is particularly so when a failure to arrest a specific defect when it is first identified leads to incurring large expenditure of maintenance funds in the future.

8.10.3 Lack of Appreciation of Broad Objectives in Formulating Budgets

Usually the people involved in the preparation of maintenance budgets lack a general appreciation of the whole maintenance process in the organisation. Their roles are considered to be excessively narrow and often concentrate on allocating funds for jobs with the sole aim of merely satisfying the immediate needs of a particular group of users/tenants. The strategic plans are rarely made to preserve the organisation's properties throughout their economic life.

8.10.4 Arbitrary Determination of Maintenance Frequencies

Determination of frequencies for each maintenance operation is criticised on the grounds that it is arbitrary and there appear to be no particular basis on which these are established. Questions as to how often you require to redecorate externally or internally depend upon:

a. the age and size of the building,

b. the organisation's maintenance policy,

c. the type of function the building serves,

d. the number of users,

e. the level of expsoure of the building elements to direct sunlight, strong winds and rainfall especially to paint films and other finishes.

These factors are rarely taken into account in establishing re-decoration cycles of buildings.

8.10.5 Difficulties in Estimating Appropriate Maintenance Standards

Establishing maintenance standards is rarely spelled out in the organisation's maintenance policy. Such omission in the overall policy means that it is the duty of individual maintenance managers to establish maintenance standards for each maintenance operation. It is difficult ot express maintenance standards in precise terms. They are normally expressed by fixing of upper and lower limits of acceptability of each maintenance job. However, the assumption here is that maintenance defects will occur at a uniform rate of deterioration. This is rarely the case and fixing of such arbitrary limits will require an analysis of what is an acceptable standard to the users. There is thus a need to establish standards tied to authorised expenditure limits which should be related to the expected results of doing each job in terms of user satisfaction.

8.10.6 Lack of Uniform Units to Express Maintenance Costs in Budget

How maintenance costs are expressed in maintenance budgets is subject to general criticism that they are not expressed in uniform units. These may be either in Productivie Standard Hours or total occupancy costs per unit of floor area or a straight percentage of the organisation's overall gross funds in a year. Most organisations express these costs as a percentage of the total budget for the whole organisation. This percentage is arrived at by analysing past allocations and then expressing these as percentages of previous budgets. The major weakness of this calculation is that there is an underlying assumption that good maintenance management policies on budgetary control were adopted. It assumes that there were no cases of gross maintenance under-funding in the previous budgets. In large maintenance organisations with a high proportion of operatives it is common to introduce work study based incentive schemes to motivate the operatives and eventually increase their productivity. Maintenance costs for each trade may be calculated in terms of Productive Standard Hours for an operative. Maintenance job times are calculated and the length of time it takes an operative of a particular trade (carpenter, plumber, etc.) in each job is recorded. The cost of doing a job using a particular trade is normally expressed per each productive standard hour. Annual forecasts are used to prepare maintenance budgets once the jobs proposed to be carried out in the budget are known and calculations as to how much it will cost are known as well. Lack of universally agreed format of expressing maintenance costs for budgetary control purposes makes inter-organisation comparison difficult. The purpose of such comparisons is to help the management to know how well it is

doing compared with other similar maintenance organisations. This is vital especially where the organisation aims to get value for each pound of maintenance funds.

8.20 RECOMMENDATIONS

Introduce Management by Objectives in Budget Compilation

Adoption of management techniques such as management by objectives will provide real assistance in maintenance budgetary control systems. The whole idea behind management by objectives is that objectives should be specified and that management and workers should agree on the results by which the workers are to be judged in accordance with these objectives. At each level objectives are formualted, discussed, agreed to and passed up the hierarchy to the management. This will require the maintenance manager to establish maintenance standards by which performance should be judged of each maintenance job and a detailed plan for improvement of performance in all maintenance works. For budgetary control sufficient information should be provided to the management and operatives of proposed jobs in a budget showing how much is expected to be spent on it and how long it will take to complete the work. This will assist in working out acceptable times of completion of jobs and planning for the work throughout the whole period so as to achieve an even cash flow of maintenance funds.

8.20.1 Establishing Maintenance Standards

Maintenance standards should be established for each job and potential acceptable levels for each type of maintenance job clearly defined for each property. In setting up these standards it is essential to ensure:

8.20.1.1 that the establishment of authorised expenditure limits of each type of maintenance is known and that the limits set are related to the anticipated return or gains to be derived from the achievement of the stipulated standards.

8.20.1.2 that there is a system of assigning priorities to the various items in the maintenance budget so that the less important items can clearly be identified. This is particularly vital for planning of maintenance work to spread over the whole budget period. Priorities should be assigned to show when a particular job should start to be done and estimated completion dates. The use of a priority sequence shows when the job can be done. For example:

i. Priority 1 - will designate emergency works. This priority covers any work that must start within twenty-four hours after the need for it becomes apparent.

ii. Priority 2 - will designate work that must be started at a given time to prevent further damage occuring.

iii. Priority 3 - will cover jobs other than emergencies. It can also cover additions and alterations necessary to improve the condition of the building or its performance. Jobs within this priority are started within seven days of the time the work order is written.

iv. Priority 4 - designates all work not covered by any other priority. Jobs in this classification will be started within thirty days of the time the work order is written.

8.20.1.3 that there is a defined procedure to be adopted in determining maintenance frequencies of maintenance jobs. The methods for doing this involve the use of past maintenance data over a set period so that a trend can be established of how often certain defects occur in certain properties. Analysis of past job tickets and works orders issued to contractors over say a ten year period will be useful to establish past expenditure patterns of the organisation. By use of statistical methods it is possible to determine the rate of increase in the maintenance budget each year within the set period of analysis. Such increases may be due to an increase in building stock requiring more funds for particular maintenance work, or due to existing stock of buildings requiring higher maintenance costs to maintain them to

acceptable standards especially old buildings; or due to merely increases due to a sharp rise in the general level of prices especially in an inflationary economic climate. Proper planning will ensure that items requiring frequent attention are included in a planned preventive maintenance programme. Use of such trends should be made with some reservation however, for the underlying assumption of using past maintenance data is that good maintenance management techniques in the control and execution of jobs were used. Some high costs are likely sometimes to be due to:

a. bad job methods adopted;

b. incorrect entries for labour manhours and expenditures by difference trades;

c. lack of records of physical consumption and expenditure by different types of materials, and

d. incorrect records of actual utilization of plant and machinery in the past.

8.20.1.4 that a systematic approach is adopted in forecasting the probable costs of deferring maintenance jobs proposed in the budget. The maintenance manager should be able to predict the consequences of various maintenance alternatives likely to occur due to failure to allocate funds for a particular job when it is most economic to execute it. The

probability of such costs being incurred in the future should be made clear to the management so that before any cuts of maintenance funds are made, it is left in no doubt of the full consequences of such cuts. For plant and equipment comparisons should be made using discounting methods to show economic consequences of either replacing or repairing a particular component. Statistical methods of probability can be applied to predict occurence of certain maintenance defects especially where these show a uniform pattern of occurence over time. Due to the uniqueness of their nature, small and quite irregular, maintenance jobs do not confirm to a distinguishable pattern. However, with a careful analysis of cocurences of such small jobs over a period, a discreet pattern is most likely. This is what should be taken into account in predicting occurence of small maintenance jobs but not the individual job pattern which normally is quite irregular.

8.20.2 Intensive Survey to Determine Maintenance Needs

For forecast with some degree of certainty the various amounts required for each maintenance operation proposed in the budget, a careful assessment of the initial property of the organisation is needed to ascertain the various requirements of each property. An inspection report or manual is essential to record findings of such a survey and the proposed actions to put such properties to acceptable standards. This requires the skills of technical

officers with proper knowledge of the various estates and the nature of work required in each. Once such data is recorded it is necessary to carefully plan the maintenance work load in a pattern such that it is easy to identify which jobs fall under planned preventive, routine maintenance programmes, emergency works and improvements. An initial assessment as to how much each category will cost is necessary especially when there are not sufficient funds to cover all the proposed works. The maintenance budget should show how the proposed works will be executed either by direct labour or contract. An even distribution of the work load is recommended all the time so that there is no one time the direct labour force is overloaded with lots of pending work orders or left to stay idel for months.

8.20.3 Introduction of Life Cycle Costing

Life cycle costing techniques should be adopted to show total occupancy costs of each maintenance operation over the whole period of the budget. This involves converting the maintenance expenditure flow on a particular job to the present value at a chosen discount rate to give a discounted cash flow of that job. This will help to show with more accuracy the amounts expected to be spent each period and help to plan jobs more evenly throughout the budget period. For maintenance it is good practice to envisage a longer budget period than the usual accountants period of one year. Usually a maintenance budget should be spread over a five year period with annual provisions allowed for in the short term budget. Maintenance budget planning should be based on this long term

maintenance budget for five years evenly distributed to avoid irregular maintenance expenditure fluctuations. Maintenance expenditure profiles for individual maintenance jobs may be unevenly distributed but a combination of several maintenance operations costs profiles will show a more even spread of maintenance expenditure. This should aid management in deciding how much should be allocated for maintenance expenditure in the particular proposed budget.

8.20.4 Development of a Budget Manual

For a good budgetary control system in maintenance it is advisable to develop a budget manual which sets forth:

8.20.4.1 the objectives of the particular budget. These objectives should be in tune with the overall objectives of the organisation.

8.20.4.2 the part which maintenance budgetary planning and control plays in the accomplishment of these objectives. It should be precisely stated what the particular budget is aiming to achieve in terms of better conditions of use of a property, improved user satisfaction which may indirectly contribute higher levels of production or lower costs to be incurred in subsequent periods in future.

8.20.4.3 the specific procedures to be followed in the preparation of maintenance budgets. These will include initial survey of all the building stock, establishing of maintenance standards to be achieved, ranking of all maintenance jobs in various planned maintenance programmes, routine,

emergency maintenance and improvements. Then establishing control limits for each job and corrective measures to be adopted in cases of under or over expenditures.

8.20.4.4 the preparation of variance reports to record deviations from the budget establishing their causes, and the size and incidence of such variations. Records of these should be maintained for comparisons with actual budgets.

8.20.4.5 the reports comparing budgeted and actual performance should be prepared to assess the efficiency of the management. Various effective performance measures should be adopted especially where there is a large proportion of directly employed labour. Costs comparisons of executing maintenance jobs by use of direct labour and contractors could be made to show which of the two methods is cost-saving for the organisation in the long-run.

8.20.4.6 the functions and the role of the maintenance manager as a maintenance budget officer and his relationship with the various levels of management in the development of the system of maintenance budgetary control.

8.20.5 Budgetary Control and Evaluation of Management Efficiency

Maintenance budgetary control systems can be used as a basis for control and evaluation of management efficiency by comparing the estimates proposed in the budget with the actual expenditures incurred over the budget period. The control embraces every expenditure incurred in maintenance jobs. The chief value of a maintenance

budget as a control device will be realised through the effective use of reports and meetings to discuss progress. Reports should be compiled showing annual and monthly budgets, actual expenditure, the variance between actual and the maintenance budget and usually the percentage variance. If such comparisons show "significant" variations, some comments as to their definite or probable causes should be included in order to assist the management in taking appropriate action. Such maintenance reports should highlight the essentials and deviations and possibilities for improvement. These reports should show for example:

8.20.5.1 what the maintenance expenditure should have been;

8.20.5.2 how closely the maintenance manager came to meeting the expected level of expenditure or by how much such level was exceeded;

8.20.5.3 whether there is a significant trend of improvement in terms of performance compared with past budget periods or not;

8.20.5.4 establish a means of explaining the maintenance cost variances so that a thorough knowledge of their causes can be used as a weapon to guard against further cuts of maintenance expenditure.

8.20.6 Use of a Computer for Budgetary Control

Use of operational aids especially the use of a computer will improve the flow and quality of maintenance budgetary information. To introduce a computer requires a good maintenance management information system. The effectiveness of the system depends entirely on the maintenance manager's ability to make use of the reports and information produced for budgetary control which is likely to result in:

8.20.6.1 shortening the maintenance planning cycle by removing much of the manual calculation.

8.20.6.2 improving accuracy of maintenance expenditure forecasts by effectively using the power of the computer.

8.20.6.3 continuous maintenance forecasting being made possible by speed of calculations.

8.20.6.4 spot analysis of maintenance expenditures and capacity to question results and examine assumptions on the maintenance expenditure input data.

8.20.6.5 the possibility of evaluating expenditure alternatives of each maintenance operation and bring into easy access through visual display units the data and computational procedures used to compile the maintenance budget to the management whenever required.

Maintenance managers need to know the current maintenance work load backlog and performance record for comparison with the budgeted expenditures. Facilities which can be provided by the computer is to produce:

a. backlog summary report which will provide an analysis of backlog of work on hand for the next one to fifty-two week period;

b. completed work order report containing information about all work orders completed during the week;

c. maintenance delays report giving information on the cause of lost time and showing the hours lost, per category, related to total hours worked;

d. exception report which pinpoints all work orders that have, for example, exceeded predefined limits such as:

   i. job behind schedule by specific amount.

   ii. job over or under predetermined performance percentage levels.

   iii. job over or under predetermined estimated cost levels.

The computer offers opportunities of analysing maintenance costs and establishing maintenance expenditure trends and incidence of maintenance budget variances and also show the effects of alternative budgetary choices. A properly written computer programme will substantially reduce the number of human errors which inevitably creep into calculation of maintenance costs. Figure 8.1 illustrates a suitable maintenance information flow for financial control in maintenance.

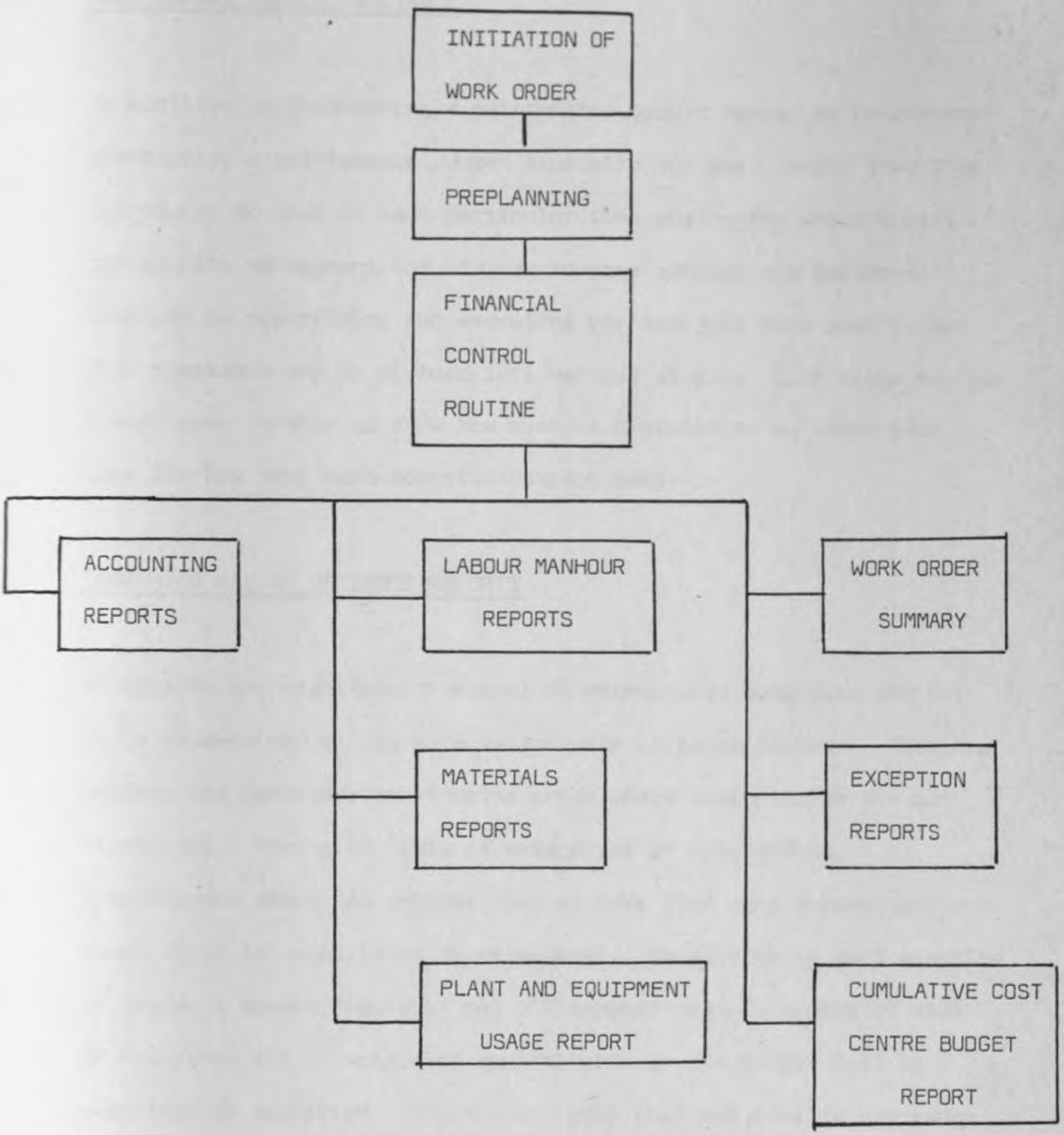


FIGURE 8.1 : Information Flow - Maintenance Financial Control

8.27 MAINTENANCE BUDGET TIMETABLE

In addition to introducing a maintenance budget manual as recommended previously, a maintenance budget timetable for each period should be introduced so that at each particular time during the whole budget period, the management and the maintenance manager and personnel involved in supervising and executing various jobs know what to do. This timetable may be divided into various stages. Each stage may be broken down further to show how much is expected to be spent each time and how long each operation should take.

8.28 INCREASED USE OF VARIANCE REPORTS

To achieve any significant control in maintenance budgetary control it is recommended to use more extensively variance reports. Variance reports are necessary to pinpoint areas where expenditures are out of control. They give lists of categories of maintenance expenditures which are greater than or less than some percentage range which is established by management. Usually it is good practice to choose a common figure of say all expenditures in excess of 110% or less than 90% of estimated expenditures in the budget must be explained or justified. In this way jobs that are outside the range are systematically brought to the attention of the management.

To summarise in order to achieve good maintentance budgetary control proper maintenance management is essential. This requires a maintenance management information system which will provide management with a series of reports for maintenance planning, performance of maintenance work and control of maintenance costs.

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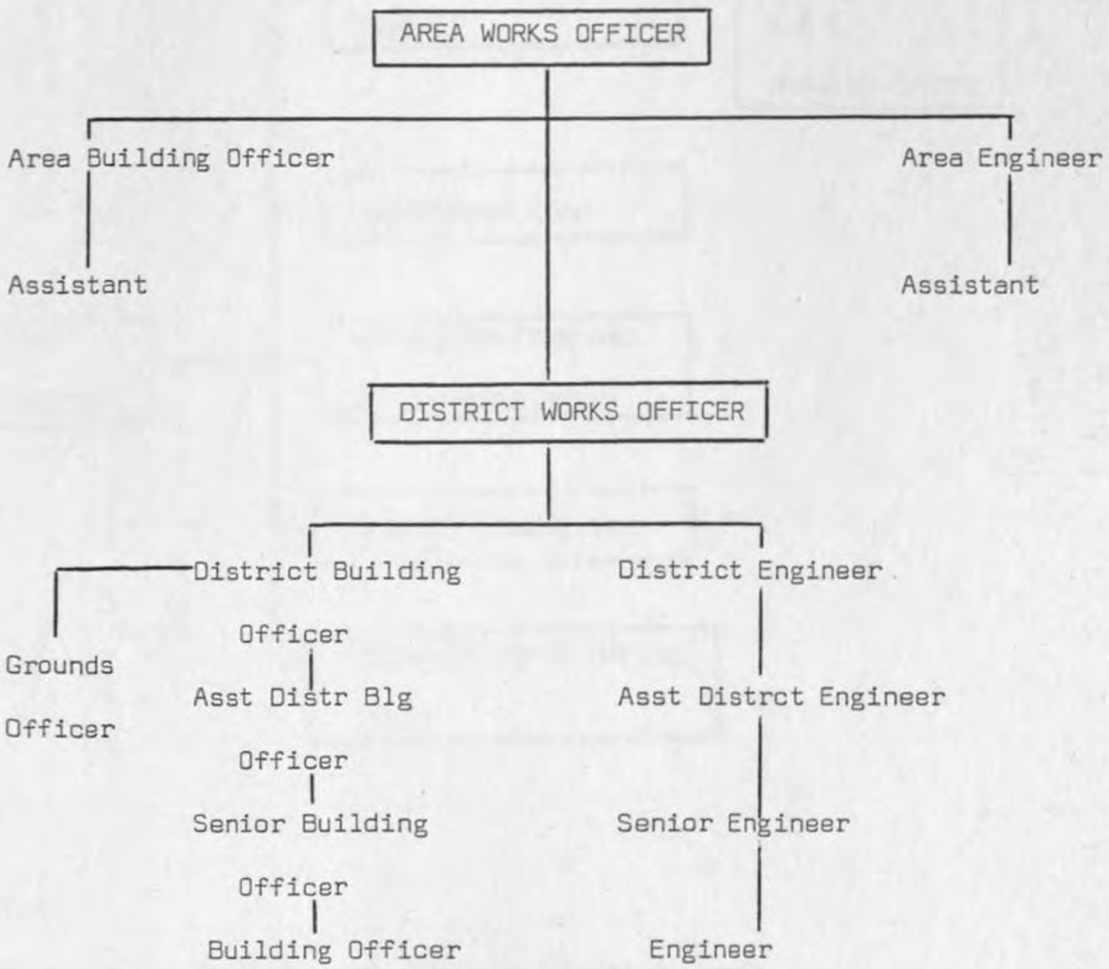
APPENDIX A

Devon Area Health Authority : Maintenance Management Structure

SOURCE : BMCIS - Case Study 396 1980/81-93-11.

The Area Health Authority has the following management structure:



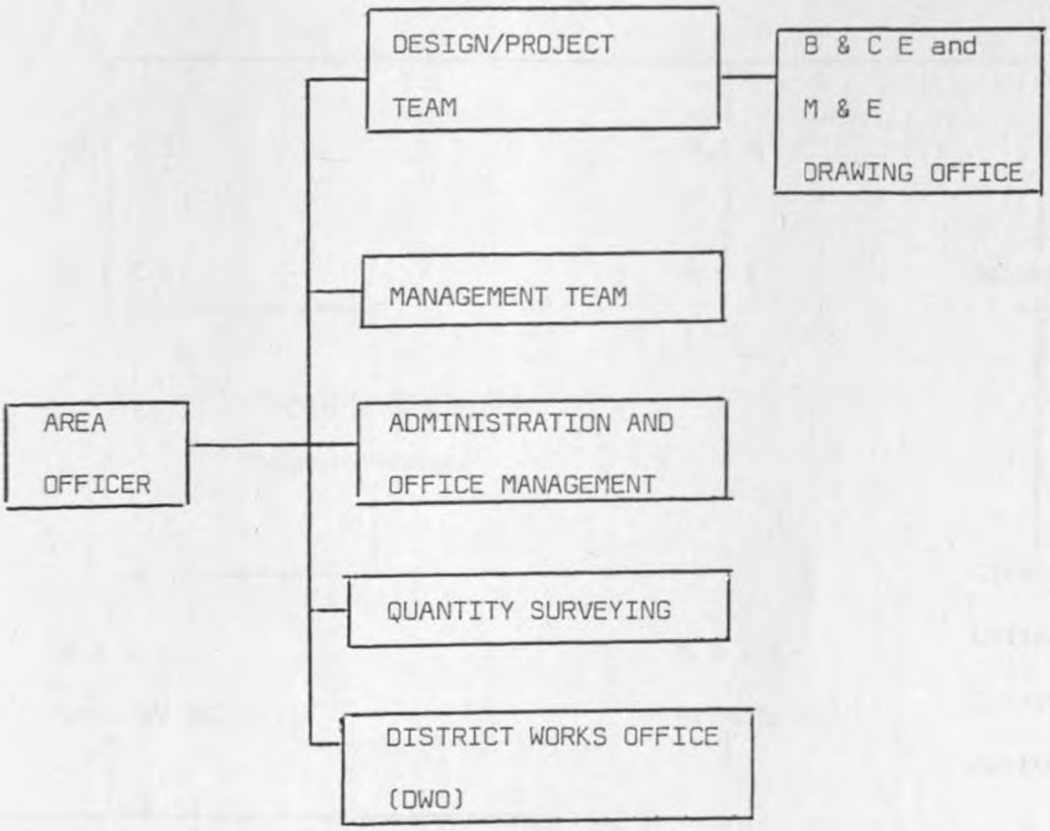
Building, Engineering and Grounds Craftsmen

plus Secretary and Administrative Staff

The structure from the District Works Officer downwards is basically repeated for four districts.

APPENDIX B

The PSA Area Office Organisation : The following chart shows a typical area office organisation for the administration, control, planning and execution of development and maintenance works.



KEY:

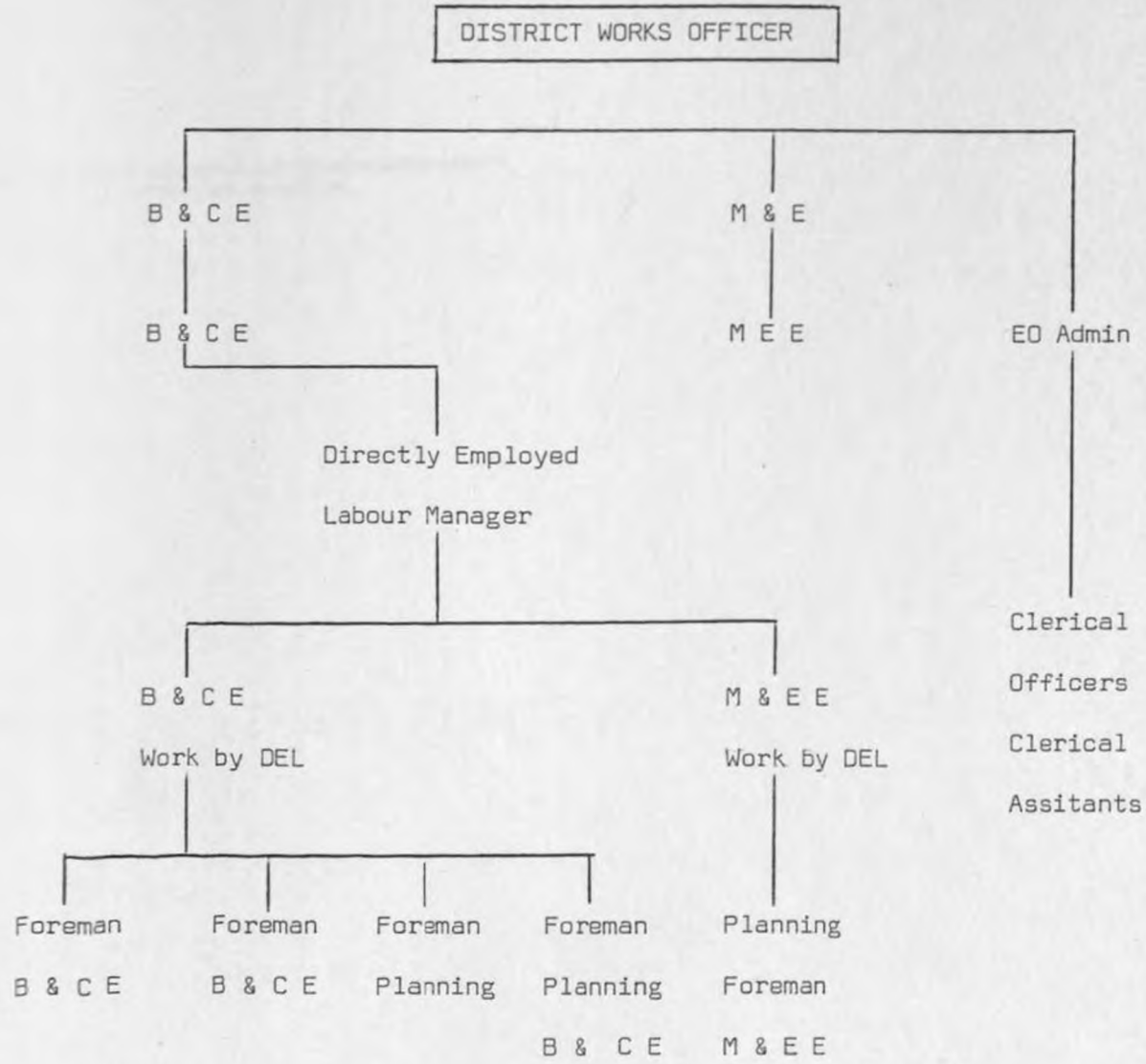
B & C E - Building and Civil Engineering Works.

M & E - Mechanical and Electrical

SOURCE : DOE/PSA - District Works Office Code, February 1981

APPENDIX C

The PSA District Works Office organisation. A typical DWO organisation is shown in the following outline:



SOURCE : DOE/PSA - District Works Office Code, February 1981.

DRAFT ORDER TO PROCEED ON WORKS SPECIALIST TERM CONTRACT

(Note to Originator: An order for additional work on STC must be made on form W4)

Payee No.

Contract No.

(Omit all punctuations marks, 'CON', obliques or irrelevant prefixes or suffixes)

DWO's EUN

To:

Order Commencement Date

Order Completion Date

Carry out work in accordance with the terms and conditions of the above contract at:

From:

Signed.....

PSA ORDERING OFFICER

Name.....

(BLOCK LETTERS)

Grade..... Date.....

ADDRESS

Telephone:.....Ext. .....

DRAFT FOR/COPY OF ORDER ON *

APPENDIX M

...ment of the Environment
...rty Services Agency

EASURED TERM CONTRACT WORKS ORDER

...er No.

...tract No.

This order varies order No.

From: **Department of the Environment**

.....

.....

..... Tel. .....

Please carry out the work detailed below on or before...../...../.....under the terms of the above contract.

Signature..... District Works Officer/Area Job Officer*

Name.....Date...../...../.....

...t ...e

Client's Ref. No. (where appropriate)

...	Site/Building/Room etc.	Supplementary Condition No. 50A will/will not apply* **Description of Work** FOR INTERNAL USE ONLY–NOT AN ORDER ON A CONTRACTOR	Estimated Price

...Supervising Officer will be:–

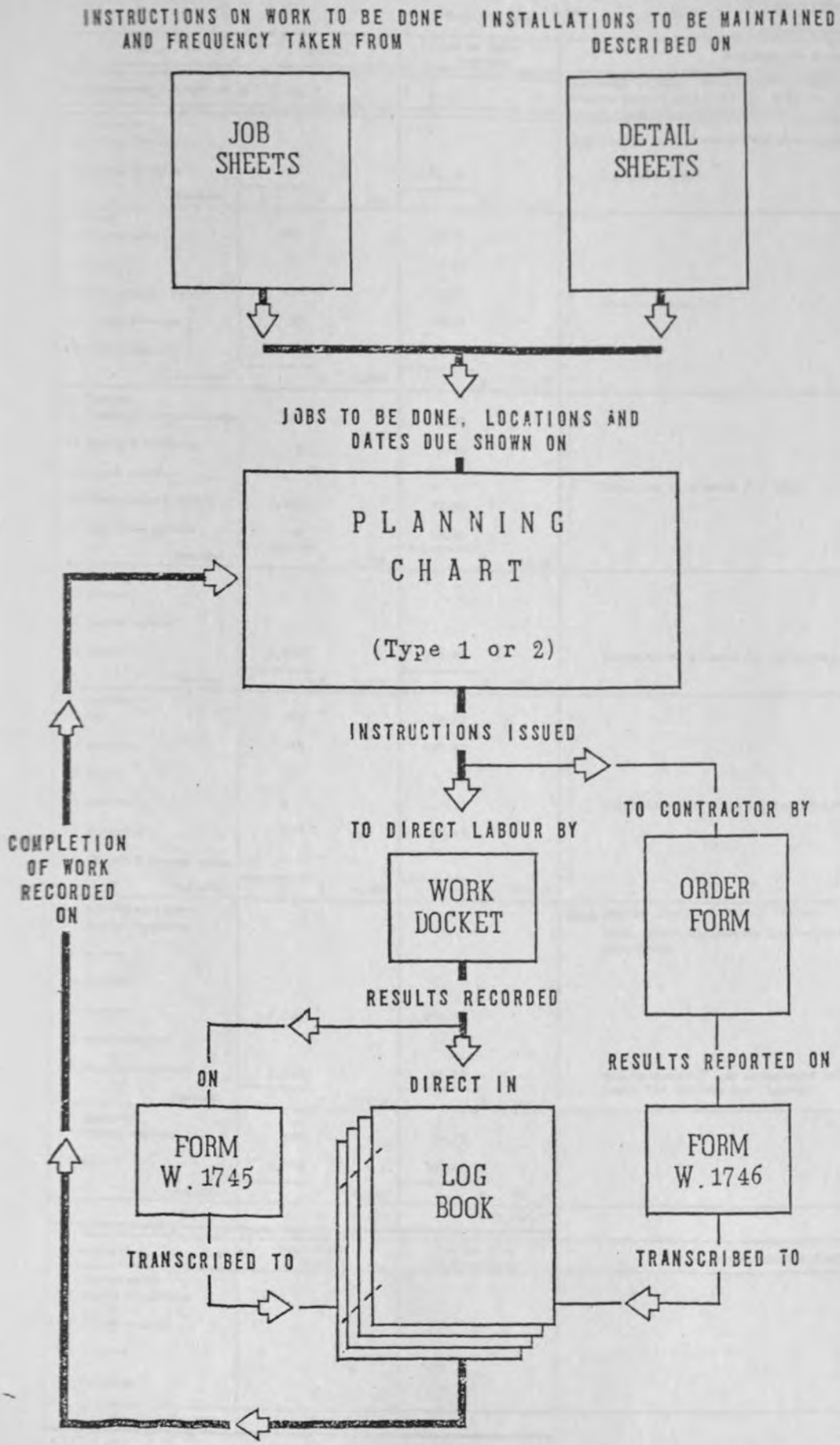
Total Estimated Cost = £

FINANCIAL STATEMENT (CONSOLIDATED) FOR YEARS 1970/71 - 1978/79

Gross Floor Area 1970/71 - 1975/76 1,217 m²
1976/77 Onwards 1,460 m²

Element	FINANCIAL YEAR								
	1970/71	1971/72	1972/73	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79
	Cost per 100 m² F.A.	Cost per 100 m² F.A.	Cost per 100 m² F.A.	Cost per 100 m² F.A.	Cost per 100 m² F.A.	Cost per 100 m² F.A.	Cost per 100 m² F.A.	Cost per 100 m² F.A.	Cost per 100 m² F.A.
0. Improvements & Adaptations	-	2.14	8.79	402.96	-	2,465.08	35.27	-	81.03
1. Decoration	16.19	-	17.42	32.37	-	60.15	7.33	14.52	52.33
2. Fabric	22.43	22.84	89.81	13.48	29.66	60.89	24.38	98.43	141.37
3. Services	28.43	26.79	42.15	28.10	70.01	50.62	110.27	85.27	83.49
4. Cleaning	83.65	96.71	118.49	139.93	189.65	198.60	212.81	223.63	240.82
5. Utilities	97.62	104.19	121.36	120.13	162.20	190.39	211.99	238.15	291.44
6. Administrative Costs	346.18	337.06	370.09	427.94	735.00	928.26	1,019.45	1,128.08	1,359.93
7. Overheads	115.12	116.35	114.05	140.35	195.65	223.91	245.96	274.38	297.19
TOTAL	709.62	703.94	873.37	902.30	1,382.17	1,712.82	1,832.19	2,062.45	2,466.57
8. External Works	-	-	-	-	-	-	-	-	-

THE PLANNED MAINTENANCE SYSTEM



CI/SfB
561
Sports Centre - 1 - m

FINANCIAL STATEMENT FOR YEAR 1978/79
Gross Floor Area of Estate 131,817 m^2

Gross floor area: 1,460 m^2

Element	Total £	Cost per 100 m^2 floor area	Brief description of work
0. Improvements & adaptations	£ 1,183	£ 81.03	Rearrange cricket netting (£301), Alts. to winding gear (£81), Hanging basket balls (£555), Alts. to cricket net (£131) Repair floor trap covers (£115)
1. Decoration			
1.1 External decoration	-	-	Note Change to 2,4 and 8 year cycle internally
1.2 Internal decoration	764	52.33	Selected areas
Sub-total	£ 764	£ 52.33	
2. Fabric			
2.1 External walls	580	39.73	)
2.2 Roofs	21	1.44	)
2.3 Other structural items	190	13.01	) General repairs
2.4 Fittings & fixtures	59	4.04	)
2.5 Internal finishes	1,214	83.15	)
Sub-total	£ 2,064	£ 141.37	
3. Services			
3.1 Plumbing & internal drainage	74	5.07	)
3.2 Heating & ventilating	5	0.34	)
3.3 Lifts & escalators	-	-	)
3.4 Electric power & lighting	1,060	72.60	) Contains an element for PPM.
3.5 Other M & E surfaces	80	5.48	)
Sub-total	£ 1,219	£ 83.49	
4. Cleaning			
4.1 Windows	-	-	
4.2 External surfaces	-	-	
4.3 Internal	3,516	240.82	Contains an element for internal window cleaning
Sub-total	£ 3,516	£ 240.82	
5. Utilities			
5.1 Gas	993	68.02	)
5.2 Electricity	2,885	197.60	)
5.3 Fuel oil	-	-	)
5.4 Solid fuel	-	-	) Allocations by Area/Population ratios
5.5 Water rates	377	25.82	)
5.6 Effluents & drainage charges	-	-	)
Sub-total	£ 4,255	£ 291.44	
6. Administrative costs			Note Change in direct labour force:-
6.1 Services attendants	-	-	Mech. plant attendants incl. boiler shift men 8
6.2 Laundry	-	-	Groundsmen 19
6.3 Porterage)			
6.4 Security)	18,606	1,274.38	
6.5 Rubbish disposal)			
6.6 Property management	1,249	85.55	Maintenance Officer management only, excludes management costs for Porters and Cleaners.
Sub-total	£ 19,855	£ 1,359.93	
7. Overheads			
7.1 Property insurance	580	39.73	
7.2 Rates	3,759	257.46	
Sub-total	£ 4,339	£ 297.19	
TOTAL	£ 36,012	£ 2,466.57	

External area ..... m^2	External works Total £	Cost per 100 m^2 of external area	Brief description of work
8. External works			
8.1 Repairs & decoration			
8.2 External services			
8.3 Cleaning			
8.4 Gardening			
External Works Total	£	£	

OVERALL COST PER P.S.H. MONTH: JUNE

DISTRICT: 21 1978-1979

		OVERHEAD COST/PSH AS SHOWN BY CALCULATION SHT										
Code	Trade	Basic Cost/ P.S.H	Direct Labour 'On Cost'	Trade Super-visors	Support	Driving	Labour-ing	Estab & Misc Charges	Trade Transport	General Transport	Trade Materials & Stores	Overall Cost/ P.S.H.
11	Painters	2.26	0.93	0.08	NA	0.29	NA	1.70	Nil	0.20	0.76	6.22
12	Bricklayers	2.41	0.99	0.09	0.33	0.29	0.73	1.70	0.43	0.20	1.37	8.54
13	Carpenters	2.81	1.15	0.09	0.33	0.29	0.73	1.70	0.63	0.20	3.90	11.83
14	Plumbers	3.07	1.25	0.09	0.33	0.29	0.73	1.70	0.53	0.20	3.33	11.49
15	Electricians	2.91	1.19	0.09	0.33	0.29	0.73	1.70	1.31	0.20	3.98	12.73
16	Glaziers	1.60	0.66	0.08	0.33	0.29	0.73	1.70	0.92	0.20	2.95	9.46
18	Fencing/B'up											
25	Gardeners	2.02	0.83	0.31	0.33	0.29	0.73	1.70	0.27	0.20	0.26	6.94
26	Dust/Drains	2.75	0.84	0.13	0.33	0.29	0.73	1.70	1.50	0.20	-	8.72

GLC HG

Greater London Council – Housing Department – Maintenance Branch

Cost/PSH Comparison of D L with Contractors

TRADE	OVERALL COST per P.S.H.				Annual PSH's.	Extra Cost i
	Direct Labour	Contractors	Difference	% Increase	Completed by Direct Labour	D/L Work don by Contracto
	£	£	£	%		£
PAINTERS	6.92	7.72	0.80	+ 11.6	1,652,084	1,321,667
BRICKLAYERS	10.13	11.94	1.81	+ 17.9	408,759	739,854
CARPENTERS	14.88	23.50	8.62	+ 57.9	398,170	3,432,225
PLUMBERS	14.25	14.67	0.42	+ 3.0.	506,521	212,739
ELECTRICIANS	12.45	30.11	17.66	+141.8	210,455	3,716,635
GLAZIERS	13.85	10.92	2.93	- 21.2	100,722	- 295,115
TOTAL ADDITIONAL COST IF DIRECT LABOUR WORK WERE TO BE DONE BY CONTRACTORS						£9,128,005

NOTES : The above figures have been calculated using the Contracts in force during 1979 / 80.

1.	2.	3.	4.	5.	6.	7.	8.
Item No. From Schedule.	JOB DESCRIPTION	Occasions Job Occurred in Model	Workstudy Code	Standard Minutes per Job	Total Productive Standard Hours @ $\frac{3 \times 5}{60}$.	Fixed Price Contrac	
						Cost per Job (G.L.C.)	Total Cost 7 x 3.
53	Fit 2 new butt hinges to cupboard door.	76	CD/D	23	29.13.	4.73.	359.48.
54	Replace ball catch or cupboard catch.	612	CD/G	11	112.20.	1.73.	1059.76.
63	Ease external door without removal.	378	ED/A	6	37.80.	3.31.	1251.18.
66	Fit 2 new butt hinges and re-hang external door.	422	ED/F	40	281.33.	6.30.	2658.60.
67	Remove defective entrance door, fit new on 2 butts.	212	ED/G	74	261.47.	37.24.	7894.88.
69	Fit Wellington mortise night latch to existing door.	14	LN/F	83	19.37.	13.16.	184.24.
74	Remove defective letter plate and fix new.	77	ED/M	33	42.35.	9.83.	756.91
75	Fit new weather board to new door.	158	ED/K	11	28.97.	4.34.	685.72.
77	Fit rim lock to new door.	130	LN/C	29	62.83.	8.34.	1084.20.
78	Fit new 6-screw bolt to new door.	10	T/K	15	2.50.	1.97.	19.70.
79	Fit safety chain to new external door.	6	ED/W	9	0.90.	0.75.	4.50.
81	Re-secure loose door frame. (per fixing)	552	DF/C	8	73.60.	5.51.	3041.52.
93	Take off, ease and re-hang pair of garage doors.	13	TC40	95	20.58.	21.00.	273.00.
99	Hang new external cupboard or pramshed door or gate.	119	T/D	42	83.30.	33.55.	3992.45.
100	Renew single board to ledged and braced door.	44	MC/A+MC/B	7.5	5.50.	3.78.	166.32.
101	Ease external tee-hinged door or gate after removal.	64	T/B	28	29.87.	3.15.	201.60.
154	Renew plastic W.C. seat.	101	WC/A	9	15.15.	5.27.	532.27.
155	Renew 2-piece plastic W.C. seat.	101	WC/A	9	15.15.	7.82.	789.82.
	TOTALS				2573.82.		45771.72.

Add average job allowance percentage = $\frac{7 \text{ SM's}}{154 \text{ SM's (Ave.work content)}} \times 100. = 4.54\%$ Note: this allowance is for initial preparation etc.

Total P.S.H's. + 4.54% = Overall total of 2573.82. + 4.54% = 2691 Productive Standard Hours.

Model of Typical Work

TRADE = Carpentry

1.	2.	3.	4.	5.	6.	7.	8.
Item No. From Schedule	JOB DESCRIPTION	Occasions Job Occurred in Model	Workstudy Code	Standard Minutes per Job	Total Productive Standard Hours Col $\frac{3 \times 5}{60}$.	Fixed Price Contract: Cost per Job	Fixed Price Contract: Total Cost Col 7×3.
4/ 1.	Re-cord bottom sash, (Double hung).	17	DH/A	33	9.35.	4.57.	77.69.
3.	Re-cord top and bottom sash, (Double hung).	69	DH/C	49	56.35.	8.82.	608.58.
7.	Replace double hung sash fastener.	155	DH/J	9	23.25.	1.84.	285.20.
8.	Ease hopper/fanlight sash without removing.	336	HF/A	15	84.00.	2.05.	688.80.
10.	Remove sash, renew hinges, ease and re-hang.	78	HF/C	43	55.90.	4.25.	331.50.
12.	Remove and re-fit fanlight quadrant stay.	72 prs.	HF/G	6	14.40.	2.73.	196.56.
14.	Remove and re-fit fanlight cord catch.	118	HF/H	21	41.30.	3.12.	386.16.
15.	Ease casement sash without removal.	380	CS/A	13	82.33.	2.36.	896.80.
16.	Remove casement sash, fit 2 new hinges and re-hang.	57	CS/C	41	38.95.	4.25.	242.25.
17/19	Remove and replace casement stay.	335	CS/F	11	61.42.	3.32.	1112.20.
20/30	Replace section of damaged stile or rail.	512	WR/C	46	392.53.	8.66.	4433.92.
43	Remove old and fit new draining board.	303	DB/SA	48	242.40.	23.75.	7196.25.
44	Renew wall bearer when replacing draining board.	131	DB/B	11	24.02.	1.58.	206.98
48	Fit and fix framework and front bath panel.	165	BP/D	100	275.00.	18.11.	2988.15.
50	Ease door without removal.	153	ID/A	6	15.30.	2.84.	434.52.
51	Ease door and hinge recesses after removal.	34	RB/D	21	11.90.	5.88.	199.92.
52	Ease cupboard door without removal.	281	CD/A	5	23.42.	1.89.	531.09.

Continued .....

Analysis of Costs

District 32 - EASTERN

Month SEPTEMBER '80.

TRANSPORT

COSTS :-

Class 1 - Minis & Escorts £55. per week

Class 2 - Transits & Similar £83. per week

Class 3 - Heavier Vehicles £121. per week

Overhead Group:-	TRADE	Vehicle Class	No. of Vehicles	Total Cost per Week	Total Cost per Month	Total P.S.H's.	O/Head Cost per P.S.H.	Allocat to Trade
TRADE TRANSPORT i.e. Those Vehicles used exclusively by one trade.	11. PAINTING	1.	-	-	-	9330	-	11
		2.	-					
		3.	-					
	12. BRICKLAYING	1.	-	£166	£664	2747	0.24	12
		2.	2					
		3.	-					
	13. CARPENTRY	1.	2	£359	£1436	2744	0.52	13
		2.	3					
		3.	-					
	14. PLUMBING	1.	7	£800	£3200	5073	0.63	14
		2.	5					
		3.	-					
	15. ELECTRICAL	1.	10	£550	£2200	2491	0.88	15
		2.	-					
		3.	-					
	16. GLAZING	1.	1	£470	£1880	1581	1.19	16
		2.	5					
		3.	-					
	18. FENCING & Bdg.-Up.	1.	-	£166	£664	541	1.23	18
		2.	2					
		3.	-					
	25. GARDENING	1.	-	£166	£664	3175	0.21	25
		2.	2					
		3.	-					
	26. DUST & DRAIN CLNG.	1.	-	-	-	-	-	26
		2.	-					
		3.	-					
GENERAL TRANSPORT Vehicles not shown above.	ALL TRADES	1.	4.	£1043	£4172	27682 ALL.	0.15	ALL
		2.	7					
		3.	2					

Analysis of Costs

District 32 - EASTERN

Month SEPTEMBER

Basic Cost per P.S.H.

TRADE	11	12	13	14	15	16	18	25	26	TOTAL
WAGES	26847	7290	10297	20110	8833	6750	1877	7098	-	-
P.S.H's.	9330	2747	2744	5073	2491	1581	541	3175	-	27682
COST / P.S.H.	2.88	2.65	3.75	3.96	3.55	4.27	3.47	2.24	-	-
DIRECT LABOUR ON-COST = 41%	1.18	1.08	1.54	1.63	1.45	1.75	1.42	0.92	-	-

Overhead Cost per P.S.H.

OVERHEAD GROUP	Personnel in Group	A Weekly No.of Personnel in Group	B Cost per Person per week	C Total Cost per week A x B	D Total Cost per month C x 4 or 5	E Total PSH's as Indicated	F Overhead Cost per PSH D ÷ E	G Allocat to Trade
LABOURING	Sector & Other Labourers	16 + 2	£137	2466	9864	18352 All exept Trade 11	0.54	All Except Trade 1
DRIVING	Trans.Sup. Drivers Drivers Mates	8	£176	1408	5632	27682 All.	0.20	All
SUPER-VISORS	Painting Sup.	1	£220	220	880	9330 11+16 only	0.09	11 & 16
	Gardening Sup.	1		220	880	3175 25 only	0.28	25
	B.T.S.	2.5		550	2200	13596 remainder	0.16	All exce 11,16,2
SUPPORT	District C/hands & Clerks	6 + 2	£190	1520	6080	18352 All exept Trade 11	0.33	All Except Trade 1
MISC. & ESTA CHARGES	Not Applicable			9550	38200	27682 All	1.38	All

Materials, Equipment & Stores Operatives On-Cost

TRADE	11	12	13	14	15	16	18	25	26	TOTAL
COST	7341	9782	11191	12950	4185	5327	4231	379	-	-
P.S.H's.	9330	2747	2744	5073	2491	1581	541	3175	-	27682
COST / P.S.H.	0.79	3.56	4.08	2.55	1.68	3.37	7.82	0.12	-	-
Allocate to Trade	11	12	13	14	15	16	18	25	26	-

GLC Housing Maintenance – Procedural Map

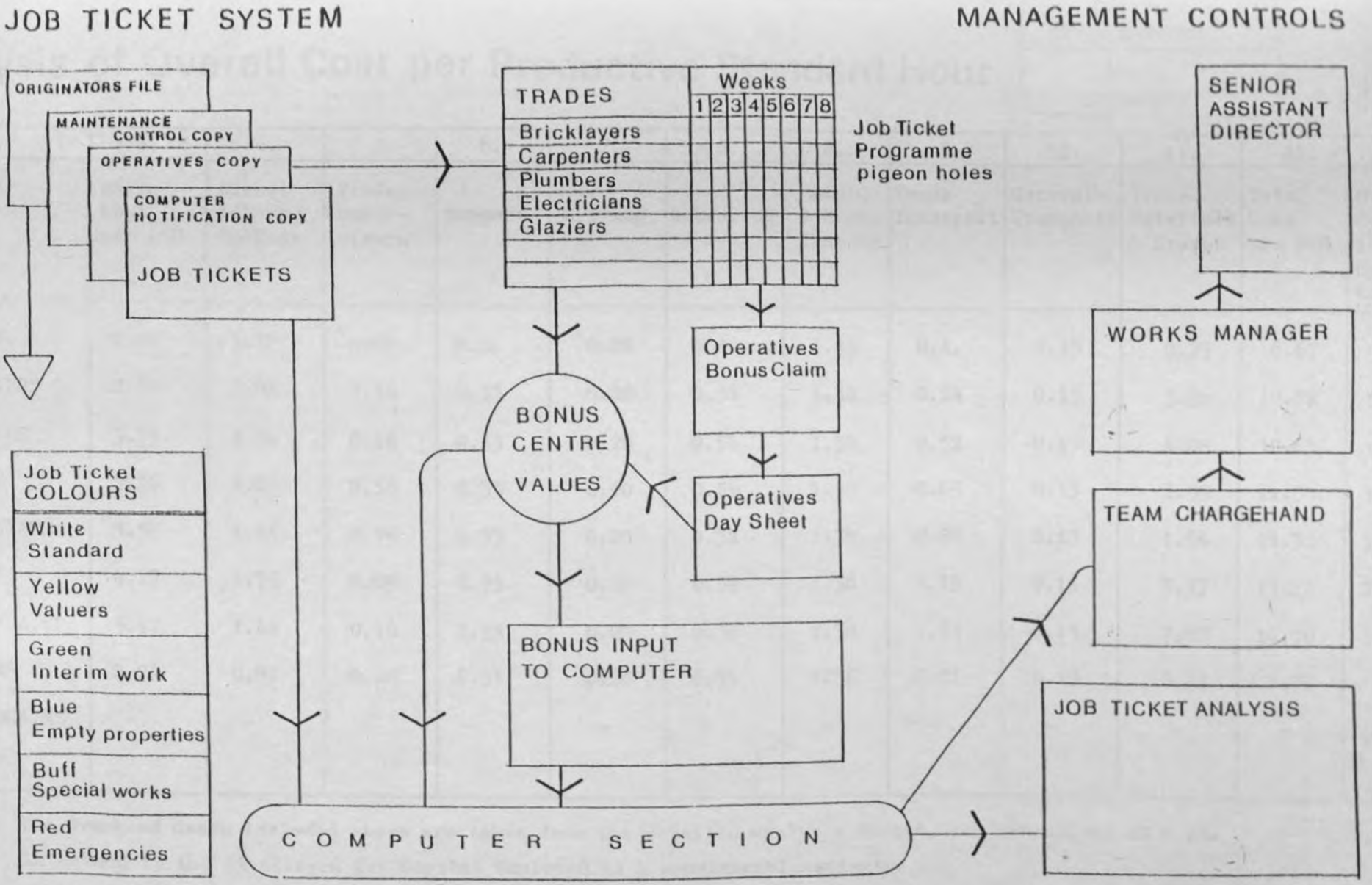


FIGURE 4.6

Greater London Council - Housing Department - Maintenance Branch

District
32 - EASTERN

Month
SEPTEMBER

Analysis of Overall Cost per Productive Standard Hour

.	2.	3.	4.	5.	6.	7.	8.	8.	9.	10.	11.	12.	13.
le	TRADE	Basic Cost per PSH	Direct Labour On-Cost	Trade Super-visors	Support	Driving	Labouring	Estab. & Misc. Charges	Trade Transport	General Transport	Trade Materials & Stores	Total Cost per PSH	Overall Cost/PSH inc. 2% for Capital Employed
1.	PAINTERS	2.88	1.18	0.09	N.A.	0.20	N.A.	1.38	N.A.	0.15	0.79	6.67	6.80
2.	BRICKLAYERS	2.64	1.08	0.16	0.33	0.20	0.54	1.38	0.24	0.15	3.56	10.28	10.48
3.	CARPENTERS	3.75	1.54	0.16	0.33	0.20	0.54	1.38	0.52	0.15	4.08	12.65	12.90
4.	PLUMBERS	3.96	1.63	0.16	0.33	0.20	0.54	1.38	0.63	0.15	2.55	11.53	11.76
5.	ELECTRICIANS	3.55	1.45	0.16	0.33	0.20	0.54	1.38	0.88	0.15	1.68	10.32	10.53
6.	GLAZIERS	4.27	1.75	0.09	0.33	0.20	0.54	1.38	1.19	0.15	3.37	13.27	13.53
7.	ZINCING/Bd.UP	3.47	1.42	0.16	0.33	0.20	0.54	1.38	1.23	0.15	7.82	16.70	17.03
8.	GARDENERS	2.24	0.92	0.28	0.33	0.20	0.54	1.38	0.21	0.15	0.12	6.37	6.50
9.	DUST & DRAINS	-	-	-	-	-	-	-	-	-	-	-	-

NOTES: The Overhead Costs included above are taken from the detailed analysis sheets, see Appendices A2 & A3.
In column 13 the 2% allowed for Capital Employed is a provisional estimate.

	Operations of Service	Frequency	Relationship to other operations of time allowed to complete operation
11.00	DRY RISERS AND ALL FIRE FIGHTING EQUIPMENT	Twice per year	Check dry-riser to ensure that all valves and fittings are in position and undamaged. Check all hose reels and fittings and all fire extinguishers to ensure that they are fully charged and securely fixed. Resulting work to be programmed immediately. Arrange for fire prevention officer to check at the appropriate intervals.
12.00	ELECTRICAL RE-WIRING (Renewals)	25-30 years	Or as agreed on special renewals programme.
13.00	RENEWAL OF GAS WATER HEATERS	25 years	Or as agreed on special renewals programme.

	Operations of Service	Frequency	Relationship to other operations of time allowed to complete operation
7.00	Refuse		
7.01	Cleaning of hoppers on staircases and access balconies	3 times each year	Check to ensure hopper seal working correctly, check ventilation and that the chute lining is in a sanitary condition. Any grease or other dirt to be removed by approved treatment.
7.02	(a) Clean dust chute chambers	3 times each year	Paint internally or wash down as specified. Any defects to be reported to the Works Manager for action.
	(b) Chute cut offs	3 times each year	Repair immediately any defects or renew cut off.
8.00	Horticultural Work		
8.01	Grass cutting	Every 9 working days in normal growing periods	Reduce to 7 working days or less in peak growing periods or increase to 10 working days in slow growth periods of drought. (M1 to be consulted).
8.02	Hedge cutting	Twice a year	April/May and August/September. Cut only once in the year following splitting.
8.03	Hedge splitting to 30" high x 10" wide	1/5 each year	5 year programme. Between October/March.
8.04	Winter Programme	Yearly	As agreed by Horticultural Manager (M1)

	Operations of Service	Frequency	Relationship to other operations of time allowed to complete operation
9.00	Inspections and Servicing of Mechanical Plant.		
9.01	Woodworking machinery (including Timber Treatment Plant, compressed air Plant and Equipment, Dust Extractor Plant) and all other machinery	(a) Daily inspection as Procedural Note M3/306	Give immediate attention to any defect or servicing required.
9.02		(b) Not exceeding 6 months periods	To be inspected by the manufacturers or his agents (Supplies contact) at intervals not exceeding six months. Correct any defect immediately. Unserviceable machines shall not be used under any circumstances. See Procedural Note M3/306
10.00	PLAYGROUND EQUIPMENT		
10.01	All Playground equipment including boundary fencing, walls gates and ground surface	Daily Monthly	Visual inspection by Caretaker. All playground equipment to be tested monthly and action taken immediately on any defects. See Procedural Note M1/108.
10.02	Exhaustive condition tests on playground equipment	5 yearly	The 5 yearly exhaustive tests shall be carried out in co-operation with the Scientific Adviser. Equipment found to be defective must be immediately immobilised, made safe followed by immediate action to repair. For details see Procedural Notes Report of Scientific Adviser to be acted upon immediately.

Operations of Service		Frequency	Relationship to other operations of time allowed to complete operation
6.00	Inspections and Tests (Contd.)		
6.03	Power Tool Inspection and tests (including portable hand tools)	(a) Daily inspection when in use	Immediate attention to be given to any defects. Defective tools shall not be used see Procedural Note M3/308.
		(b) Monthly and annually as in Procedural Note M3/308	To be inspected by the manufacturers or his agents (Supplies contract) at intervals not exceeding six months. Correct any defect immediately. Unserviceable machines shall not be used under any circumstances see Procedural Note M3/306.
6.04	Scaffold and Plant	Monthly	Plant for external painting to be serviced in winter period and for internal painting to be serviced in Summer period. All shall be inspected monthly and appropriate action taken to ensure that only scaffold and plant in good condition are available for use.

Operations of Service		Frequency	Relationship to other operations of time allowed to complete operation
5.00	Servicing of Appliances and Equipment, Etc. (Contd.)		
5.07	Scale Reducers	Annually	Or more frequent where required and any shortening of time period to be agreed with M1.
5.08	Cleaning of ventilation ducts and individual extractor fans	Annually	During Summer period.
5.09	Gully and drainage channel cleaning	Annually	To include all public and private balconies.
5.10	Petrol and oil interceptors	Annually	To be inspected cleaned out where necessary.
6.00	Inspections and Tests		
6.01	Roof Storage Tanks	Annually	See procedural note. Special attention to be given to covers, overflows and trap.
6.02	(a) Multi storey blocks externally and common parts internally. (Quinquenial inspection)	5 years	To be thoroughly inspected 18 months ahead of external painting and followed by preparation of programme of works to meet requirement of item 1.00. Any Defective Premises Act and Safety at Work Act matters to be reported to M1 and dealt with immediately.
	(b) All other property externally. (Quinquenial inspection)		Blocks over 6 storeys in height shall be inspected from cradles. Quinquenial inspection of all property externally complete Form M114.

Operations of Service		Frequency	Relationship to other operations of time allowed to complete operation
4.00	Day-to-Day Repairs and Servicing		
4.01	Emergencies (Red job ticket) (safety, security, health reasons).		Complete within 24 hours of notification to Works Manager or make safe if a long job. (Progress must be checked daily by Works Manager until completed.)
4.02	Bricklaying repairs within	5 weeks (average)	5 weeks average programme but no repair jobs to be outstanding more than eight weeks of issue of Job Ticket.
4.03	Carpentry repairs within	4 weeks (average)	4 weeks average programme but no repairs to be outstanding more than six weeks.
4.04	Plumbing repairs within	3 weeks	3 weeks average programme but no repairs to be outstanding more than five weeks.
4.05	Glazing renewals within	2 weeks	2 weeks average programme but no repairs to be outstanding more than four weeks.
4.06	Electrical repairs	1-2 weeks	Average programme but no repairs to be outstanding more than three weeks.
4.07	Space heating	3 days or A.S.A.P.	Average programme.
4.08	Miscellaneous	5 weeks	5 weeks programme.
4.09	Fencing repairs	5 weeks	5 weeks programme.

Operations of Service		Frequency	Relationship to other operations of time allowed to complete operation
5.00	Servicing of Appliances and Equipment, Etc.		
5.01	Gas appliances including boilers	Annually	Only staff who have passed the Council's training scheme shall be engaged on this work. Central heating units to be serviced during Summer period, Hot water heaters all year round. Special attention to be given to ventilation.
5.02	Electric heating (all types)	Annually	Job ticket repairs to be treated as red tickets and dealt with immediately.
5.03	Immersion heaters	Annually	Job tickets repairs to be treated as red tickets and dealt with immediately.
5.04	Vent Axia Fans	Annually	To be cleaned, serviced and tested.
5.05	Door Closers	Annually	To cover complete range of door closing equipment.
5.06	Soil stacks	Annually	To be thoroughly cleaned as Procedural Note. Back surges to be reported to Works Manager for attention to drains.

Operations of Service		Frequency	Relationship to other operations of time allowed to complete operation
3.00	Painting and Decorating (Contd.)		
	Internal		
3.03	Empties - Estate properties at change of tenancy	3 weeks from receipt of keys (Maximum time allowed)	Repair all work necessary to rooms being redecorated. Check window safety catches, oil or grease all hinges. Check all rising butts and oil and treat as agreed. Renew where burring has occurred on splayed bearing surfaces. A maximum of 40 hours decorating to be carried out when necessary.
3.04	Empties - General properties	3 weeks	Repair all work necessary to rooms being redecorated. Check window catches, safety catches, oil or grease all hinges. Treat rising butts as above.
	(a) Expenditure up to £1000		Within 3 weeks from receipt of keys.
	(b) Expenditure from £1000 to £3000		Within 4 weeks from receipt of keys.
	(c) Expenditure from £3000 to £6000		Within 6 weeks from receipt of keys.
	(d) Expenditure from £6000 to £9000		Within 8 weeks from receipt of keys.
	(e) Expenditure over £6000		Time to be agreed as calculated for work programme.
3.05	Common staircases to flatted dwellings without lifts	2½ years (approximately)	To be included with external painting programme as wet weather work. Non-painted surfaces to be washed down.
3.06	Clubrooms	2 years	Where Council responsible.

APPENDIX A . AN OUTLINE OF THE PROCEDURE FOR CARRYING OUT A SURVEY OF A LOCAL AUTHORITY HOUSING ESTATE TO ESTABLISH MAINTENANCE FREQUENCY

SOURCE :

GLC HOUSING DEPARTMENT, MAINTENANCE BRANCH
MAINTENANCE SERVICE STANDARDS

	Operations of Service	Frequency	Relationship to other operations or time allowed to complete operation
1.00	Repairs prior to painting (external painting)	-	Inspection 1½ years in advance of painting and all major work shall be included in Estimates. Execute 1 year ahead of external painting. Minor repairs three months before painting. All external hinges, tee bands shall be lubricated at least every 6 years.
2.00	Painting and Decorating		
	External		
2.01	Normal external painting of all property	5 years	Including common staircases to flatted blocks with lifts.
2.02	New property external painting	3-4 years	After inspection if found necessary.
2.03	Short life property external painting	5 years	To be programmed and painted if life is two years or more and it has not been painted for five years.
2.04	Clubrooms external painting (if Council responsibility).	5 years	Together with adjoining properties.

Operations of Service		Frequency	Relationship to other operations of time allowed to complete operation
3.00	Painting and Decorating		
	Internal		
3.01	Main entrances to all blocks of flats, including hallways and internal corridors together with staircases to blocks of flats without lifts	2½ years (or earlier on inspection if in poor condition)	To be included with the external painting programme as wet weather work and additional treatment to fit programme. Surfaces manner. All main entrances to not painted shall be cleaned down in an approved flatted blocks shall be inspected annually and treated immediately if in a poor condition.
3.02	Normal programme work (limited liability) if finance available to the following:	NOTE	All existing metal lift off hinges and particularly rising butts shall be re-lubricated with grease at least every 6 years or during cyclical re-decoration of the premises. Cylinder locks/latches shall be re-lubricated with light oil.
	(a) House or maisonette	5 years	The hall, landing or staircase only.
	(b) Flat or bungalow	5 years	The hall and any landing and staircase together with one bedroom.
	(c) Sashes and frames	5 years	Throughout the building if necessary to preserve the fabric and prevent wet rot or decay.
	(d) Special cases	5 years	Restricted to OAP's, one parent families or disabled persons all as notified by Estate Management Branch and covering minimum re-decoration to all occupied rooms.

Section 5

Water and Asnitary services.

- Water supply
- Sanitary fittings
- Soil wastes

Section 6

Other domestic services and appliances.

- Electrical Wiring
- Space and Water Heating - electric

Section 7

External (Site) Works

- Drains and Manholes
- External services
- Paths and paved areas, fences, boundary walls
- Gates and clothes posts

Section 8

Ancillary and Miscallaneous

- Refuse disposal
- Disinfestation
- Vandalism

Source: Ministry of Housing and Local Government.

Report of the Working Party on the costing and Maintenance of Local Authority Housing. HMSO, 1964.

Appendix G. List of Maintenance operations.

Section 1

External re-painting.

all painted surfaces
walls
windows, doors and roofs.

Section 2

Internal re-decoration.

all decorated surfaces
programmed work
vacated dwellings and
non-programmed work

Section 3

Structure.

external walls
foundations
pitched roofs
flat roofs
rainwater wastes
internal partitions
floors, staircases,
and skirtings.

Section 4

Structural Finishings and Fixings.

Doors
Windows
Glazing
Plastering and wall tiling
Joinery fixtures and sundries

To be effective, a maintenance management information system requires data from a variety of sources. Here's a breakdown of the data contained in a suggested series of reports for such a system. With these forms, plant engineering and maintenance personnel can keep up-to-date on all maintenance activities in the plant.

Report A (Weekly) **Backlog by Craft** Distr. ★Δ

1. Contains information needed by planners and foreman to define future schedules and manpower requirements.
2. Includes all incomplete and pending work orders, except preventive maintenance.

Report B **Backlog Summary Report** Distr. ★

1. Provides an analysis of backlog of work on hand for the next 1 to 52 week period.
2. Provides planners with a basis for scheduling dates for new work orders.

Report C (Weekly) **Craft Summary Report (Performance)** Distr. ★Δ

1. Provides information needed to evaluate craft performance.
2. Contains information about completed work orders and craft activities in the past week. By comparing the preceding week's reports to the present period, trends and abnormalities can be detected.

Report D (Weekly) **Completed Work Order Report** Distr. ★

1. Contains information about all work orders completed during the week.
2. Provides the details necessary to evaluate planning efficiency and performance on specific jobs.

Report E (Weekly) **Class of Work Summary Report** Distr. ★

1. Indicates the type of maintenance that is being performed.
2. Serves as a planning and evaluation tool.

Report F **Maintenance Delays by Reason** Distr. ★Δ

1. Gives information on the cause of lost time and shows the hours lost, per category, related to total hours worked.
2. Forms the basis for evaluating maintenance activity and coordination effectiveness.

Report G **Exception Report** Distr. ★Δ

1. Pinpoints all work orders that have, for example, exceeded predefined limits such as:
   - Job behind schedule by specific amount.
   - Job over or under predetermined performance percentage levels.
   - Job over or under predetermined estimated cost levels.

Source: From p. 69, March 18, 1971, "Plant Engineering."

APPENDIX F : TYPES OF MAINTENANCE MANAGE

Report H Special Backlog Listing — Distr. ★△

Period Report

1. Provides detailed hours by craft for special jobs or for special periods such as shutdown.
2. Serves as basis for planning all craft activity during a special period.

Report I PM Backlog Report and Schedule — Distr. ★△

1. Presents the entire backlog of PM work orders.
2. Provides a planning and scheduling tool. Work is scheduled by craft and priority.

Report J Weekly Craft Schedule — Distr. ★△

1. Contains the work orders scheduled for completion in the coming week. (PM not included.)
2. Serves as a suggested craft schedule.

Report K Cost Center Charges — Distr. ★□

1. Brings out excessive maintenance costs and depicts cost trends related to specific equipment.
2. Relates to maintenance budgets and highlights problem equipment for major overhaul or replacement considerations.

Report L Purchase Requisition List — Distr. ★●

1. Contains information to facilitate purchasing.

Report M Open Purchase Orders — Distr. ★●

1. Provides a reference for units on order and anticipated delivery dates.

Report N Inventory Expedite List — Distr. ★●

1. Contains information about purchase orders that have not been met by the specified date.

Report O Inventory Status and Evaluation Report — Distr. ★□●

1. Identifies and presents the current status and activity history of every part in the inventory file.
2. Serves these purposes:
   a. to value inventory.
   b. to detect obsolescence.
   c. to act as reference files for storeroom and planning personnel.

Key Report Distribution

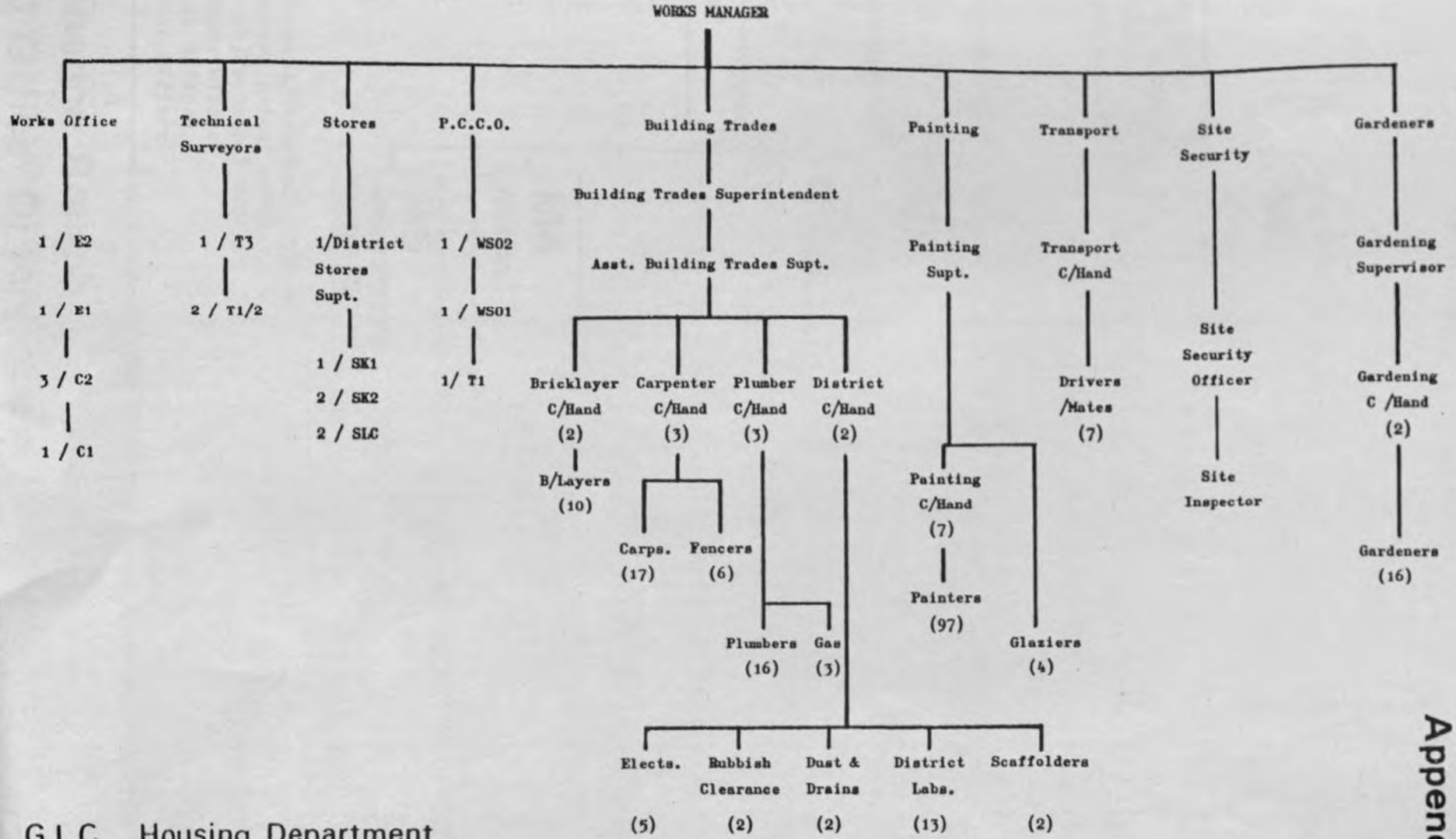
★ For Maintenance Planning

△ For Maintenance Foremen

□ For Accounting Department and Cost Centers

● For Purchasing Department

ENT REPORTS



GLC Housing Department

Maintenance Branch Typical District Maintenance Organization

Appendix B

Maintenance Branch

SENIOR ASSISTANT DIRECTOR OF HOUSING (MAINTENANCE)

PRINCIPAL MAINTENANCE OFFICER

SECRETARIAT

M1 TECHNICAL SERVICES

Divisional Head	1
Group Surveyors	4 PTO's
General Technical	10 PTO's
Painting	10 PTO's
Electrical	10 PTO's
Heating & Ventilating	8 PTO's
Horticulture	7 PTO's
Clerical Support	4 E/C

M2 SPECIAL WORKS

Divisional Head	1
Major Maintenance Major Technical Problems Estate Improvements Acquisitions & General Properties: Joinery & Structures: Contracts: Q.S. &	74 PTO's
Site Supervision	10 PTO's
Clerical Support	6 E/C

M3

GROUP MANAGERS

Group Managers	4
Assistant Group Managers	4
Management Dev.Adviser	1
Clerical Support	1 CO

PRODUCTION COST CONTROL

Divisional Head	1
Deputy & Technical Methods Manager	1
Central Work Study Bonus Control	22 WSO/TO/CO
Work Checking & Specialist Training	4 TO's
Plant Officer	1 TO
Transport	5 TO's
Clerical Support	1 CO

M4 FEEDBACK

Divisional Head	1
Feedback Officer	1
Clercial Support	1 CO

M5 ADMINISTRATION & FINANCE

Divisional Head	1
Office Manager	1
Contracts General Services Finanace - Estimates & Budgetary Control	24 E/C
Labour Relations & Safety & Welfare	5 E/T

Total ..... 224 Staff

Key

PTO Professional/Technical Officer
E/C Executive/Clerical Officer
E/T Executive/Technical Officer
WSO Work Study Officer
CO Clerical Officer
TO Technical Officer

Maintenance Branch Central Office Organization