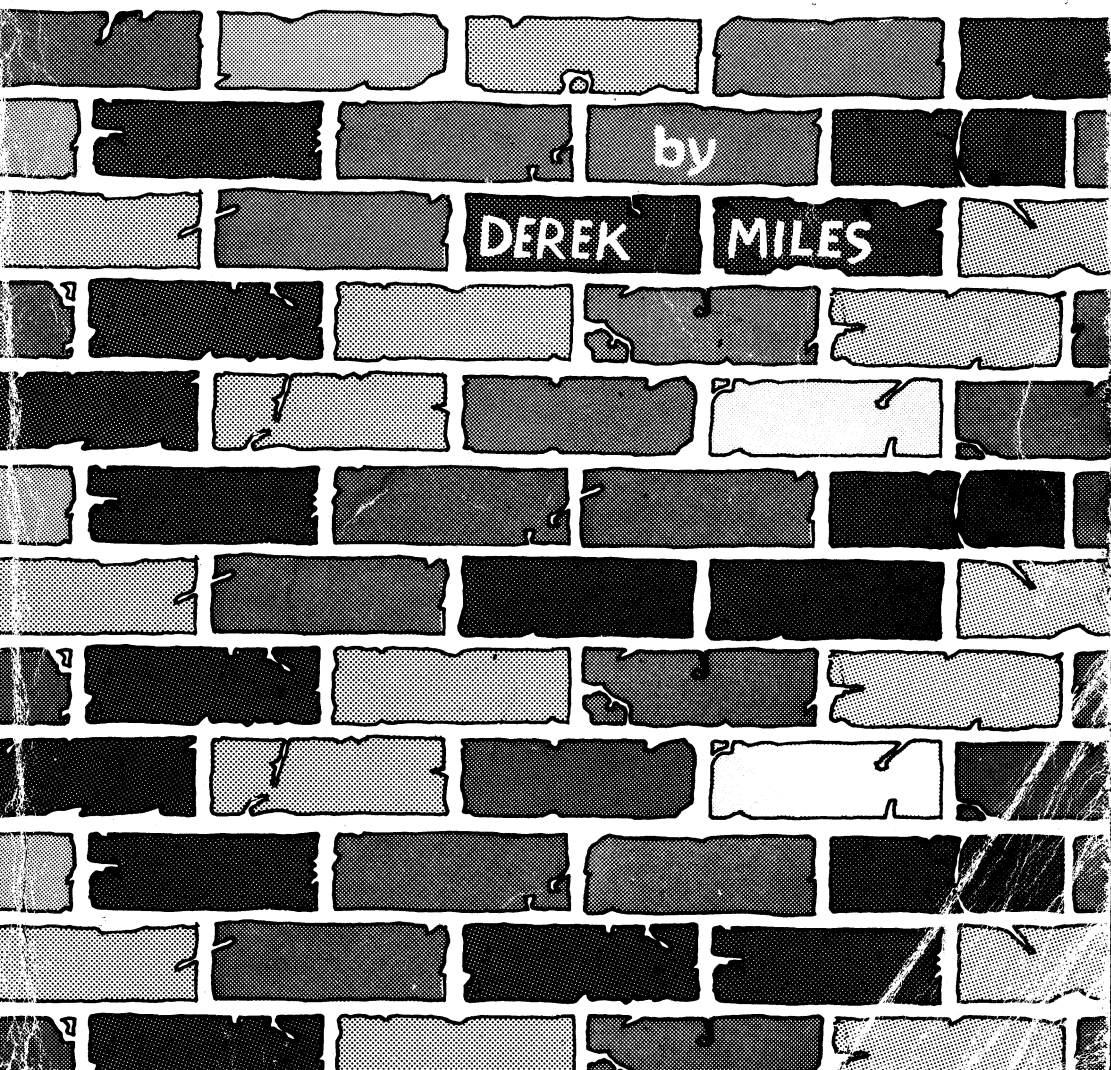


A Manual on Building Maintenance

Volume 1: Management



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A Manual on
Building Maintenance
Volume I : Management

by
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Preface

The Intermediate Technology Development Group is a non-profit making organisation founded in 1965 by a group of engineers, scientists and others from industry and the professions, all with personal knowledge of developing countries. Their object is twofold.

Firstly they seek to stimulate new thinking and action on the part of both rich and poor countries so that development finance can work more effectively for the benefit of the whole of the community to which it is directed.

Secondly, they supply basic and applied research in Britain and training facilities on the spot to provide the type of industry best calculated to relieve unemployment and poverty in developing countries.

Investigations by IT Building project staff reveal a general lack of suitable guidance for managers of small building units in both the private and the public sectors, in the technical aspects of construction work, and in the administration and management of building sites.

As a result of its research and training activity in developing countries since its inception in 1969, the IT Building group has built up a stock of experience in training strategies, methods and techniques appropriate to the special needs and opportunities in those countries. This experience is expressed in the series of teaching manuals and information papers which are intended to assist in increasing the operating efficiency of building units in developing countries.

Not only are problems associated with new construction often neglected, but also those concerned of repair and maintenance of existing structures. Owing partly to the differing systems for allocating funds between capital and revenue budgets, expensive buildings often deteriorate more rapidly than is necessary as a result of lack of attention to their systematic upkeep.

This waste of resources is particularly unfortunate because repair and maintenance operations are usually considerably more labour-intensive than original construction work. Thus a lack of attention to building maintenance leads to a loss of valuable employment opportunities as well as a rapid deterioration of expensive capital assets.

It is hoped that this manual will help to draw attention to this neglected area of construction activity and may be of direct assistance to those struggling with the practical application of maintenance policies and procedures.

Financial Control - Objectives

This manual in the IT Building Maintenance series is intended to set out the guidelines for a system of budgeting and financial control of maintenance procedures in developing countries. Although overall spending on maintaining, renovating and cleaning buildings is usually quite large and involves a large number of employees, it is seldom given the share of top management attention that is devoted to new construction work. This is partly due to the nature of maintenance work, which involves a large number of small jobs some of which take as little as an hour or so of a craftsman's time.

In addition, maintenance work is very diverse and difficult to group into clear categories for budgeting purposes. Thus there is a tendency to budget by guesswork, taking last years overall figure for building maintenance and adding a percentage plus a figure for any new buildings that have to be looked after. This budget total is then taken as a financial ceiling for control purposes, and cost control consists of the maintenance manager periodically adding up his total expenditure in the financial year and comparing it with the budget total to see how much he has left.

The maintenance manager cannot take the primary blame for this rather haphazard system. The blame must lie with top management which fails to see proper standards of building maintenance as the key to maintaining the value of their organisation's substantial investment in property, as well as ensuring that the useful life of the property is increased and that a safe and efficient working environment is made available to their staff. Too often top management merely agrees on overall figures for annual building maintenance (usually after an arbitrary cut), without requiring a proper statement of the technical assessment of the state of the properties for which they are responsible or of a division of items into those which are vital to maintain structural safety, those which are justified by yielding an acceptable financial return and those which are merely desirable.

3 REASONS FOR MAINTENANCE

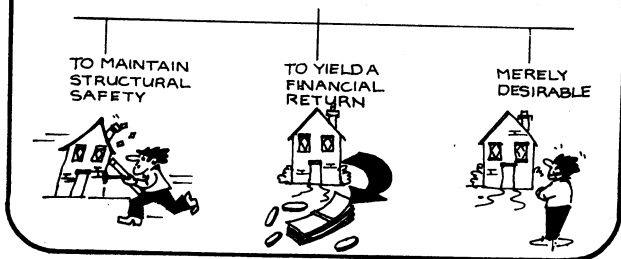


Fig. 1

In fact many top managers and senior civil servants are still unaware of the total occupancy costs for the property under their control, and in some cases the maintenance function is not clearly delineated with one man responsible for all building maintenance and running costs. They often do no more than require one of their employees to take action when complaints are received from occupiers that the roof is leaking or when the paint starts to flake from external surfaces. These manuals are intended to assist more far-seeing organisations who appreciate that they have a capital asset which should be economically maintained, and are prepared to do something about it.

Other manuals in this series cover other aspects of forming a maintenance policy, the practical management of building maintenance and technical skills. All of these aspects are important in ensuring that the work of a maintenance department is properly carried out, but it is also vital that the operations of the department should be subjected to efficient control procedures. The basis for control should be a resource budget, covering finance, manpower, materials and equipment, together with a rational and practical system for measuring output and performance.

Whether the organisations concerned with maintenance is a large and busy public works department or a small jobbing builder, there will be a need for top management to set the policy and ensure that

progress is properly monitored. Great care must be given to setting up a suitable cost recording and reporting system so that it is not over-cumbersome to operate yet provides essential information for monitoring past performance and improving future budgets and policies.

Motivation is a further factor of crucial interest to top management. Maintenance managers and their staff often suffer from a steadily sapped morale as their only contact with other staff or the public is when something has gone wrong in one of the buildings for which they are responsible, and at other times they are barely tolerated as a necessary but unproductive nuisance. This may be partly due to the lack of objective criteria in the work area of building maintenance. An effective budgeting system covering planning for costs, liquidity and capital expenditure can make a useful contribution to dealing with this problem by making clear that the maintenance function performs an essential task and that its performance can be measured.

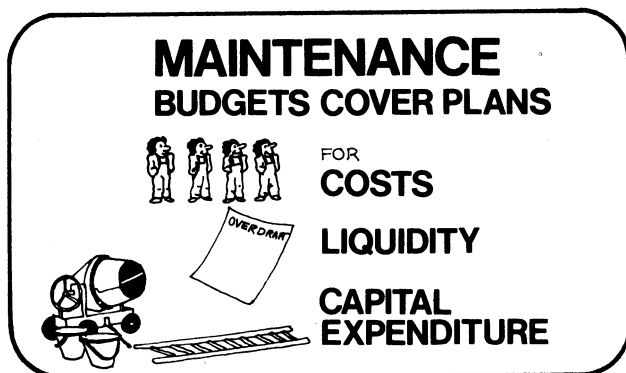


Fig. 2

Measurement is one of the keys to good management and, since engineers and managers rely on numeracy, activities that are not measured (either because they are thought to be unmeasurable or because they are not thought to be worth measuring) tend to be undervalued. This is understandable since activities must be measurable if plans are to be quantified and actions are to be monitored and evaluated. If the maintenance manager wishes to ensure that his

problems and achievements are appreciated by top management, he should give careful attention to devising and operating an appropriate system of budgetary control.

The general process of budgeting has been compared to the routine that is followed by a ship's captain who is to undertake a voyage from one port to another. When he has been told his destination he will start to plan the route, taking into account his ship, the type of cargo, tides and possible climatic problems. During the voyage he checks on his plans and records any unexpected happenings. If necessary he may even deviate from his planned route to take account of these. After the voyage he will compare it with the plan so that he adds to his stock of experience. In the same way the maintenance manager, who also has to deal with many uncertainties, can use his budget as a yardstick and a guide in an effort to keep on course.

The first step in setting budget figures is to install a proper system for cost recording and control.

Costing

Costs can be classified as follows:

- 1) Committed costs
- 2) Variable costs
- 3) Managed costs

1. Committed costs cover costs that cannot normally be altered during a particular accounting period as a fixed contract exists with a supplier, for example covering the lease of office equipment.

2. Variable costs or 'Engineered' costs are closely related to the activity of the organisation and their size is fairly closely related to the output of the unit. For example labour and material costs for concreting on a large building site are likely to grow in proportion to the quantity of concrete to be poured. It is, at least in theory, possible to measure the work content accurately and establish precise costs for a given level of activity.

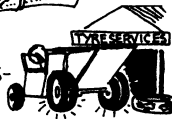
3. Managed costs are uncommitted and are not directly related to the volume of activity, but are specifically authorised at the discretion of the management. Since all decisions on managed costs are of a 'one off' nature, they are a matter of judgement on the part of the maintenance manager.

3 TYPES OF COST

1. COMMITTED COSTS
FIXED BY CONTRACT ETC



2. VARIABLE (ENGINEERED) COSTS-
RELATED TO OUTPUT OR ACTIVITY



3. MANAGED COSTS
SPENT AT DISCRETION OF MANAGEMENT



Fig. 3

Committed costs are the easiest to identify and to handle, since they are defined by the conditions of contract entered into by the supplier or contractor. Any variation in cost will either be carried by the contractor or would normally be absorbed within a 'contingency item' in the contract. For this reason some organisations prefer to rely on outside contractors rather than a direct labour force under their own control. However, there are other financial advantages that can result from carrying out work by direct labour since, assuming the same regular levels of efficiency and output can be achieved, the profit margin that would have been required by the private contractor will accrue to the benefit of the employer. In addition a direct labour force can be deployed more flexibly than the employees of a private contractor, who may require a variation order before his programme of work is changed.

Unfortunately there is no scientific method by which any given type of cost can be clearly categorised as always being an 'engineered cost' or always being a 'managed cost'. The difference between them is in their usefulness in evaluating performance. Since engineered costs are directly related to output, if labour cost is budgeted as 40 per cent of output, a labour cost of 38 per cent would be an improvement

but a labour cost of 45 per cent would suggest that something was going wrong.

However, performance on managed costs is not so easy to judge objectively, particularly with regard to the maintenance function. If a sum of £25,000 is allocated for 'general building maintenance to workshops' and only £19,000 is spent it may mean that the maintenance manager has done a good job. But it may also mean that he has not bothered to carry out the work properly or that the original estimate (or guesstimate!) was too high.

Managers usually perform best when their activities are measurable and their performance can be realistically evaluated, and consequently it is usually a basic aim of management to move costs wherever possible from the 'managed' category to the 'engineered' category. Many accountants seem to see no prospect of switching maintenance costs in this way, and so they despairingly lump all maintenance expenditure into the category of managed costs. However, the search continues for ways of quantifying and rationalising building maintenance costing procedures. This search is particularly important for larger organisations, where annual maintenance costs amount to substantial sums. As a result of a survey carried out by the Bath University of Technology for the UK Ministry of Public Building and Works the following broad list of maintenance criteria was identified:

MAINTENANCE CRITERIA

1. TECHNICAL FACTORS
2. POLICY CONSIDERATIONS
3. ORGANISATIONAL CONSIDERATIONS
4. FINANCIAL FACTORS
5. ECONOMIC CRITERIA
6. ENVIRONMENTAL CRITERIA

Fig. 4

1. Technical Factors

- Age of buildings
- Nature of design (degree of in-built maintenance)
- Material Specification
- Past standard of maintenance, including regularity of treatment, quality of work and any backlog of essential work,
- Cost of postponing maintenance.

2. Policy Considerations

- Prestige - whether maintenance standard is in keeping with 'image' of organisation without being over-lavish.
- Nature of past and current usage of building
- Extent to which productivity of employees may be reduced by poor working environment (or enhanced by good!)

3. Organisational Considerations

- Position of building maintenance department in the organisational hierarchy
- Personality of maintenance manager
- Knowledge and experience of decision-maker in top management
- Degree of detail and formality of the budgeting process.

4. Financial Factors

- Level of profitability of organisation or (in the case of a public body) resources allocated by Ministry of Finance.
- Cash flow availability during financial year.
- Timing of works programme and its effect upon cash flow
- Size of direct labour force and its financial implications
- Prices and general levels of cost
- Level of previous expenditure and its cost effectiveness plus a factor for inflation together with an addition to cover any expansion of premises or new activity that may increase wear and tear on buildings.

5. Economic Criteria

- Extent to which building maintenance is seen as a factor in the total problem of property management.
- Organisations attitude to property as an asset required to provide an economic return on investment.

6. Environmental Criteria

- The general economic climate
- The system of tenure
- Environmental changes

Under this final heading, the physical position of the site is also important relative to adjacent industry or social activity which may change. If the road by the building becomes a route to a football ground or if chemical attack from exhaust fumes increases this may also alter maintenance requirements.

The weight to be attached to each of these criteria will of course vary from organisation to organisation. In some cases the need for maintenance is more or less directly related to the age of the building, but many soundly constructed old buildings are likely to give less trouble than flimsy new structures. In fact one reason for keeping a close watch on maintenance budgets and costs is to 'feed back' lessons by the maintenance unit on materials and design features that give rise to high maintenance costs so that they can be avoided in future structures.

Thus the costing system should be designed in such a way that any unusual item for 'general repairs' on a particular building is highlighted, so that it will lead the maintenance manager to ask the right questions. His first question should be 'Is this a normal and forecastable failure?' and his second question 'How can we avoid, or at least delay, a similar failure in the future?'

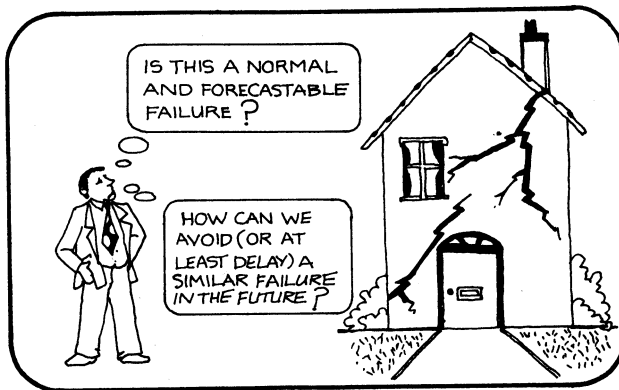


Fig. 5

In some cases he may decide that there is little that can be done to improve the performance of the existing building. However the analysis will still have been useful, since it will allow him to put forward a reasonable objection to any similar design feature in future buildings of the same type. If this is done in a systematic way over a period of years, the maintenance performance of the stock of buildings under his control should progressively improve.

Setting up a Costing System

The final objective of any costing system is to allow the manager to make objective decisions leading to effective cost control and then to a study of the possibilities for cost reduction. The system will only be useful if it improves the way tomorrows' problems are tackled, although of course the first step is to make clear how well or how badly previous decisions have worked out in practice.

The first function of a maintenance costing system is to provide a clear record of the running costs for a building or a group of buildings. To achieve this all expenditures throughout the year must be collected into suitable expense centres according to location and type of expenditure. This implies a suitable cost coding system so that the many small individual costs involved in building maintenance can be collected together systematically from job cards, time sheets and stores issue notes.

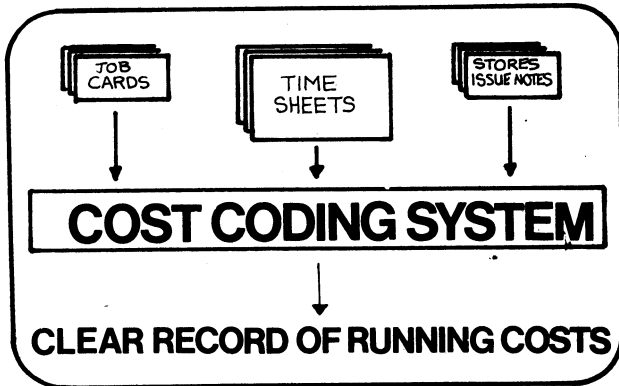


Fig. 6

The design of an appropriate coding system is a vital task, and its structure must of course depend on the particular needs of an

individual organisation. It must, however, be both simple and clear, so that it can be applied without an army of clerical workers and the cost figures can be kept up to date, abstracted and compared with budget figures regularly. A typical system of cost coding classification for maintenance expenditure on housing and buildings is given below.

BUILDINGS - REPAIRS AND MAINTENANCE

TYPICAL COST CODES

<u>Primary Codes</u>	<u>Secondary Codes</u>
1. EXTERNAL DECORATION	
2. INTERNAL DECORATION	
3. MAIN STRUCTURE	31 Foundations and basements
	32 Frame
	33 External walls
	34 Roof structure
	35 Roof coverings
	36 Roof lights and glazing
	37 Gutters and rainwater pipes
	38 Windows
	39 External doors incl. glazing
4. INTERNAL CONSTRUCTION	41 Ground floors
	42 Upper floors
	43 Staircases and steps
	44 Internal walls - structural
	45 Partitions and partition walls
	46 Internal doors incl. glazing
5. FINISHES AND FITTINGS	51 Ceiling finishes
	52 Wall finishes
	53 Floor finishes
	54 Joinery, shelves, etc.
	55 Ironmongery
	56 Misc. fittings
6. PLUMBING AND SANITARY SERVICES	61 Cold water service pipes, tanks, cisterns and valves

- | | | |
|--|----|---|
| | 62 | Hot water service pipes, tanks, cylinder boilers, valves and insulation |
| | 63 | Sanitary fittings |
| | 64 | Waste, soil and vent pipes |
| 7. MECHANICAL SERVICES,
HEATING AND VENTILATING | 71 | Boilers, firing, flues |
| | 72 | Hot water distribution |
| | 73 | External water supply, treatment and storage |
| | 74 | Air conditioning, ventilation and refrigeration |
| | 75 | Lifts |
| | 76 | Workshop equipment |
| | 77 | Misc. equipment |
| 8. ELECTRICAL SERVICES | 81 | Generation |
| | 82 | Transmission and distribution |
| | 83 | Wiring, switch and control gear |
| | 84 | Appliances and fittings |
| | 85 | External lighting |
| | 86 | Lighting protection |
| | 87 | Kitchen equipment |
| 9. EXTERNAL WORKS | 91 | Roads, car parks, hardstandings |
| | 92 | Paths, playgrounds, paved areas |
| | 93 | Fences, walls and gates |
| | 94 | Drains and ditches |
| | 95 | Sewers and sewage disposal |
| | 96 | Water storage |
| | 97 | Gardens |
| | 98 | Misc. external works |

It is of course possible to achieve greater accuracy by adding tertiary codes, but this must be balanced against the increased overhead and staff cost that would be involved. Where, for example, it is suspected that certain types of flooring give rise to substantially higher maintenance costs than others, appropriate tertiary cost

divisions will provide objective evidence over a period.

In applying the cost code allocation system it is most important that costs for individual jobs are not duplicated, and are either applied to a single code number or are split between codes on a suitable proportional basis.

The accuracy of a costing system is wholly dependent on the accuracy of the information upon which it is based. Thus a proper booking system for labour and materials is vital. All existing forms should be checked to make sure that they are adequate and provide all the information that is required. (It is also important to make sure that they do not waste the operatives time by asking for information that is not required).

The basic forms will probably be:

1. A Daily Labour Allocation Sheet, showing the number of men in each gang employed on various tasks. (See page 74)
2. A Materials Sheet, detailing the materials employed in each job. (See page 75)
3. A Job Sheet, describing the work carried out and detailing any additional expenses. (See page 76)

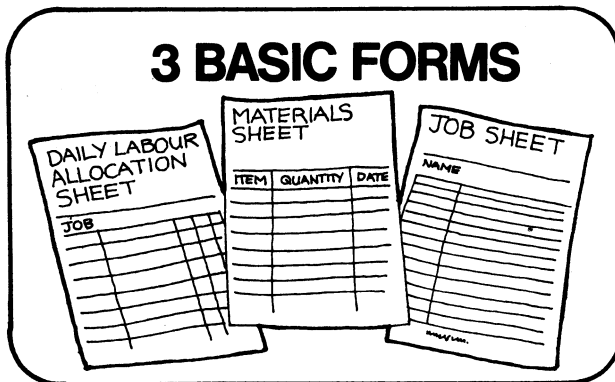


Fig. 7

If the forms are very different from those currently in use in the organisation, they should be explained to the foreman who will be required to complete them.

Once the new forms are in use, it will be possible to start gathering the material for cost analysis, by collating the costs of labour and material into totals against each item in the cost code, summarised by location and type.

Comparison with estimates

Once the costs for an accounting period have been collated, they should be compared with the original estimates. It will be particularly important to look closely at those items where estimated costs have been exceeded, and to investigate the reasons for this. Where these figures differ widely from the estimate, it may be worthwhile to compare with the actual figures for previous years.

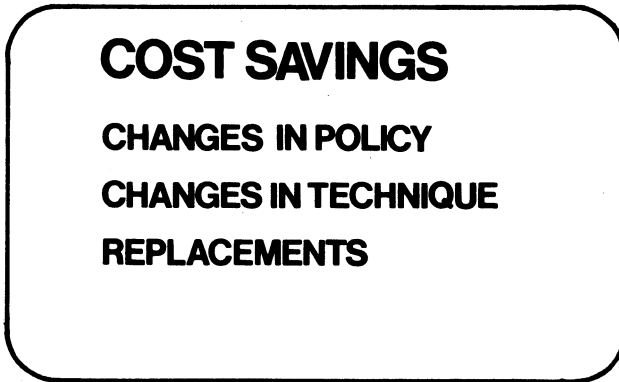


Fig. 8

Cost saving investigations

The next stage is to examine the possibilities for achieving cost savings, by changes in policy, technique or replacing items which are giving rise to unacceptable maintenance or repair costs. Examples of changes which might lead to savings due to lower overall maintenance costs are:

Replacement of plant or equipment with high maintenance costs or which breaks down frequently, or which is not fully - used as it is not efficient.

Replacement of plant or equipment with high fuel costs.

Provision of additional plant and tools for maintenance.

Provision of automatic lighting controls to reduce electricity costs.

Besides allowing management to assess the possibilities for cost saving by policy changes on a realistic basis, cost figures should provide the basis for future revenue budgets.

Preparing the Maintenance Budget

A proper budgeting process is crucial to effective cost control on an ongoing basis in all organisations, whether in the public or the private sector. It is also important that budgeting should not be a process that is simply left to the accountants, since it must be based on a proper technical appreciation of maintenance needs. A further factor is that the budget must be used as a working document throughout the year, and managers are more likely to work wholeheartedly to achieve budgets which they have put forward themselves than figures which have been imposed by others.

Since resources for maintenance are usually particularly scarce in developing countries, it is vital that they should be planned and used to the best possible advantage. The budget is the vital link in the chain of control which involves three aspects:

1. Communications of information about plans and intentions.
2. Motivating people to achieve planned targets.
3. Reporting performance.

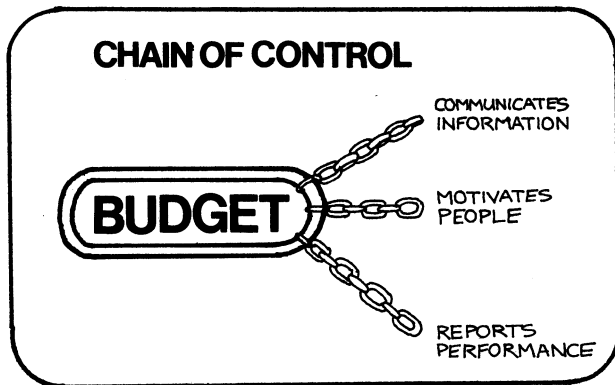


Fig. 9

The third aspect leads to a continuing cycle of activity, in which the accuracy of plans and budgets should be steadily improved, leading to maintenance expenditure yielding greater benefits in the form of an improved working environment and buildings with a longer useful life. The basis for effective control of any activity must be careful planning, but accurate information is needed as a guide.

Although a budget is naturally expressed in financial terms, these figures must be seen as an expression of human responsibilities since it is the maintenance manager and his staff who control operations, answers complaints and decide priorities. Although some maintenance managers feel that their experience is so great that they can make day-to-day decisions without guidance, the quality of all decisions can only be as good as the quality of the knowledge of the facts (or assumptions) upon which they are based. One of the most important functions of a budget is to provide a factual basis for control.

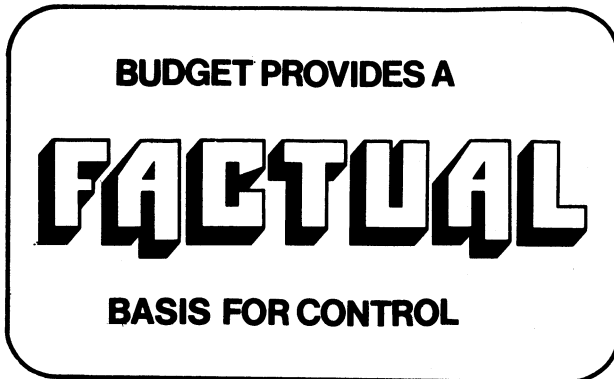


Fig. 10

Financial planning is part of the overall planning of an organisation covering the long term and the medium term, while budgetary control is concerned with the planning of operations in the relatively short term. The financial plan, which should include plans for long term provision of funds for repair and maintenance of buildings, will project long-term plans for the organisation in financial terms. Within the framework of the financial plan, a budgetary control system should be operated to ensure that detailed plans are prepared for the current year of the long-term financial plan.

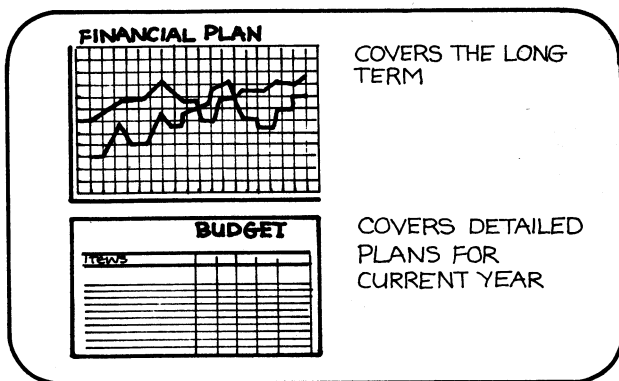


Fig. 11

In most cases the budget will run for a period of one year. Budgeting beyond a period of one year can be difficult, particularly for repairs and maintenance, which can be very difficult to forecast. There must, however, be much shorter 'control' periods - when actual costs and performance are measured and compared with an appropriate proportion of the budgeted figure. If the maintenance manager were to leave comparing his actual costs with the budget until the end of the financial year, it would then be much too late to take corrective action. Thus the budget is broken down into a series of control periods: weekly, monthly or at the most three-monthly, at the end of each of which the actual cost and performance is compared with those forecast or implied in the budget.

At the end of each control period, the manager should examine his figures and take particular note of those which vary greatly from the budget. If costs are higher than budgeted, he should determine the reasons which have led to this. It may simply be that the operatives performance is at fault and that productivity must be improved. In the emergency repairs category, which is notoriously difficult to forecast accurately, it may simply be that an abnormally large item has happened to have to be dealt with in this particular control period. The third possibility is that the original budgeted figure was too low. In this case, the budget may have to be revised upwards, although it may be possible to make compensating savings on items where actual costs are lower than budget, so that the overall total remains the same.



Fig. 12

It is very important that this analysis should be carried out as soon as possible after the figures for the particular control period become available. The longer the activities of the department go on unchecked, the greater will be the danger of serious overspending or failing to complete the planned programme of work. There are a great many ways of analysing costs and expenditure, but the aim should always be to present the facts in such a way that they point the way to a sensible decision on the way in which resources are to be used.

Most maintenance expenditure can be divided into two main categories:

1. Cyclical maintenance

These are items which regularly recur and must be carried out as a routine to maintain the structural characteristics of the building and its components or to maintain the building as a suitable working environment. An example is painting and decoration, which should be carried out regularly to protect wooden and metal components from rot, rust and decay. It is usually foolish to economise too much on cyclical maintenance, since this can lead to a much heavier eventual expenditure on major repairs or replacement.

2. Occasional items

Some activities which fall into the category of repairs and Maintenance will be carried out only when inspection reveals a serious structural or other fault. For example, the roof on a particular building may frequently leak during the rainy season, so that it requires almost continuous minor repairs. The point will come where it is cheaper to renew the complete roof structure, and this may in fact be treated as a 'capital' rather than a 'revenue' item.

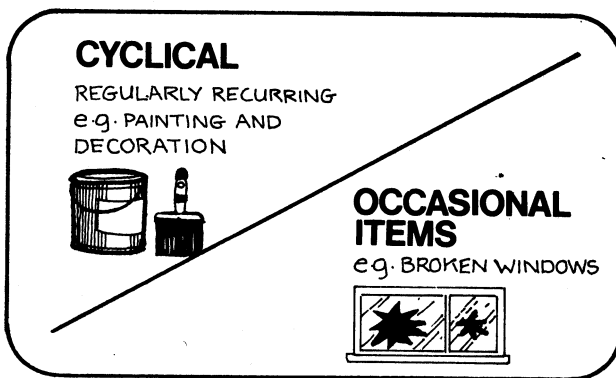


Fig. 13

As the maintenance manager comes to draw up his budget for the coming year, he has to take account of the general policy of his organisation. Some of the factors which he will have to bear in mind are:

FRAMING THE BUDGET

- 1. DEMAND FOR MAINTENANCE**
- 2. RESOURCES**
- 3. STANDARDS OF SERVICE**
- 4. NEED FOR REGULAR MAINTENANCE**
- 5. STANDARD COSTS**
- 6. PRODUCTIVITY**

Fig. 14

1. Demand for maintenance

If the use of the buildings is to be intensified it is likely that a higher expenditure will be needed to keep the required standards. In factory premises or workshops, new processes might give rise to greater demand. In a shop or office, the organisation may decide to provide higher standards to improve relations with customers.

2. Resources

The budget will obviously be affected by the overall financial resources available to the organisation. A company or firm will be limited by the amount of its working capital and the levels of cash flow and profits. A government department will be limited by the funds that can be raised and allocated by the Ministry of Finance. However, it is the responsibility of the maintenance manager to calculate the level of expenditure that would be adequate in accordance with accepted standards of safety and the organisations general policy. If a lower level of expenditure is adopted for reasons of general financial stringency, this fact should be clearly stated so that higher levels of management will realise the implications

(and not complain needlessly at a later stage that the buildings are not as well maintained as they would wish).

3. Standards of service

One of the major problems facing any maintenance manager is the large number of demands upon him for repairs and redecorations, and the difficulty of allotting priorities when the urgency of the various claims is approximately equal. This is a particularly difficult problem where house maintenance is concerned, as he knows that there is a danger of being accused of favouritism whichever job is chosen as top of the list. A useful guideline is to break down the allowances for maintenance into sums for each housetype, so that he can clearly show how much money is available for maintenance each year. If the amount allocated in the budget is not enough to meet the needs, he will have to install some kind of rationing system or, where maintenance is planned on a regular cycle, the period of the cycle must be increased. For example, painting may be carried out every four years instead of every three years.

4. Need for regular maintenance

Wherever possible maintenance should be carried out on a preventive basis, with specific time cycles allocated for each particular task. In many countries, safety legislation requires regular maintenance of items such as lifting tackle, but there is also a need to carry out such jobs as external painting regularly if the structure is to remain sound and keep its value. Unfortunately there is always a temptation to extend the maintenance cycle when money is short, although this leads to an ever-increasing back-log of work so that it becomes difficult for the maintenance department ever to catch up with their schedules and bring the buildings up to an acceptable standard. The maintenance manager is in a stronger position to secure sufficient funds to properly fulfill his duties if he prepares fully costed programmes for cyclical repairs and maintenance from which a budget can be accurately built up.

5. Standard costs

Where repetitive costs are involved, standard costing techniques can be very helpful in improving the accuracy of budget forecasts. The standards must of course be based on realistic assumptions of output and productivity and must make allowance for fixed overhead costs. These standards will of course also be of great value in estimating costs for additional work that may be required from time to time.

6. Productivity

The resources needed to undertake a given volume of work in a labour-intensive activity such as building maintenance is highly dependant upon the productivity of the labour force. This can be very difficult to assess in maintenance work, due to the extreme variability of the tasks to be performed. However, by the use of standard costing techniques, supported by the recruitment and training of reliable foremen and supervisors, the maintenance manager can achieve steady improvements in productivity and the quality of service provided.

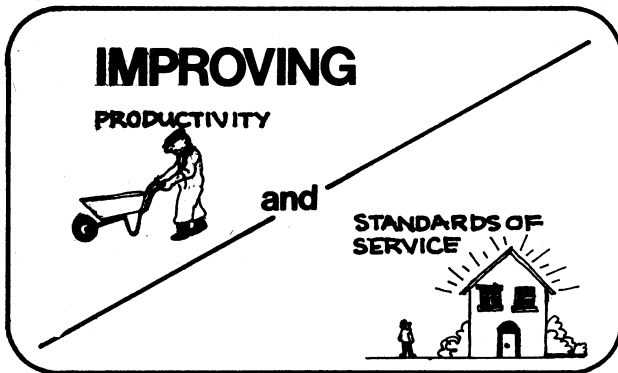


Fig. 15

It will be help to divide the properties for which he is responsible into a series of broad use classes, since different types of buildings have different needs for standard, regularity and

urgency of maintenance. Most maintenance managers will only be faced with looking after a few of these categories. For example, a Ministry of Works may have workshops, stores, offices and some residential property. A Ministry of Education may have offices and residential buildings in addition to its schools and colleges.

In addition, some types of building may have to be maintained at particular times or periods of the year so that the work does not interfere with their operational requirements. In general, schools would have to be redecorated in holiday periods so that the teaching programme is not disrupted. Repair and maintenance work on factory buildings may have to be done at week-ends to avoid interruption. Special arrangements may have to be made for shops and supermarkets so that regular customers do not change their shopping habits because their usual shop is closed for a period.

Any classification must be rather arbitrary, but seven broad classes of building with comments on their general needs are outlined on the following pages:

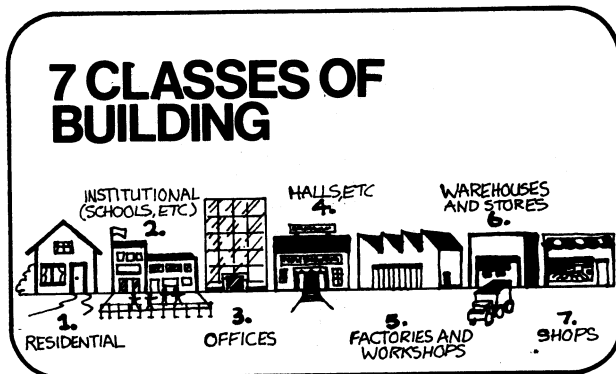


Fig. 16

1. Residential

This classification includes houses, bungalows, flats and domestic quarters. The occupier of the property will normally pay a rental partly to cover depreciation of the property and interest on the capital value, but also to cover the costs of regular repairs and maintenance. This latter element could be adjusted to cover actual costs, so that repairs and maintenance could become broadly self-financing.

The objective should be to provide reasonably comfortable living surroundings. Fixtures and fittings may need to be more robust than in owner-occupied dwellings, since some families may subject them to harsh treatment. Where difficult or 'problem' families have to be housed, it may be necessary to reserve a particular group of dwellings for them, where damages will be less serious. Careful thought should be given as to which items will be repaired by the authority and which will be the responsibility of the occupier.

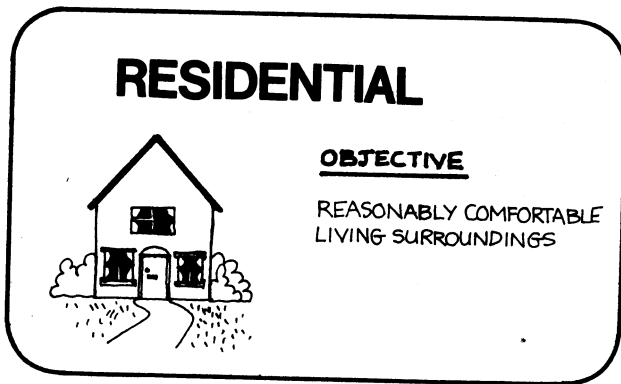


Fig. 17

2. Institutional

The category covers a broad range of institutional buildings including schools, universities, hospitals, health centres and libraries. The government normally commissions the building and one of the Ministries is usually the owner and occupier. There will usually be an attempt to standardize designs to reduce construction costs and this can lower maintenance costs, since operations can be made routine and maintenance staff should be faced with fewer unexpected problems.

At the design stage steps should be taken to incorporate features, components and materials that will minimise repairs and decorations, using easily-cleaned and hard wearing decorative materials. Where, as is often unfortunately the case, the maintenance manager is unable to influence the design, he should gradually introduce improvements when redecorations and replacements become due.

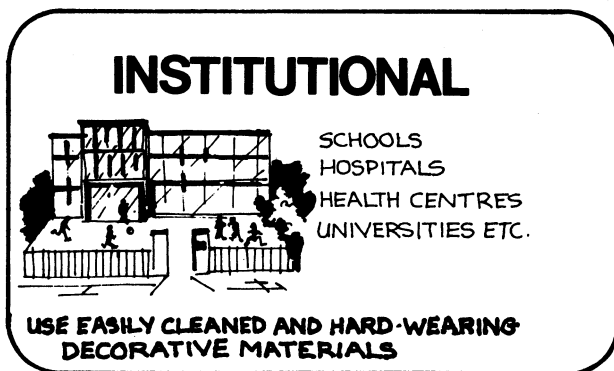


Fig. 18

3. Offices

Where legislation has been enacted covering standards of safety and environment, the first requirement is to comply with these. However, it is also important to provide a pleasant environment in which employees can give of their best. A colour scheme using light coloured finishes will improve conditions for office employees, since they will find it difficult to work effectively in a dark corner of a building.

Sound-proofing can be very important as the sound of typing, for example, can be heard through flimsy partitions and can interrupt telephone calls or important business discussions. In large offices it is helpful to ensure that all rooms are clearly and logically numbered so that visitors can find their way without difficulty.

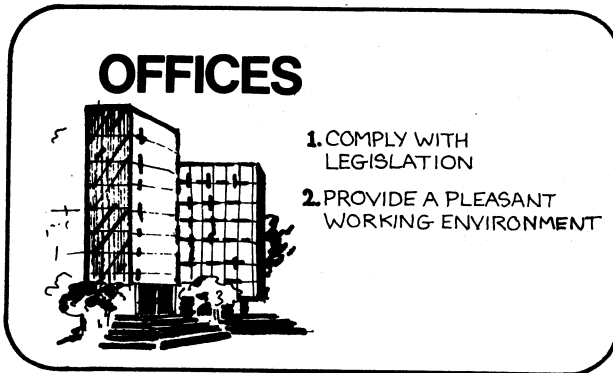


Fig. 19

4. Halls and Places of Assembly

This category includes theatres, cinemas, sports stadia, churches and other buildings where large groups of people meet for various purposes. The maintenance manager who has responsibility for this group of buildings should concentrate on two main areas of priority:

- (i) Particularly where the building is used for a commercial purpose, such as film shows at a cinema, he will have to keep the building in a condition that will attract paying customers. This will mean regular cleaning and decoration so that the building presents a pleasant, clean and tidy appearance;
- (ii) Since there is always the danger of panic where large crowds assemble, special attention must be given to balconies, barriers, fire escapes, etc. in order to ensure that structural safety is maintained and any defective elements are promptly replaced. The need to vacate the building rapidly in the case of fire or other emergency means that escape doors should be regularly checked and no equipment or other articles should be left or stored in corridors.

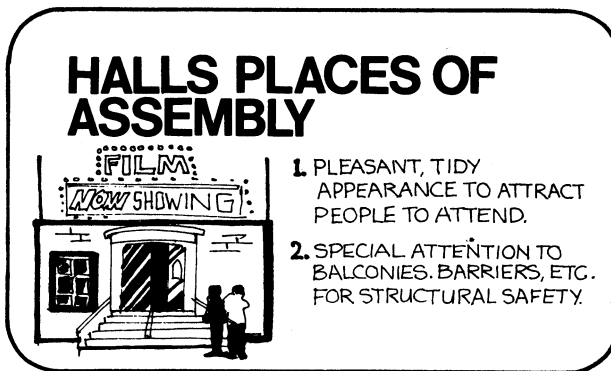


Fig. 20

5. Factories and workshops

As for offices, the first duty is to satisfy the statutory requirements. However, it is also important to provide an acceptable working environment in which workers feel encouraged to maintain good levels of productivity. In premises such as machine shops or foundries, which are subject to particularly heavy wear, the regularity of inspection and maintenance will have to be increased.

Care should be taken in siting additional machinery so that there is adequate working space around it for operation and plant maintenance. Advice should be sought on the design of foundations for heavy machinery so that there is no danger of overstressing the existing building.

The maintenance staff should see that gangways between machinery are clearly marked with white lines, and that the operatives do not leave parts or materials in gangways areas.

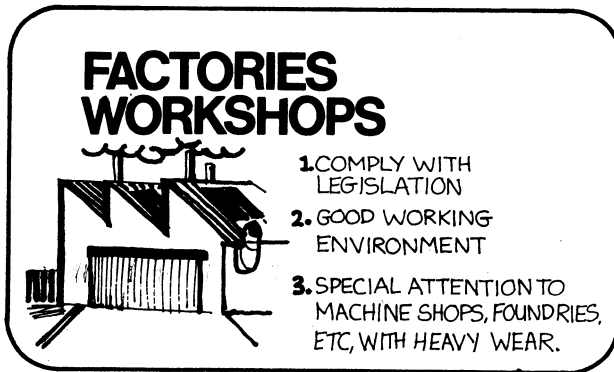


Fig. 21

6. Warehouses and stores

Here the main requirement is to ensure that the stability and working life of the structure and its elements are maintained. Usually only a small number of men will be employed in relation to the area occupied by the building. Special attention should be given to provision of suitable environmental conditions if perishables are to be stored.

Where mechanical handling devices such as conveyor systems or fork lift trucks are to be used in an existing building, it may be necessary to consult a qualified structural engineer to check that the building is sufficiently strong to withstand the additional loads.

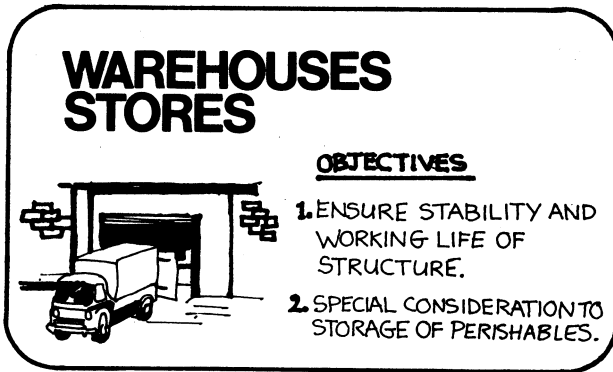


Fig. 22.

7. Shops

In addition to maintaining the strength and stability of the structure, the maintenance manager should ensure that the premises are neatly decorated and kept clean and tidy. A clean and attractive appearance encourages potential customers to enter a shop and return to make regular purchases.

If the shop is used for the sale of food, special attention should be given to ensuring that it can be properly stored so that it will not deteriorate due to undue heat or attack by rodents or insects. A further consideration may be the danger of burglaries, in which case the maintenance manager may have to install shutters, steel bars or burglar alarms to deter potential thieves.



Fig. 23

The main difference in the maintenance programme will be in the levels and standards of internal maintenance. External maintenance and structural requirements will be similar for all use classes, although the actual amount of work to be done will naturally depend upon the age of the building, the materials and type of construction. However, the variations in requirements for internal maintenance are such that it is usually best to prepare separate master lists and plans for the various use classes. Apart from planning advantage, it is also helpful to separate the various use classes for budgeting and general accountancy purposes, so that the maintenance costs for various types of building can be correctly assessed.

Before a full maintenance budget can be prepared, it is first necessary to clarify the maintenance programmes for all properties involved, leading to the preparation of a master maintenance plan.

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Maintenance Plans and Programmes

Although maintenance plans and programmes for a large group of buildings of various ages, materials and types of construction may well be very complex, the objectives of the plans and programmes is simple. It is to answer three basic questions:

WHAT is to be maintained?

HOW is it to be maintained?

WHEN should it be maintained?

The answer to the first question is usually "all the buildings used by the organisation", but the answer to the second question will depend on use, class and the physical nature of the building itself. It can only be answered satisfactorily after careful examination of each building, leading preferably to a job specification which will describe fully the tasks to be carried out at each maintenance inspection interval. A full system of job specifications will take time to formulate, but will be a vital aid to effective planned maintenance by ensuring that:

1. The task or job is carried out in the manner intended.
2. The possibility of a particular item being forgotten (perhaps endangering structural safety) is minimised.
3. Acceptable levels of wear and deterioration before repainting, repair or replacement are clearly defined.
4. The craftsman or operative understands what is required of him.
5. The work will always be carried out in the same way, so that the performance of materials and components can be objectively compared.

6. All workers carry out tasks in the same way, easing calculations for work study or incentive bonus purpose.
7. A reference standard is available in that additional buildings of the same type can be rapidly brought into the system as soon as they are built or acquired.

JOB SPECIFICATIONS

ensure

1. JOB IS CARRIED OUT AS INTENDED.
2. ITEMS ARE NOT FORGOTTEN.
3. DEFINITION OF ACCEPTABLE WEAR AND TEAR.
4. CRAFTSMEN KNOW WHAT TO DO.
5. MATERIALS PERFORMANCE CAN BE COMPARED.
6. EASIER WORK STUDY CALCULATIONS.
7. A RECORD OF STANDARDS FOR REFERENCE

Fig. 24

Each Job Specification should give the following details:

1. The number or title of the particular building.
2. Its address or location.
3. The maintenance schedule reference number.
4. The job specification reference number.
5. The frequency of maintenance.
6. The trades (e.g. carpenter, mason, painter etc.) required to carry out the work.
7. The specific details of the work to be inspected and carried out.
8. Any special tools and equipment required.
9. Working drawings, manuals and specifications available.
10. Safety procedures to be followed.

The frequency of major maintenance and repair works will depend on the type and use of the building, but will probably be based

on a maintenance cycle of 3,4 or 5 years. Whichever cycle is chosen, it must be used as the basis for all detailed planning, so that no buildings are forgotten and allowed to slip into serious disrepair.

Once the maintenance manager has decided on a suitable cycle of maintenance for the buildings for which he is responsible, he can prepare a master maintenance plan which will show the work to be carried out in each successive year. Where many different types of building have to be repaired and maintained, it is of course possible to have different maintenance cycles for different types of building. However, it is generally preferable to decide on an appropriate period between maintenance inspections and apply this universally.

The master maintenance plan should be a simple document, listing the properties to be maintained on the left and giving a series of columns, one for each financial year, so that the maintenance inspection dates for each year can be clearly indicated. It may be helpful to split each yearly column into two so that the date on which work on any particular building has been completed can also be clearly indicated. An example of a typical maintenance master plan for government buildings is shown in Fig 25.

Fig 25 Typical Maintenance Master Plan

BUILDING	1971/ 72	72/ 73	73/ 74	74/ 75	75/ 76	76/ 77	77/ 78	78/ 79	79/ 80	80/ 81
Ministry of Works main office	x 16/7					x				
Ministry of Works district office		x 30/5					x			
Mechanical workshop			x 8/5				x			
Main Store				x 1/9				x		
Training centre					x 2/8					x
Main garage	x 20/8					x				
Joinery workshop	x 1/2					x				
House 1		x 15/6					x			
House 2		x 25/7					x			
House 3			x 20/7				x			

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Main garage	x 20/8					x				
Joinery workshop	x 1/2					x				
House 1		x 15/6					x			
House 2		x 25/7					x			
House 3			x 20/7				x			

The crosses indicate the financial year in which maintenance is due, and the dates are filled in to show when the work to be carried out following the maintenance inspection has been completed. When preparing his maintenance master plan, the maintenance manager will take care to ensure that the work to be done is reasonably balanced between one year and another. This leads to a steady workload, and allows him to recruit a full-time permanent maintenance crew as well as ensuring that his budget should not fluctuate from year to year (apart from provision for wage and price increases).

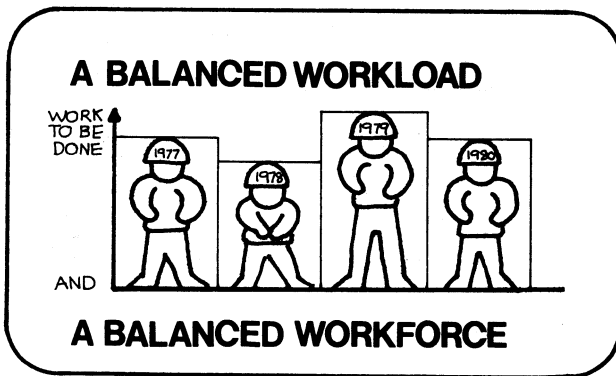


Fig. 26

The maintenance master plan, like all plans, is only useful if it is employed as a working document. If a five year cycle of inspection, maintenance and repair has been decided on, this must be worked to. Otherwise the backlog from one year will be carried forward to the next, making that year's task much more difficult to achieve and requiring additional financial resources which may not be made available. Once this point has been reached, it is all too easy to allow the situation to get completely out of control, so that maintenance ceases to be planned altogether and the maintenance gangs return to the chaos of reacting to complaints as they arise.

A further important point is that when the time comes for a building to be dealt with, the work should be completed in one operation. This is a good reason for setting up a comprehensive inspection system, so that the clerk-of-works will examine the building in detail and

decide on the work to be done before the maintenance gang start their work. Apart from the fact that discontinuous operations are usually uneconomic as well as inconvenient to building users or occupiers, a very bad impression is created by men appearing to carry out one task, leaving the site for a week and then returning to do something else.

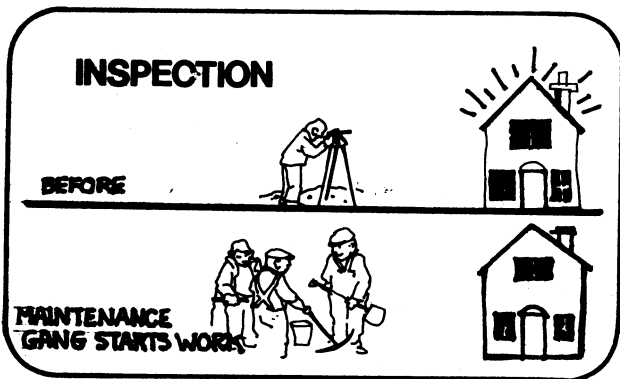


Fig. 27

Inspection

The inspection of buildings must be done on an objective basis by a Clerk of Works or Inspector with training and considerable experience. The maintenance manager should aim to keep the standards of repair and decoration as uniform as possible for any similar group of buildings since, particularly in estates of houses, users and occupants compare standards avidly and are inclined to suspect favouritism where additional work is done. The difficulty lies partly in the variety of problems that can cause building materials or components to wear or decay. These include climatic conditions, pollution, fungi, insect attack, subsidence and flooding. They seldom attack a group of buildings in a uniform manner, and the lack of uniformity is made worse by the fact that occupants and users treat their buildings with varying degrees of consideration.

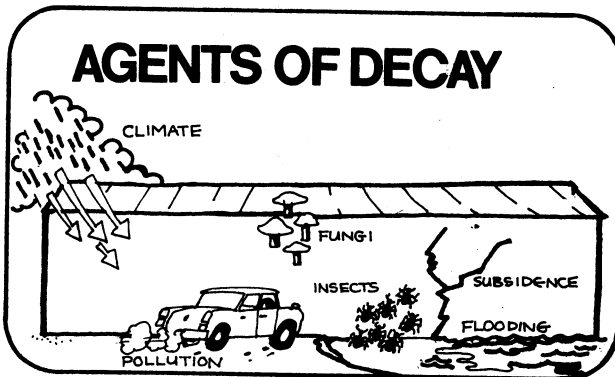


Fig. 28

Thus the plans and programmes, and the budgets that are calculated from them, cannot be completely rigid, and it will be necessary

for the maintenance manager to switch resources and re-allocate funds if an inspection reveals unexpectedly severe deterioration. Therefore an important part of the maintenance manager's work in the planning of his activities is the planning of a systematic approach to the inspection of the buildings for which he is responsible.

For each building he has to provide the answers to six key questions:

1. When should the building be inspected?
2. What should be inspected?
3. What maintenance should be done as a result of the inspection?
4. At which level of deterioration should a component be repaired?
5. At which level of deterioration should a component be replaced?
6. Should preventive maintenance be carried out?

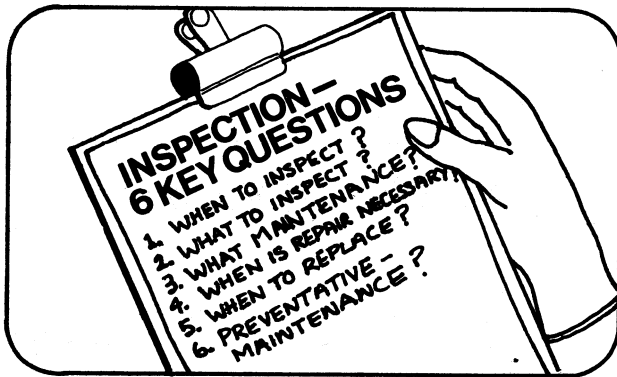


Fig. 29

The first question should be answered from the maintenance master plan. For any one financial year it is necessary to list the buildings which are due to be inspected, together with any backlog from previous years.

WHEN TO INSPECT?

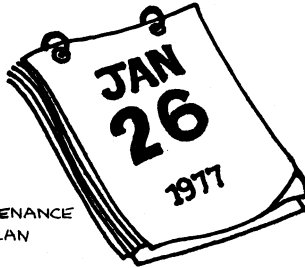


Fig. 30

The next question, "what should be inspected?" is more difficult, since so much depends on the judgement of the member of staff carrying out the inspection. However, the problem can be eased by introducing standard forms, report layouts and checklists, so that the inspector has a ready reference to the details that he is expected to gather.

WHAT TO INSPECT?

DEPENDS ON JUDGEMENT.....

BUT

STANDARD FORMS

REPORT LAYOUTS

CHECKLISTS

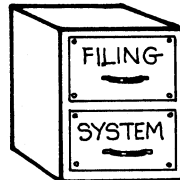


Fig. 31

Once this system has been introduced, a file can be built up on each property showing the inspection reports and work carried out over a period of years. This will assist in giving guidance on the rate of deterioration of materials and elements, so that the decision on the need to repair or replace any particular item following a 5-yearly inspection can be made in a more logical fashion.

SETTING UP A FILING SYSTEM

Except in the case of small properties, which may be dealt within groups, a separate file should be opened for each main building that is to be maintained. If one is available, a working drawing of the building should be inserted in the file (suitably amended to show any alterations that were undertaken during the construction period). This drawing should be regularly updated to show any additional work, particularly alterations to drainage and services, since a great deal of time can be wasted attempting to find their location on site.

Although it is appreciated that this may be difficult where buildings have been standing for some years, it is much easier to apply in the case of new buildings as they are taken over as the maintenance manager will be in a position to insist that all the details which he may require are supplied.

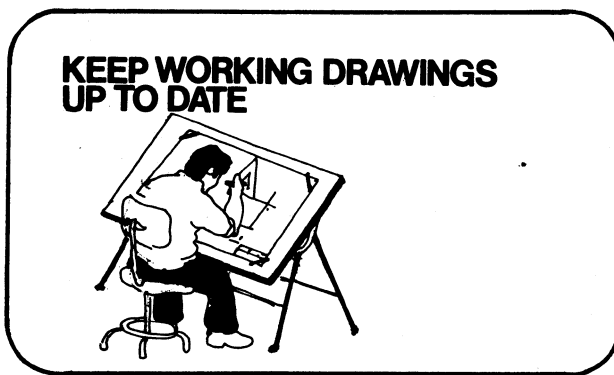


Fig. 32

The next paper which should be prepared for each file is a general description of the property or properties which it covers. The details which this should contain are as follows:-

1. Address of property (with key plan if necessary)
2. Use of property (e.g. house, office, factory)
3. Name of occupier (with address if different)
4. Any special instructions (e.g. where key can be obtained)
5. Date of construction of main building (and annexes if different)
6. Names of builder and architect
7. Access (pedestrian and vehicular)
8. General remarks on state of building and expected life.

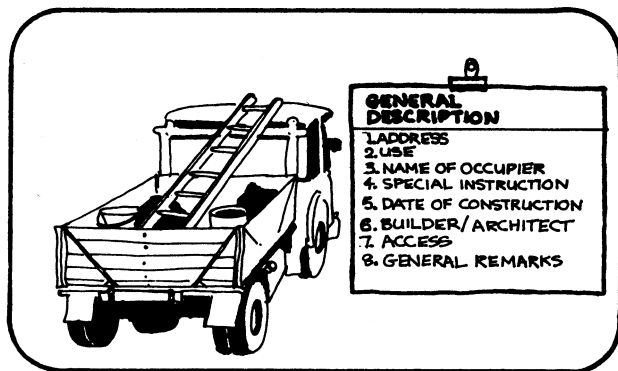


Fig. 33

The General Description should be updated from time to time as any of the details alter, e.g. change of use, new occupier, additional construction works. The remaining information will be compiled in the form of an Inspection Report, which should be written out by the member of staff who carries out the inspection. It may be convenient to separate major items from general decoration and minor maintenance items, since the latter could be set out on a room-by-room basis on a standard form.

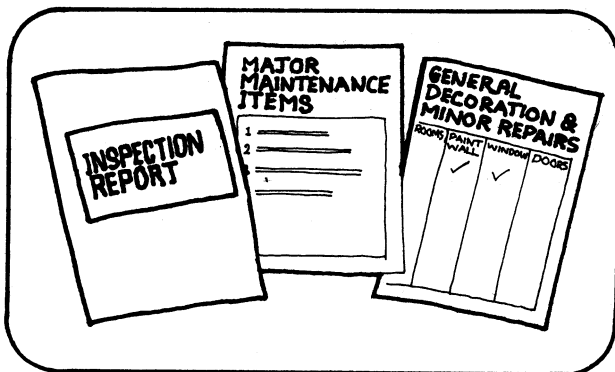


Fig. 34

A typical standard form for inspection of individual rooms in a building is shown in Fig. 35 on page 57. Although it is not always possible to use standard forms for internal inspection of buildings, they can usually be applied where a standard design of building has been constructed, such as school classrooms or government houses. In these cases it is possible to pass a copy of the completed form on to the foreman of the maintenance gang, once the work to be done has been approved, so that he will have a clear picture of his workload.

Where the properties to be maintained are of uniform construction such as government houses on an estate, it may also be possible to devise a form to cover external repairs.

COMPILING A CHECKLIST

Where the buildings are so variable that a standard form cannot be employed, a checklist may be helpful as a reminder to the inspector of the items which he should examine and report on. This will naturally vary according to the building types, but the checklist might well take the following form:

INSPECTION CHECKLIST

A. ROOF

1. Covering
 - description
 - finish - main
 - hips
 - ridge
 - verge
 - other roofs
 - general condition
 - immediate repairs required
 - estimated life

2. Eaves
 - construction
 - projection
 - defects
 - repairs required

3. Gutters
 - materials
 - size
 - condition
 - defects
 - repairs/redecoration required

4. Rainwater pipes
 - materials
 - size
 - condition
 - defects
 - repairs/redecoration required

5. Flashings
 - chimneys
 - abutments
 - gutters
 - repairs required

6. Interior
 - access
 - construction
 - boarded areas

- condition of timbers
- infestation
- immediate repairs required
- estimated life of main structure

7. Rain penetration

8. Insulation

9. Storage tank

- material
- capacity
- age
- support
- cover
- conditions
- whether replacement needed
- estimated life

10. Pipework

- material
- condition/leaks
- whether repairs or replacements needed
- estimated life

11. General remarks

B. WALLS

1. Materials used

2. External finish

3. Condition (note any cracks)

4. Pointing

5. Decoration

- material used
- condition

6. Gables

7. Plinth
8. Foundations
 - subsoil
 - construction
 - settlement
 - defects
9. Air bricks
 - type
 - size
 - position
 - obstructions
 - any action needed
10. Damp course
 - material
 - obstructions
 - height above ground level
 - height above floor level
 - continuity
 - pointing
 - any action needed
11. General remarks and work to be done.
12. Windows
 - type
 - material
 - sub frame
 - sill
 - position in rebate
 - finish
 - condition of putty
 - general condition
 - glazing
 - any replacements needed
 - work to be done
13. External doors
 - type
 - material
 - frame

- threshold
- finish
- condition of putty
- general condition
- any replacements needed
- work to be done

14. Flashings

- materials
- position
- adequacy
- work to be done

15. Balconies and
Verandahs

- construction
- rail
- finish
- any replacements needed
- work to be done

C. FLOORS

1. Construction
2. Stability
3. Finish
4. Any infestation
5. Other defects or damage
6. Surface condition
7. Expansion joints
8. Access traps
9. Any replacements needed
10. Work to be done

D. STAIRCASES

1. Construction
2. Stability
3. Finish
4. Any infestation
5. Other defects or damage
6. Treads
 - finish
 - nosing
 - condition
7. Rails
8. Any replacements needed
9. Work to be done

E. INTERNAL FINISHES

1. Plaster
 - ceiling
 - walls
 - finish
 - work to be done
2. Woodwork
 - condition
 - any infestation
 - decorative repair
 - work to be done
3. Fittings
4. Decorations
 - materials
 - standard
 - condition
 - work to be done

F. WATER SERVICE

1. Main supply
 - position
 - type

2. Rising main
 - material
 - position
 - condition
 - repairs or action needed

3. Cold water service
 - material
 - condition
 - repairs or action needed

4. Hot water service
 - storage
 - material
 - condition
 - immersion heater
 - repairs or action needed

G. ELECTRICITY SERVICE

Report from specialist if necessary

H. DRAINAGE

1. Outfall
 - foul
 - stormwater

2. Interceptor

3. Fresh air inlet

4. Manholes
 - construction
 - covers
 - rendering
 - channels
 - benching

5. Drains
 - material
 - size
 - condition (state if water, air or smoke tests carried out)

- any work to be done
- 6. Waste pipes
 - material
 - size
 - condition
 - replacements or repairs needed
- 7. Cesspools
 - size
 - capacity
 - condition
 - overflow
 - work to be done
- 8. Septic tanks
 - size
 - capacity
 - condition
 - outfall
 - work to be done

I. OUTBUILDINGS

1. Description
2. Condition
3. Work to be done

J. GROUNDS AND GARDENS

1. Driveways
2. Paths
3. Lawns
4. Gardens
5. Hedges
6. Trees

7. Work to be done

K. BOUNDARIES

- | | |
|------------------------|----------------------|
| 1. Fences | - material |
| | - condition |
| | - work to be done |
| 2. Walls | - material |
| | - condition |
| | - work to be done |
| 3. Gates | - material |
| | - condition |
| | - work to be done |
| 4. Unmarked boundaries | - marking to be done |

L. GENERAL REMARKS

The above checklist would be issued as a general reminder to inspectors, and it would not be necessary for them to report in full on every item for each building in turn. It has been made deliberately comprehensive so that nothing should be forgotten, but the inspector would use his judgement in deciding which items should be closely examined and where a cursory examination would be sufficient.

Wherever possible the general checklist leading to a written report should be superseded or supplemented by a more detailed checklist form with gaps which could be filled in by the inspector as he undertakes his inspection. It may be difficult to do this where buildings are very diverse in their nature, but could be very helpful for standardised structures such as schoolrooms. In that case it will usually be possible to employ a standard layout for decoration and minor repairs to rooms, such as that shown in fig. 35.

Fig. 35

BUILDING INSPECTION CHECKLIST - INTERNAL						APPROVAL
ROOM NAME/No.	FIRST INSPECTION			FINAL INSPECTION		
ITEM	SURFACE	POSITION	INSTALLATION	OPERATION	GENERAL	
FLOOR + skirtings			/	/		
WALLS + screens			/	/		
CEILING			/	/		
WINDOWS + fittings						
DOORS + fittings						
FIXTURES + fittings						
ELECTRICITY lights & sockets	/					
WATER SUPPLY	/					
DRAINAGE	/					

Organising Maintenance

The nature of an activity should always determine the way in which it is organised. A contractor specialising in building repair and maintenance work will approach the problem differently to a public sector organisation which can plan its work on the basis of a planned and known workload. In addition the contractor has to give a good deal of attention to obtaining enquiries for work and submitting tenders and estimates, while the direct labour organisation will normally only carry out repairs and maintenance to the stock of houses and buildings for which it is responsible.

In either case the schedule of work to be done will be based on an inspection of the buildings to be maintained, which will lead to a list of work to be done on each particular building. Although the budget should give a realistic estimate of the resources required to provide a suitable service on an annual basis, the maintenance manager will have to direct and manage the resources from day to day and weeks to weeks to ensure that the actual work needed that is revealed by the inspection is carried out as cheaply, rapidly and effectively as possible. The three key resources which must be brought to the right place at the right time are: 1. Men, 2. Materials, 3. Tools, plant and equipment.

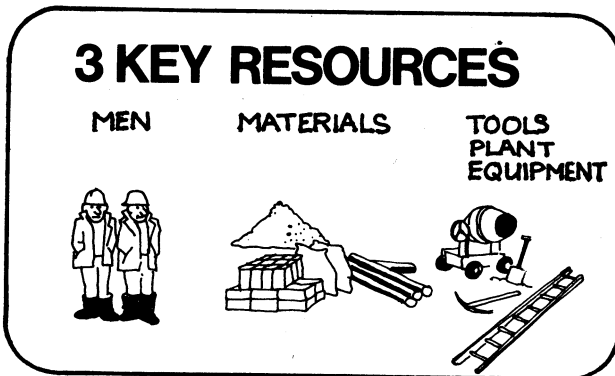


Fig. 36

1. Men

It is certain that the service provided by any building department cannot be better than the quality of the labour force employed. This is even truer of building maintenance than it is of general construction, since craftsmen work in smaller groups and it is not possible to give strict and continuous supervision. Thus it is vital that these men should fully understand the objectives of their work, and be motivated to carry out their tasks skillfully and effectively. If their only interest is the size of their pay packets at the end of the day, week or month, they will be unlikely to provide an acceptable service, and the reputation of the maintenance department will suffer.

Thus the maintenance manager must be an understanding manager of men as well as a technically qualified professional. The intensity of supervision will depend on the number of men employed on each building at any one time. On a large renovation job requiring a substantial labour force, it may be possible to run the work like a typical building contract, with a full-time foreman. On a slightly smaller job there will probably be a working foreman or charge-hand.

However many of the smaller jobs will not even justify this degree of supervision and a group of two or three men would probably be instructed and supervised by a travelling supervisor, with responsibility for a number of jobs.

One way of improving the performance of men, particularly where it is only possible to provide occasional supervision, is to introduce some form of financial incentive scheme based on a measurement of the work carried out.

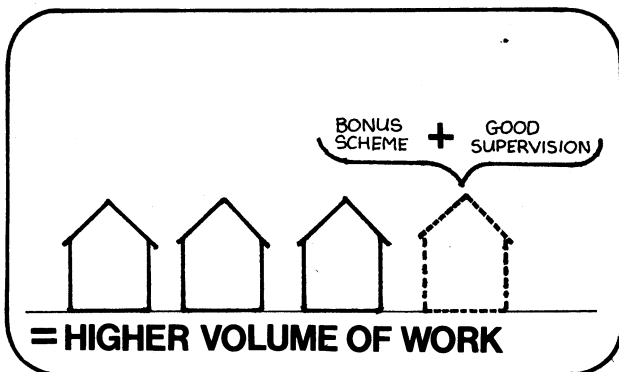


Fig. 37

Targets can be set for individuals, although this tends to take time and be expensive, so it is often better to set targets for a group of men working on the same job. The setting of targets is an important activity and must be done on the basis of considerable knowledge and experience of general building work, as the targets must be acceptable as fair and reasonable by the employees, while ensuring improved performance.

If the targets are too low and easily reached, there will be no incentive to work more effectively and output will not improve as it should to cover the increased wages cost resulting from the bonus payments. On the other hand, if targets are set too high, the operatives will find that they have no hope of reaching them and the incentive effect will be lost.

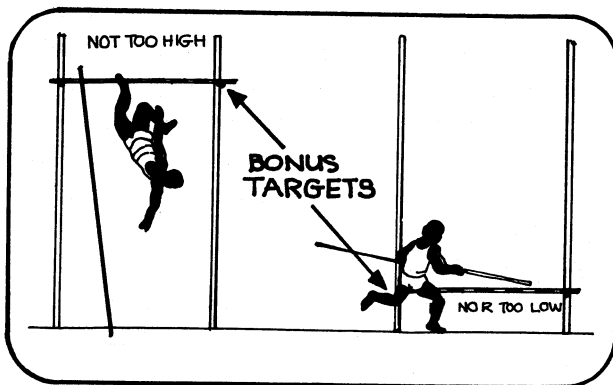


Fig. 38

Once the bonus targets have been set, they should be kept at the same level for a reasonable period. If an employer is suspected of raising bonus targets 'because his men are earning too much money', they will slow down their output and make jobs appear more difficult than they really are. This can be done more easily on repair and maintenance work than on major construction contracts, since supervision cannot be so close. Thus it is even more vital to earn employees loyalty by fair treatment.

A bonus scheme should not be seen as an alternative to proper supervision, because it can only work if there is good supervision. But it is a way for a good employer to share the benefits that result from a fully motivated performance with the operatives that contribute to better standards and a higher volume of work.

There is a number of ways in which incentive schemes can be operated. The cruder method is to simply sub-contract the labour element in the work at a fixed price for each part of the jobs, or according to a schedule of rates. This has the advantage for the employer of enabling him to know precisely the labour cost that will be involved before the job is started, but also the severe disadvantage that the labour force is unlikely to feel much loyalty towards the employer as they have no expectation of continuing and improving working conditions.

A better way to provide an incentive scheme is to employ men directly at a generally accepted wage rate, and pay a bonus related to productivity once their output has passed a target figure. It is important that the target figure for bonus purposes is known and understood by the labour force in advance, so that they can appreciate the required level of output and to avoid unnecessary arguments about bonus levels after the work has been done.

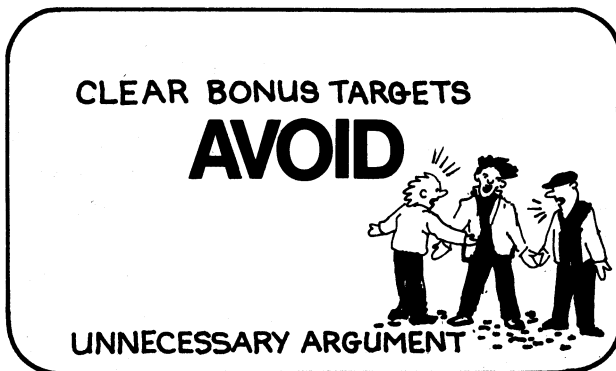


Fig. 39

Of course bonus schemes are not a substitute for good management. If the workman has not got the right tools or has to wait for detailed instructions or materials do not arrive when they are needed, he will be unable to reach the required output but will not be blameworthy. In fact, if he fails to earn a bonus due to mistakes by management, he will feel that he has been cheated. Thus incentive schemes must go hand in hand with improvements in management. It is only by a combination of incentives with good management that a bonus scheme can effectively raise the level of productivity.

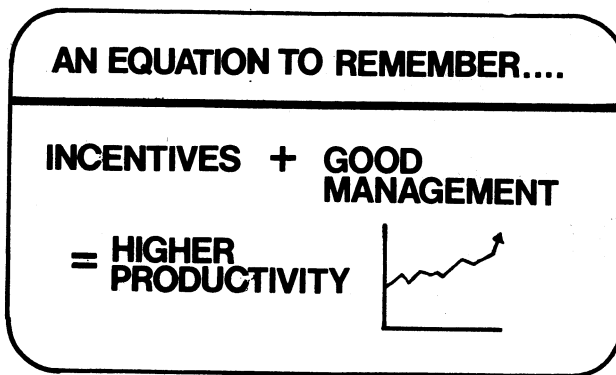


Fig. 40

There is, of course, much more to managing a labour force than providing instructions, wages and financial incentives. It is also vital to ensure that the workers are properly trained to do the work that is expected of them. Building maintenance involves a great variety of tasks, and it is unlikely that new recruits will be fully experienced in all of them.

Since they will be required to work in small groups and show initiative in dealing with problems as they arise, proper training for building maintenance workers should be seen as an investment in tools, equipment and other physical assets. If the organisation and its workload is large enough, it will be well worthwhile organising special courses, which can be tailor-made to suit special requirements.

These courses should not be limited to craft skills, but should also cover the other special skills that will be needed if the maintenance activity is to be properly organised and controlled. They would include:

1. Recognition of faults and appropriate repair techniques
2. Unit costs of common repair items
3. Recording and measuring completed work.

Supervisors should be chosen carefully, as it is always difficult to find sufficient men with a suitable blend of skill, knowledge and experience who can be trusted to faithfully represent the interests of their employer. Although the foreman should certainly be experienced in the trades that he is required to supervise, technical knowledge alone is not enough. There is also a need for human skills and a strong personality so that the workers for whom he is responsible respond by giving of their best.

It is also vital that the supervisor should be trusted and backed up by his employer. He should have the freedom to make decisions within his own area of responsibility, such as ordering plant and materials and discussing day-to-day problems with the client or occupier of the building.

A final point in this section must be the vital one of the employer's responsibility for the health and safety of his employees. Partly because the jobs are usually of short duration, concern for safety on maintenance work appears to be less than that on new construction. This is particularly marked where there is a necessity to work at heights, as the cost of erecting and dismantling of scaffolding would be high in relation to the overall cost of the work to be done. It is the responsibility of the employer to see that the men under his control do not run unnecessary risks. Although it is often difficult to provide for standards of safety and welfare that would be required on new construction, the employer should see that they do not fall below a minimum acceptable standard.

2. Materials

The cost of building materials, particularly those items which have to be imported, rises year by year and accounts for a high proportion of maintenance expenditure. Once he has ensured that his labour force is managed, the main potential savings open to a maintenance manager must come from better purchasing and more economic use of building materials.

The first step must be to review purchasing and storage arrangements to ensure that the appropriate items can be supplied rapidly when they are required. In many cases it will be important to ensure that new materials match closely with the old, so a greater variety of items will have to be stocked then for new construction and a good stock recording system must be put into operation.



Fig. 41

A Maintenance manager is subjected to many more pressures than an executive responsible for new construction. For new buildings there is usually an agreed completion date and a programme of work is drawn up to ensure that it will be met so, providing the construction work on the site proceeds according to the rate set out in the programme, he knows that his client will be satisfied. However, the man who is responsible for the maintenance of buildings once they have been constructed will often, despite a programme of preventive maintenance, be faced with emergency requests to deal with immediate problems. He will naturally want to deal with problems as promptly

as possible, so his main anxiety will be to get men and materials to the job without delay.

Thus it is easy to overlook the need to review purchasing procedures in order to ensure that the cost of materials is brought down to a minimum figure. There are five basic objectives in purchasing. These are to buy:

- the right quality
- at the right time
- from the right source
- in the right quantity
- at the right price

The first consideration is naturally to see that the quality of the goods provided conforms to the requirements, which may be that new bricks match with existing brick buildings or that a special window frame should be made up to replace one that has rotted or decayed. Of course it is not enough just to order goods of the correct quality. It is also necessary to ensure that the foreman or site representative inspects the goods carefully after they have been delivered to make certain that they conform to the order and to the requirements for the work.

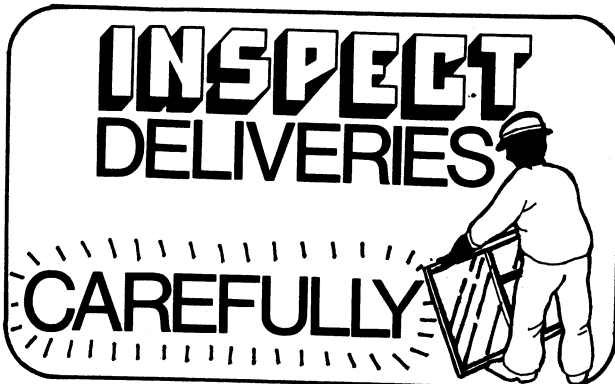


Fig. 42

The second consideration must be to ensure that the materials are delivered to the job at the right time. Late delivery of materials is a very common cause of low productivity, as the operatives and craftsmen cannot be blamed for failing to get on with their work when they have no materials to work with.

All receipts of materials should be entered in a 'goods received' book or standard form so that invoices can be checked later. The foreman should be instructed to report any additional or outstanding items so that the supplier can be asked to deliver them in time to be incorporated in the work.

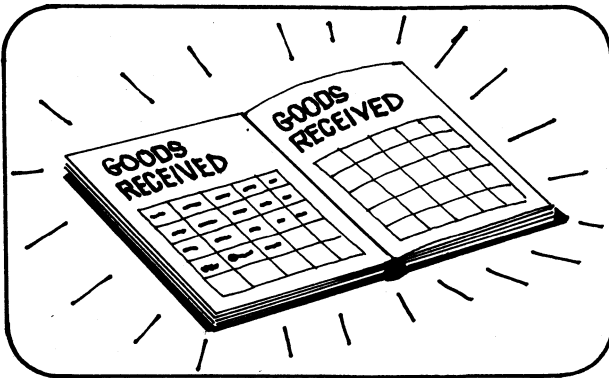


Fig. 43

The source of building materials for maintenance jobs can be either from stock or from a materials supplier. Although there are great advantages in keeping a good inventory of stores including the opportunity to make bulk purchases at good levels of discount, care must be taken in selecting types of material for stock. Where there are good records of past work, it should be possible to estimate reasonably accurately the quantities of standard materials such as cement, concrete blocks, timber and paint.

However, holding stocks does itself cost money. Although it is convenient to be able to draw any particular item from ones own store rather than to have to wait for delivery, it is also important to calculate the best level of stocks to provide a useful service without tying up too much capital.

Apart from the risk of items being stolen, getting out of date, deterioration or being destroyed by fire, the storeroom itself is an overhead and its overhead can only be charged to the stocks held. So the longer an item is held in stock the greater the additional overhead charge that it attracts, and this may easily be greater than the inflation in the prices of equivalent new materials.

Attention must also be given to ensuring that the correct quantity of each item is delivered for each job, including a reasonable allowance for breakage or wastage where this is appropriate. It is foolish to hold up a carpenter due to shortage of nails or screws, but it is also important to keep track of these small items as they can cause a significant increase in costs if they are made available without check.

The fifth consideration is to buy at the right price. The 'right price' may not always be the lowest price, since the right price is the price which leads to the lowest cost of material when it is ready to be installed. A reliable supplier who quotes a standard price may well be preferable to one who is less reliable but offers some form of discount to attract business and the alternative quotations must be carefully evaluated.

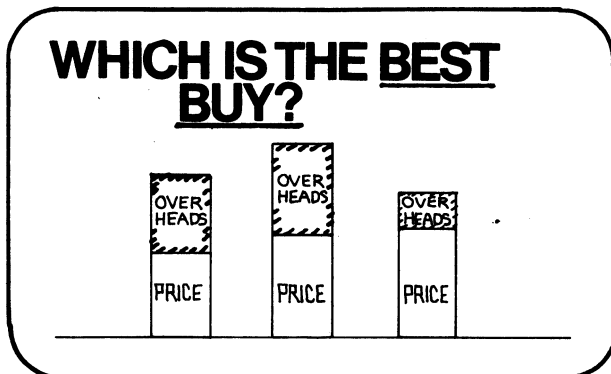


Fig. 44

Among the oncost factors which must be taken into account in deciding the addition to the price that will give the true cost of the item are:

- purchasing overheads including office costs
- costs due to defective materials
- costs of carrying stocks
- losses if work is disrupted
- costs of double handling materials
- costs of poor service by supplier

It is easy to calculate precisely the varying contributions to oncost resulting from dealing with a series of different suppliers, but it is certainly possible to make a subjective judgement on which of the suppliers gives a prompt and reliable service. In fact, where there is a good supplier in the district, it is less important for the maintenance department itself to hold a high level of stocks. In this case a slightly higher unit cost can be absorbed by savings on costs of carrying stocks and of double stocks and of double handling materials.

Another general point is that the larger the order placed with a supplier, the keener he will be to obtain the business with the result that his unit prices should be lower. So it can pay to calculate the annual requirements for timber, cement, ironmongery, paint, etc. and ask for competitive quotations on the basis that the goods should be delivered at a fixed price month by month over the whole period.

3. Tools, Plant and Equipment

A maintenance department is not likely to require as large a budget for plant and equipment in relation to turnover as an organisation specialising in new construction work. Since a maintenance department usually has to deal with a large number of fairly small jobs rather than a few large ones, the need is for a variety of small tools and light equipment that can be transported easily and used for a wide variety of types of work.

The sort of work that a typical estate maintenance department would be called upon to carry out would include external painting as well as repairing defective window sills, and frames, repairing loose door frames, new eaves, gutters or downpipes and repairs to broken or defective doors. There will also be a need for repairs to plumbing, drainage and sanitary work and there may be a call to undertake brick laying, blocklaying and plastering work. Many building maintenance departments also execute electrical repairs and maintenance.

The stock of tools, plant and equipment to be held as a matter of policy will have to be decided on the basis of the prevailing type of activity in which the maintenance department is involved, as well as the types of building for which the department bears responsibility. The stocks will consist of three main types of goods:

Plant

Major items such as benches, ladders and trestles which should last for many years;

Tools and Equipment

Small tools such as hammers, chisels, drills and trowels;

Stores

Minor items that will be needed to carry out repair work from day to day, such as screws, nails, hinges and locks.

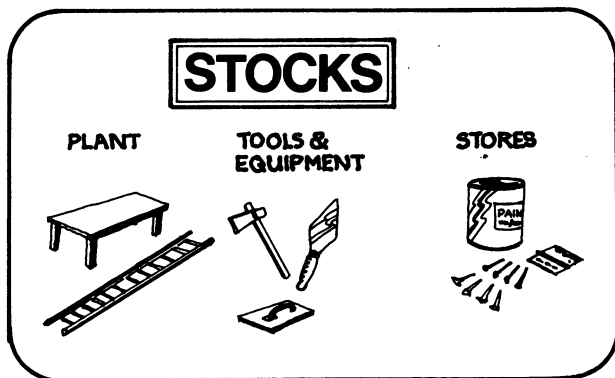


Fig. 45

As a guide to the types of plant, tools and equipment and stores which might be required for various types of work, the following tables have been prepared, although these must naturally be reviewed and modified according to local requirements:

Fig 46 TYPICAL ITEMS REQUIRED FOR JOINERY AND GENERAL REPAIRS

Plant	Tools and Equipment	Stores
Joiner's bench	Hand saws, rip	Files
Clamps	Hand saws, cross-cut	Ironmongery
Vice	Hand saws, panel	Nails
Extending ladder	Hand saws, tenon	Screws
Step ladders	Hand saws, dovetail	Door furniture
Scaffold beards	Chisels	Window furniture
Drill	Gouges	Cupboard furniture
	Screwdrivers	Hack saw blades
	Hammers	Paint
	Mallet	Varnish
	Paint brushes	
	Hack saw frame	

Fig 47 TYPICAL ITEMS REQUIRED FOR PAINTING AND DECORATING

Plant	Tools and Equipment	Stores
Ladders, various lengths	Paint brushes, various	Paints
Step ladders	Putty knives	Varnish
Trestles	Scissors	Glass paper
Scaffold beards	Scrapes	Steel work
Sunt sheets	Screwdrivers	Paint cleaner
Tarpaulins	Pinces	
	Pliers	
	Glass cutting bench	
	Diamond for glass cutting	

Fig. 48 TYPICAL ITEMS REQUIRED FOR BRICKLAYING, BLOCKLAYING AND PLASTERING

Plant	Tools and Equipment	Stores
Scaffolding	Large trowels	Cement
Ladders	Pointing trowels	Sand
Trestles	Floating trowels	Line
Scaffold brackets	Hammers	Plaster
Scaffold boards	Chisels	Tiles, various
Mortar boards	Rule	Drain pipes
Buckets	Screwdrivers	Half channels
Hods	Shovels	Step irons
Wheelbarrows	Plumb bob and line	
Plaster boards	Straight edges	
	Scrapes	

Fig. 49 TYPICAL ITEMS REQUIRED FOR PLUMBING AND DRAINAGE WORK

Plant	Tools and Equipment	Stores
Plumber's bench	Blow lamp	Solder
Jaw vice	Mallets	Taps
Pipe vice	Hammers	Waste traps
Taps and dies	Chisels	Ball valves
Pipe rocks	Scrapes	Guttering
	Files	Rainwater downpipes
	Plungers	Drain pipes
	Drain rods	C.I. pipes
		Manhole covers
		Inspection pit covers
		Basins
		Sinks
		Baths
		Sanitary ware
		Putty
		Paint

Fig. 50 TYPICAL ITEMS REQUIRED FOR ELECTRICAL REPAIRS AND MAINTENANCE

Plant	Tools and Equipment	Stores
Bench	Pliers	Light bulbs
Ladders	Screwdrivers	Cable, various
Scaffolding	Chisels	Conduit, various
Testing apparatus	Hammers	Switches, fitments
	Drills	Clips
	Torch	fuse wire

Administration

The effectiveness of a maintenance department must depend on the skill of the manager in applying the three key resources of men, material and equipment. Good clerical and administrative procedures can make a very valuable contribution to ensuring that the department provides an appropriate level of service to the uses and occupiers of buildings as well as increasing the economic life of the capital assets that the buildings represent.

In turn this implies that a prime task for the maintenance manager is to steadily build up a filing system of management information upon which he can base his decisions. Whilst the procedures that should be followed in a particular department must depend upon the administrative needs, certain basic forms will certainly be required as a matter of course.

As outlined in chapter three, three basic forms which should be prepared for medium-sized and major maintenance jobs are:

1. A Daily Labour Allocation Sheet showing the number of men in each gang employed on various tasks.
2. A Materials Sheet detailing the materials employed in each job.
3. A Job Sheet describing the work carried out and detailing any additional expenses.

Examples of each of these forms which provide the basic information for a costing system are shown in Figs. 51, 52 and 53 on the following pages.

TYPICAL MATERIALS SHEET

MATERIALS SHEET

Job No.

Address:

Gang:

Foreman/Charge Hand:

Date:

DESCRIPTION	MAKE	CATALOGUE NO.	SIZE	RECEIVED AT JOB		RETURNED TO STORE	
				QUANTITY	VALUE	QUANTITY	VALUE

JOB SHEET

Job No.

Address:

Gang:

Foreman/Charge Hand

Date:

Work Carried Out:

Extra Work or Variations:

Date started:

Date finished:

Additional Expenses:

Inspection reports and working drawings should be filed according to the property to which they refer. It will normally be best to keep separate files for each building although in some cases files may cover a group of buildings.

Other forms and written records should cover:

Staff and Employees

- personal records, wage or salary rates, records of training;

Pricing Records

- for maintenance of up-to-date price records of materials;

Purchase Orders

- for materials, plant and equipment;

Receipt Forms

- for payments received;

Maintenance Record Forms

- for use in planned maintenance;

Wages Sheets

- for preparation of wages;

Petty Cash Forms

- to record minor cash payments;

Maintenance Request Forms

- to be sent in by occupier to request repairs;

Job Cards

- authorising work given to foreman or charge hand.

Typical forms for all these activities have not been specified since needs must vary greatly from one organisation to another, and suitable forms should be designed by the maintenance manager after a careful analysis of his own procedures and needs. The steps to be taken are as follows:

1. Check all existing forms. Do they provide all the information required? Do they give any information that is NOT needed?

2. Re-design existing or design new forms as necessary.
3. Check the sequence of operations, and rearrange as necessary.
4. Check the number of operations and reduce as possible.
5. Decide who should deal with each operation.
6. Check to see that the procedures provide the information required in time for the right decisions to be made.

It will then be necessary to ensure that all staff and employees understand what is expected of them, and review the procedures after a period to check that they are working out as expected. It may also be helpful to issue a short manual to building occupiers so that they will understand the maintenance services that are available to help them, and will hopefully take a more positive interest in ensuring that the buildings which they occupy are properly looked after.

A Manual on

Volume 1: Management

Volume 2: Methods

by Derek Miles

These companion volumes have been produced because of a lack of suitable guidance for managers of building units. This applies to both the public and private sectors in the administration and management of building sites, and in the technical aspects of maintenance work.

Owing partly to the differing systems for allocating funds between capital and revenue budgets, expensive buildings are often allowed to deteriorate. This waste of resources is particularly unfortunate because repair and maintenance work is labour intensive and costly. *Vol.1: Management* deals with efficient control procedures such as resource budgets, finance, manpower, materials, equipment and provides a rational and practical system for measuring performance. *Vol.2: Methods* examines actual maintenance problems, suggests some of the more common causes of failure and sets out methods for dealing with them.

These volumes make a useful and valuable contribution to increasing the operating efficiency of building units in developing countries and in the industrialised world.

Derek Miles, MICE, the author, is a civil engineer and consultant on appropriate building construction, including the organisation and management of construction enterprises, and of training methods. He has wide experience of construction industries in developing countries and is currently Senior Technical Adviser on building to the Intermediate Technology Development Group. He is the author of several publications on building management, construction and training.

"Both volumes have been written to assist maintenance staff working in developing countries to appreciate and apply maintenance techniques . . . to their particular problems. In this, the books appear successful. In the first volume, methods of maintenance management and control are clearly set out and the book would be of use to small maintenance departments in this country. Volume 2 . . . is clearly simply written and illustrated and should be ideal for its intended use."

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