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ABSTRACT

A seminar was held to exchange experiences from participants on maintenance issues and attempt to define a common approach to the formulation of adequate and realistic maintenance policies and strategies. This paper discusses the major themes and conclusions from the seminar whose topics were structured around the knowledge of building stock, assessing needs and priorities, budgeting, programming, and organization and control. An action plan based upon the strategic thinking noted in the paper is also discussed. Appendices include a review of the issues discussed, an example of a Society of Chief Architects of Local Authorities Maintenance Survey and explanatory notes, extracts from the Carnet D'Identite and Carnet D'Entretien and an example of a summary sheet in use in Belgium, and an example from England of instructions for carrying out a condition survey. (GR)

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MAINTENANCE OF EDUCATIONAL BUILDINGS
POLICIES AND STRATEGIES

Conclusions of a Seminar in Han-sur-Lesse, Belgium
21 - 25 October 1985

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MAINTENANCE OF EDUCATIONAL BUILDINGS
POLICIES AND STRATEGIES

Conclusions of a Seminar in Han-sur-Lesse, Belgium
21 - 25 October 1985

by

Ian Bobbett

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The seminar on The Maintenance of Educational Buildings - Policies and Strategies, held in Han-sur-Lesse, Belgium, 21st to 25th October 1985 was organised by the Fonds des Bâtiments scolaires de l'Etat of the Belgian Ministries of Education in co-operation with the Decentralised Programme on Educational Building (PEB). It brought together over forty participants from thirteen OECD Member countries.

The aim of the seminar was to exchange experience on maintenance issues and attempt to define a common approach to the formulation of adequate and realistic maintenance policies and strategies. Despite differences between countries in the organisation of education, administrative structures and funding arrangements as well as in the condition of the building stock, there was a remarkable consensus on the main problems experienced and the action needed to overcome them.

This paper, prepared by the Rapporteur, Mr. Ian Bobbett, County Architect, Surrey, England, summarises the main themes and conclusions of the seminar.

The paper does not set out to prescribe solutions but aims at suggesting an approach. It should be regarded as the Rapporteur's personal interpretation of the event rather than that of the participants or the OECD. Nevertheless, the Secretariat believes that those who attended the seminar will find in it a fair reflection of the views which were expressed.

It is hoped that the paper will be of interest to all those who at different levels of responsibility are engaged in developing more systematic and objective means of assessing maintenance needs and determining adequate levels of funding.

CONTENTS

Introduction

1. Most countries represented at the Han-sur-Lesse seminar on Maintenance of Educational Buildings - Policies and Strategies had no clearly defined strategic framework within which to formulate maintenance policies. Existing strategies were inclined to the application of financial "norms" (which took no account of a possible backlog of work) at one extreme, to a reactive process based on "bids" (which took no account of the implications for future costs) at the other.

2. There was general agreement that the main objective of the seminar was to provide a sharply focussed strategic approach to the provision of adequate funding policies from which all countries could benefit. In this context a strategy was seen as a "route map" which would identify the chain of events most likely to achieve success, but which should also be flexible enough to meet very varied national and local interests. Such a strategy was envisaged as being robust and convincing enough to challenge and eventually change deeply entrenched and often hostile attitudes to any increase in funding for building maintenance at a time when public sector resources are diminished and when education priorities are often perceived as low.

3. Discussions were structured about the following issues:

- Knowledge of the building stock;
- Assessing needs and priorities;
- Budgeting;
- Programming;
- Organisation and control.

These issues are set out in more detail as Appendix A.

4. Various aspect studies and demonstrations assisted the exploration of each issue and provisional policy statements were produced by working groups in a detailed form. Many of these statements contained ideas and conclusions which were duplicated, but what emerged from group sessions was a complex picture of the very different ways in which the countries represented at the seminar approach the same problems. Organisation of education, administration and funding arrangements, the condition of the existing building stock and usage patterns were all intriguingly different - existing arrangements for maintenance, have, quite naturally, been developed to suit the immediate needs of different educational systems designed to suit different societies.

5. However, a simple theme became evident and there was broad agreement on the main problems which were being experienced and which were common to most countries irrespective of the education systems being employed and the different maintenance systems which were used:

- The problem of insufficient funds for adequate maintenance;
- An inability to present a sufficiently convincing justification for increasing funds;
- A marked deterioration in the condition of educational buildings and a consequent demoralisation of building users;
- An increasing risk of severe disruption and the possible eventual breakdown of the ability to deliver an educational service from the existing building stock

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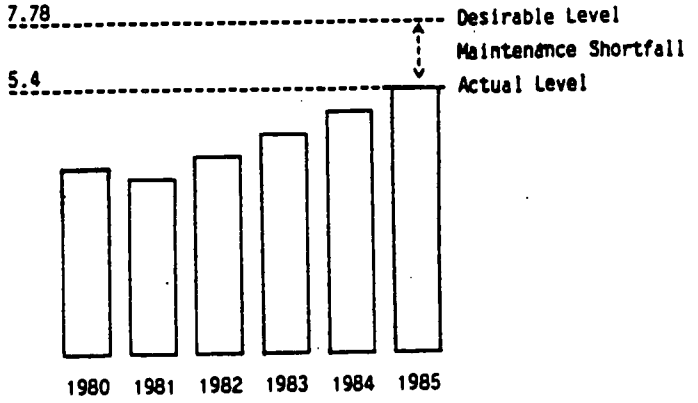
Figure 1. **TYPICAL SCHOOL MAINTENANCE EXPENDITURE**
(England and Wales - £/m^2 at 1985 price levels)



Source: "Obtaining Better Value in Education: Aspects of Non-Teaching Costs in Secondary Schools", a report by the Audit Commission for Local Authorities, H.M.S.O., London 1984.

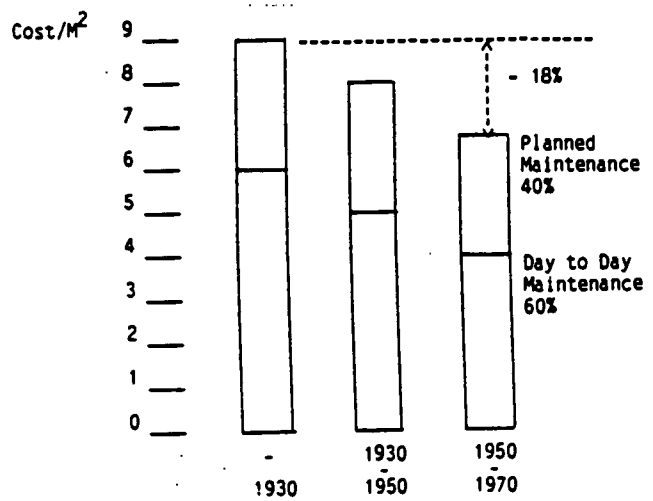
Notes

a) This diagram is typical for northern Europe and indicates an increase in funding for building maintenance over the period 1981 to 1985.

b) The diagram indicates a maintenance shortfall and it follows that even though maintenance funding has been increased a substantial backlog of maintenance still exists.

c) The desirable level of maintenance was established following annual maintenance surveys carried out by SCALA (Society of Chief Architects of Local Authorities) and a typical survey return is attached as Appendix B.

Figure 2. **AGE OF BUILDINGS AND MAINTENANCE COSTS**
(Illustrative Example)



Notes

a) Based upon a number of source documents provided at the seminar, this diagram is typical of expenditure patterns experienced in a number of countries and is contrary to the commonly accepted theory that recent buildings are more expensive to maintain than older buildings.

b) The diagram also indicates that day-to-day maintenance is generally higher than planned maintenance. This is contrary to best practice which would indicate a transposition giving planned maintenance at approximately 60 per cent and day-to-day maintenance at 40 per cent.

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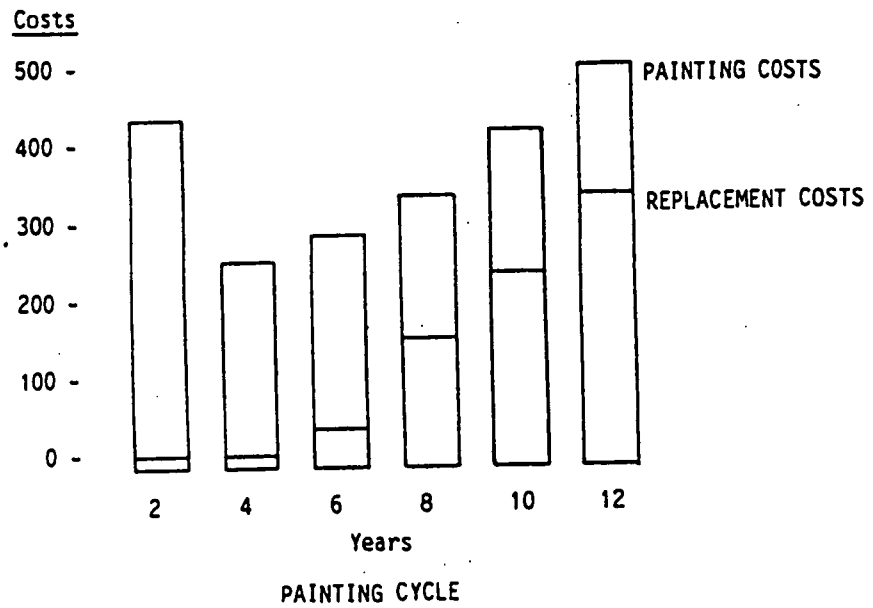
Figure 3. COST OF PAINTING EXTERNAL JOINERY OVER 20 YEARS



Source: "Obtaining Better Value in Education: Aspects of Non-Teaching Costs in Secondary Schools", a report by the Audit Commission for Local Authorities, H.M.S.O., London 1984.

Notes

a) The diagram represents a case study which indicates the effects of not complying with planned maintenance cycles. The principle equally applies to other building elements.

b) Despite well known case studies such as this many local education authorities are continuing to underfund planned maintenance thus increasing future maintenance costs.

Establishing Needs

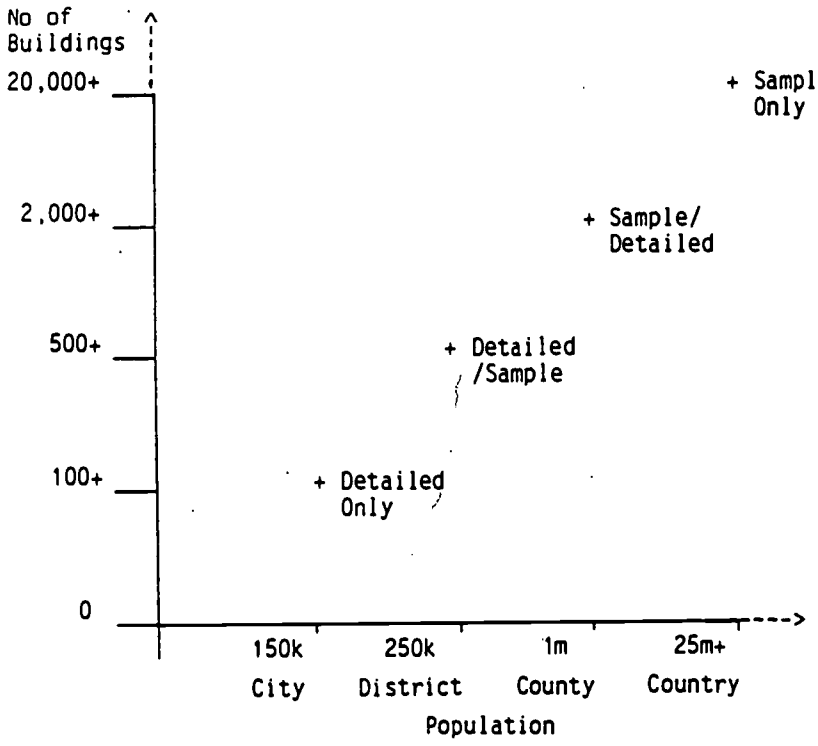
6. Good maintenance protects the investment made by society in built assets and avoids the necessity of having to spend larger sums in the future to enable buildings to continue in use. In some cases the asset value may be realised by sale or deployed to other public uses. However, there are clear advantages to be gained from good maintenance.

- Socially, it sets an example to children and young persons that the environment in which we live should be cared for;

- Educationally, the condition of the environment in which the process of educating the young takes place, indicates society's support for education;

- Environmentally, good maintenance will promote the aims of education and enhance the environmental perceptions of future citizens.

Figure 4. RELATIONSHIP OF POPULATION AND NUMBERS OF BUILDINGS TO STRATEGIC OR OPERATIONAL CONDITION SURVEYS



Notes

a) The diagram indicates the broad correlation between population and numbers of education buildings and is drawn from country statements prepared for the seminar.

b) Clearly, the administrative nomenclature may well change from country to country, for example, for "county" it is quite possible to read "city".

7. In order to promote good maintenance it is necessary to have a clear picture of the current condition of the existing building stock. This will ensure that funds are directed to the areas of greatest priority and that the effort involved in improving existing buildings is maximised. A condition statement will also establish the extent to which any backlog of maintenance work should be allowed to influence future funding levels. In considering this it is apparent that the requirements of Central Government for knowledge are different to those of local education authorities and it follows that the method, scope and content of any condition survey will be determined by the purposes to which the results of such a survey will be put.

8. In some circumstances it is apparent that the condition of the building stock has to be established by a representative sample survey - for example, in a country of 50 million population with 53 000 educational buildings. Such a survey can either be a statistically meaningful sample representing all of the various criteria and categories likely to influence it or it can be a random sample which is then statistically corrected to prevent distortion. There are also situations in which a total survey would be appropriate - for example, in a city of 450 000 population with 160 educational buildings, it will be possible to survey each building, that is, a 100 per cent sample. In other

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cases it would be appropriate to undertake a representative sample survey for specific purposes, such as establishing overall funding levels or to determine the likely extent of plant and equipment renewal programmes. Such a sample survey would then be followed by a more extensive and detailed survey built up over a period of years or perhaps concentrated upon a particular building type or constructional form.

9. Clearly, there is a difference between the strategic and the operational levels of policy making. The strategic level requires soundly based but broad knowledge in order to arrive at decisions, for example at national level, this will imply establishing the condition of the building stock by means of an appropriate random sample. The main characteristic of such a survey is that it should be simple to obtain the necessary information and that it should be possible to enlarge the original survey by including greater detail at a later date. There is also an operational level at which detailed knowledge is required in order to establish precise work programmes. This would generally be at local level and implies annual condition surveys of individual properties.

Inventory of the Building Stock

10. The formal documentation, recording and costing of survey information is critical to the budgetary process and the preparation of priority work programmes. In many countries there are no complete records of the construction characteristics or disposition of teaching spaces of buildings in use. Some countries make some use of manual and computerised systems which cover information for property management purposes. Such systems are being developed within the context of complex management, planning and financial processes which are subject to organisational and political influence. For example, an experts meeting convened by PEB has tried to define common criteria for the development of a core information system.*

11. It is not at present possible to see how the flow of information necessary to support the maintenance function should be related to such a core information system but what can be stated are the basic "building blocks" of information required to provide a knowledge of the building stock sufficient to assist the promotion of adequate maintenance policies.

12. Any inventory of the building stock will be based on two types of document.

- A building log book (carnet d'identité) of the school, being a complete "as built" record updated annually and held at the school premises;

- A building inventory (inventaire), being a note of the essential basic information contained in the log book, but held centrally. The inventory would form the primary record of any sample survey.

13. The log book would describe the site location, access arrangements, service supply routes, and would contain a detailed site plan with "as built" plans of all building, temporary or permanent, on the site. Technical specifications of building fabric elements, plant and equipment, would also be noted, together with specific routine maintenance procedures. The document

would be permanently held at the premises and updated annually by technical staff at the time of a routine annual maintenance inspection. A record of orders placed and work carried out during each year could also be included and would form the basis for assessing specific maintenance needs.

14. The inventory would contain only basic essential data (also noted in the log book) concerning a building or series of buildings forming an educational establishment. The document would note the age of buildings, areas, usage and occupancy, general condition of building fabric elements, plant and equipment, etc. The inventory would most likely be computerised and held centrally. Its purpose would be:

- To ensure that adequate and up-to-date information on the general condition and characteristics of buildings making up the educational building stock is available to managers;

- To identify action taken on individual buildings in respect of maintenance, improvements or adaptations, energy saving works, security works, etc;

- To record annual maintenance survey data;

- To assist the co-ordination and consistency of maintenance actions and to provoke review of related buildings;

- To provide costing data for budgetary purposes.

15. Various systems of storing, collecting and editing data on buildings were discussed and demonstrated at the seminar and an example is provided in Appendix B. The essential guideline which should be followed in the development of any computerised maintenance application is that the system and its hardware should be capable either of extension at a later date or be initially large enough to contain all the likely detailed information necessary from the beginning. The latter option is, of course, difficult to anticipate and further complexity is added if it becomes necessary to expand a centralised system to area or local sites. "Real time" systems would appear to provide the most appropriate response to likely maintenance needs.

Assessing Needs

16. Once collected, information relating to the building stock based on sample or detailed surveys is only a data bank and how the information is used becomes of prime importance. In some countries there are duties prescribed by law, which fall on owners and occupiers of buildings. Clearly such duties would have a major impact on the design of the information system and on the maintenance procedures derived from it.

17. In any consideration or assessment of need it is necessary to define categories of maintenance work which will generally indicate the degree of urgency or priority attached to each. General agreement was reached on the following categories of work:

- Emergency maintenance - concerned principally with the health and safety of building users. This category of work must be funded immediately if a building is to continue in occupation;

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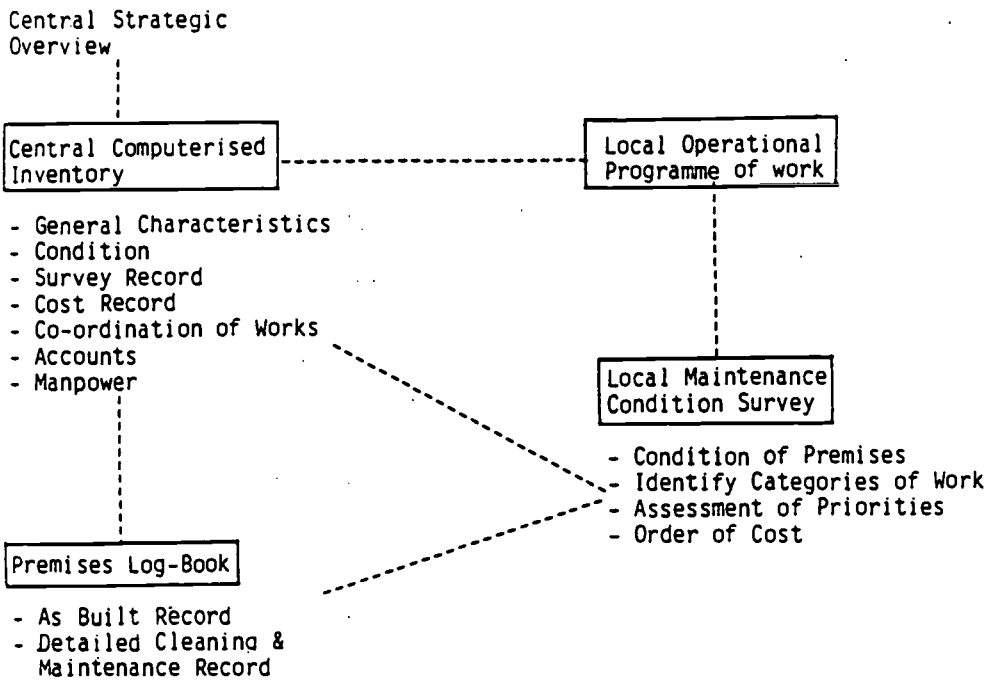
Figure 5. **ESSENTIAL BUILDING MAINTENANCE RECORDS**
(Ilustrative Example)



Notes

a) The local maintenance condition survey will be carried out either on the basis of a detailed survey or a sample. Figure 4 suggests where the latter might be necessary.

b) Typical examples of log-book and condition survey sheets are attached as Appendix C; an example of instructions for carrying out a condition survey is given as Appendix D.

- Day-to-day maintenance - excluding emergencies but including work resulting from breakdowns, breakages, vandalism and the effect of wind and weather;

- Planned maintenance - to include all work which is premeditated: preventive maintenance, cyclical maintenance, economical maintenance and caring maintenance.

18. The first two categories of maintenance work arising from survey data must generally be carried out within a short timescale and are likely to be recurrent until such time as a significant proportion (say 70 per cent) of the total maintenance workload on a given building is being carried out within the third category of work, that of planned maintenance. Emergency and day-to-day maintenance cannot usually be accurately anticipated except on the basis of experience. What is known is that where sensible planned maintenance provision has been made, then maintenance costs over the whole life of a building decrease.

19. Some element of improvement work cannot easily be divorced from maintenance, and in some systems improvements are funded from the maintenance budget. At a political level there is frequently greater interest in improvement than in maintenance alone, and indeed, an element of improvement in maintenance work would provide savings in future maintenance expenditure. Improvement is often inherent in maintenance, for example, in plant and equipment renewal and it is usually convenient to associate improvement with maintenance work when such improvements are of a minor nature.

20. The main use of the inventory is to provide data for strategic decision taking and thus form the context within which tactical decisions on a property or building will be made. Data must, therefore, be relevant and will require updating at regular intervals - at least annually. This will usually be done by means of annual maintenance surveys which will allow costed and prioritised information arising from inspections to be recorded on the building/premises inventory.

21. Initially the maintenance survey data would be recorded on a survey sheet (carnet d'entretien), the purpose of which would be:

- To provide a means of recording annual inspections of premises carried out by maintenance technicians;

- To identify the scope and content of maintenance works within the definitions noted in paragraph 17;

- To determine priorities and to provide an order or estimate of cost. Estimates based on serial contracts or schedules of rates for works within a defined geographical area would provide more precise costings than the more usual combination of pricing manual and experience. Different degrees of priority would be given to works according to whether they would be financed in the coming year, could be postponed for a year, or needed to be carried out three to five years hence;

- To allow an assessment of overall condition to be made in relation to previously established "models";

- To provide a means of collating cost and technical data for the preparation of forward programmes of maintenance works;

- To update building inventories and log-books.

Figure 6. PROJECTED TYPICAL MAINTENANCE CYCLES

Typical Building Element	Material	Planned Maintenance Cycle	Replacement Period
		Yrs	Yrs
Roofs	Felt	3	12 - 15
	Slate	5	80
	Tile	4	60
External Walls	Brick	25	100
	Timber	10	35
Windows	Timber	4	25
	Steel	10	50
Floors	Carpet	3	10
	Vinyl	6	15
	Block	5	50
Internal Wall Finish	Plaster	4	75
	Plasterboard	4	35
Doors	Timber	4	15
	Steel	6	25.

Source: "Maintenance Cycles and Life Expectancies of Building Components and Materials", paper by National Building Agency Construction Consultants Ltd., London 1985.

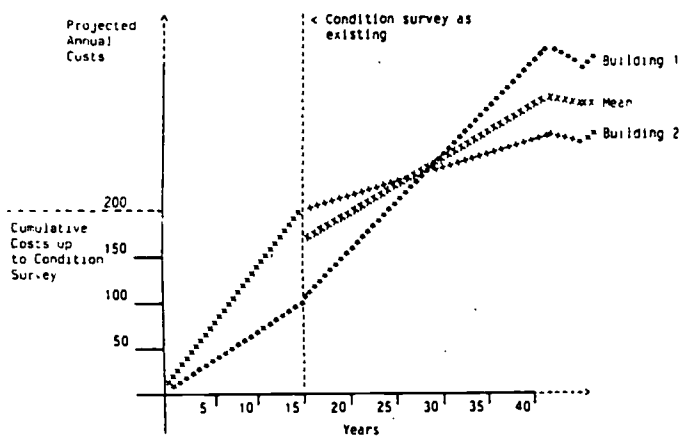
Notes

a) Following the preparation of a condition survey it is necessary to project future maintenance profiles based on tables such as this for a given building or series of buildings.

b) Accepted life cycles of the typical building elements noted here will clearly differ depending upon initial specification, nature of usage, and climate and other variations. The table noted here is typical for northern Europe; however, similar data is available for countries outside northern Europe.

c) The diagram implies that there will be peaks of expenditure associated with major replacement and renewal and there will be periods when relatively little expenditure is required.

Figure 7. EFFECT OF CONDITION SURVEYS ON FUTURE BUDGET PROVISION
(Illustrative Example)



Notes

a) The diagram indicates the effect a condition survey will have upon future maintenance costs. In the example, Building 1 is in a worse condition than Building 2 and future maintenance costs will therefore be greater.

b) Projected maintenance cost profiles will vary considerably between buildings and this indicates that future maintenance costs will not be consistent.

c) The more buildings which are included within a budget then the more such expenditure peaks are evened out.

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Budgeting

22. A condition survey forms the basis for a responsive budgetary system which takes due account of a consistent assessment of actual need. Educational buildings will vary considerably in condition between authorities depending upon the extent and adequacy of the maintenance work already carried out. It follows that the application of percentage values or "norms" for the establishment of initial budgetary levels will not be realistic since the start points will be very different. However, given a sound and consistent condition survey based either on a sample or on detailed inspection, it is possible to project a future maintenance profile for a given building or series of buildings based on the expected life cycle of the various elements of the building fabric and its plant and equipment.

23. Such maintenance profiles will also vary considerably between buildings and this implies that the resulting maintenance budgets will not be consistent. There are peaks of expenditure associated with major replacements and renewals and there will be periods when relatively little expenditure is required. However, the more buildings which are included within a budget then the more these peaks are evened out although they can never be entirely eradicated.

24. The practice of basing budgets on a percentage of a replacement value of the building stock or upon the recalculation of previous years levels of funding updated for inflation will mean that budgets become increasingly unrealistic. Such methods, together with the failure to carry out annual assessments of condition, were considered to be one of the major reasons for the currently poor state of educational buildings.

25. The method of establishing budgetary levels is therefore most important and should rely on:

- A reference to the condition of the building stock;
- A relationship to a planned maintenance profile projected for at least five years with some degree of accuracy and based upon the expected life cycles of the various elements making up the building or series of buildings;
- A degree of flexibility to ensure that unexpected emergency situations can be dealt with.

26. There will be situations in which buildings should be allowed to deteriorate or where their cultural or historical value will dictate special funding arrangements. It is also desirable to devolve some financial responsibility for maintenance to building users, perhaps in the form of localised first aid schemes controlled by value and category of work. Incentive schemes for good housekeeping could also be considered.

27. Of primary importance is the dedication of the budget to maintenance purposes and it would appear that it is common for maintenance budgets, where these form part of educational budgets, to be vired to other budget heads which are perceived as being more significant politically. Clearly, the maintenance budget should be dedicated to maintenance purposes and protected accordingly if the delivery of the service in the future is not to be prejudiced.

Implementation of Maintenance Work

28. At national level there is a desire to see long term programmes based on forecasts of financial requirement for perhaps up to thirty years. At the local level there is more concern with immediate problems of programming and implementation - some local education authorities experience difficulty in seeing more than a year ahead but recognise the need to project annual programmes to provide an indication of the likely call on local resources for up to five to ten years ahead. The general conclusions was that some central management is essential for effective control of funds but that local cost centres should be established to provide the benefits of responsiveness to local need and which would be likely to foster a sympathetic regime for the caring use of building assets.

29. Programming is seen to be an area in which information technology would be increasingly used, not only to store data on buildings but also to project composite programmes of work over future years.

30. It is common in most countries for day to day and emergency maintenance to be increasing as it becomes more difficult to command adequate resources for the provision of proper planned and preventive maintenance programmes. This trend is merely diverting work to be done at a later date at increased costs. More worrying is that in some countries there is no provision at all for planned maintenance and this situation will ultimately block both national and local educational aspirations. Such extreme cases of underprovision do highlight the necessity to consider maintenance programmes in the context of the likely life cycle use of educational buildings and the cost of providing an educational service. Clearly, it is imperative that users and administrators ensure that buildings are occupied and used efficiently and that it is never assumed that any building will remain in the same use in perpetuity, or even in the same use throughout the forecast forward maintenance programme. These considerations emphasize the need to update maintenance survey information within the context of an assessment of continuing educational need and it follows that the preparation of forward maintenance programmes by maintenance technicians can only proceed following close and detailed discussion and collaboration with educationalists, building users and administrators.

31. Following the exploration of educational need, the successful implementation of maintenance programmes will not only depend on the provision of adequate financial resources, but also upon the availability of manpower, materials and design and administration skills. Programmes of work are commonly carried out either by directly employed labour teams or by the employment of external private sector contracting organisations. Both methods have their merits, generally the more rapid response provided by direct labour organisations being offset by the problem of subsidizing labour teams during low levels of maintenance activity. Providing that a cost effective service can be delivered, then emergency and day-to-day work can be more effectively carried out by directly employed labour teams. In large building complexes this solution is inescapable.

32. Whatever the means of deploying manpower and materials, the ability of the maintenance organisation to respond quickly to problems identified by building users is paramount. The demand/response patterns and routines must be thoroughly investigated and examined for blockages, boundary disputes and complexities and simplified wherever necessary to ensure that appropriate

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response targets can be met. A truly responsive system will create confidence in the building users and enhance the credibility of the maintenance organisation. Generally, where maintenance technicians and operatives are in close proximity to the building users then these types of organisation tend to be perceived as more successful than where the administration is remote from users.

33. The problem of ensuring adequate staffing levels was widely discussed and there was a general consensus that there should be a considered relationship between staffing levels and maintenance expenditure taking due account of the work to be undertaken, the number of buildings involved in a given year, the complexity and existing condition of buildings, and the distances to be travelled, in ensuring adequate quality standards. However, in cases where staffing levels were largely determined by political considerations, it was recognised that such systems may be wasteful of skilled manpower resources.

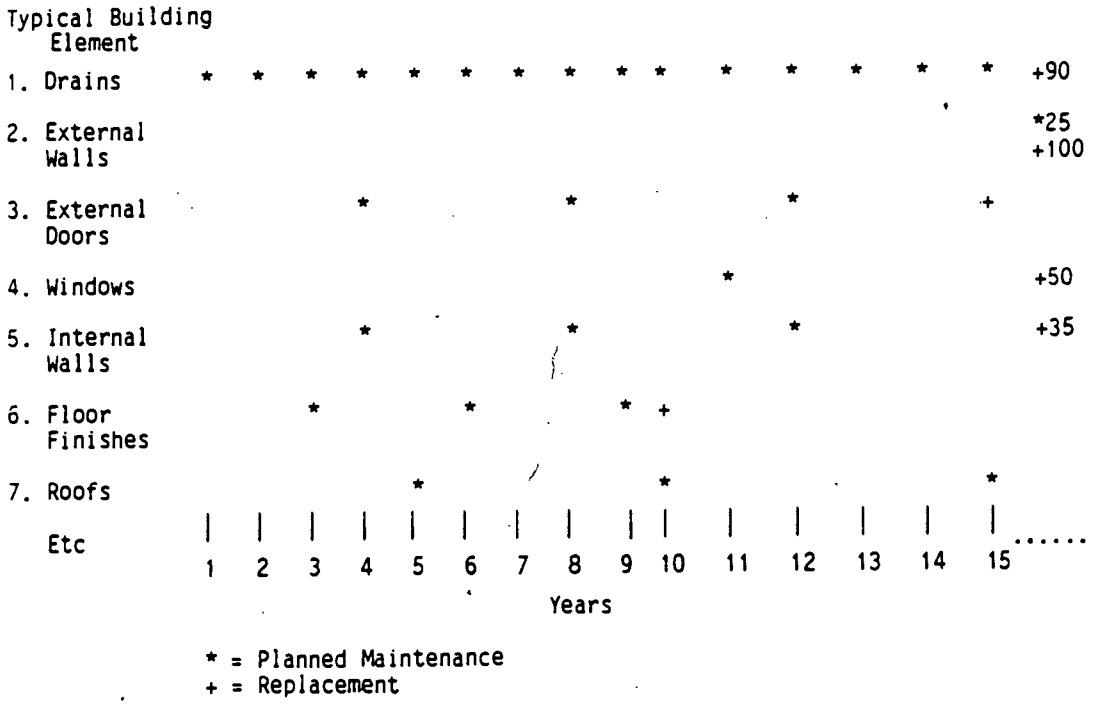
Maintenance and New Building

34. There is much evidence to suggest that designers rarely give adequate recognition to the benefits to be derived from maintenance experience of buildings and specifications in work, and the main problem is how to communicate such experience whilst still allowing room for innovation. Some authorities have included maintenance technicians in the design process with little overall benefit, and it would appear that common specifications, together with adequate technical feedback from experience of specifications in work, provides a better starting point from which to influence designers. There was little faith expressed in the use of performance specifications since it was considered that they did not present a realistic alternative to declaring and specifying precisely what was required.

35. Those authorities which have built up detailed maintenance records and which have developed profiles of future maintenance requirements can show that high initial building specifications will generally result in low maintenance costs, and that low initial specifications will generally result in high maintenance costs. There are, of course, significant exceptions to this conclusion and there was general agreement that for new design work it was desirable to establish at the time of initial proposals (schematic sketch design stages) a projected maintenance profile for each proposed building element. This would be in table form and would note the expected major repair/renewal cycle for each building element, thus enabling a correlation to be established between initial overall costs and future maintenance costs. Such a profile would also allow the development of a specification monitoring system derived from feedback of such specifications in work.

36. Life cycle costing techniques need to be developed by common agreement of the criteria to be adopted. No single existing system appears to have gained general acceptance and this would be a matter for future exploration, with the proviso that such techniques should not become an obstacle to creative innovation design, but rather assist it.

Figure 8. **MODEL NEW-BUILD MAINTENANCE PROFILE**
(Illustrative Example)



Notes

a) The diagram indicates a typical maintenance profile with which new designs may be compared.

b) A correlation may be obtained between initial overall costs and future maintenance costs based upon a desired maintenance profile.

c) In the long term such maintenance profiles will allow the development of specification monitoring systems derived from maintenance experience of specifications in work.

d) Similar tables may be derived based on life cycle costing techniques.

Promotion of Maintenance

37. Consideration was given as to how best to promote the need for good maintenance of educational buildings at national and local levels, and how best to demonstrate to those responsible for making financial allocations the need to maintain buildings adequately. Three objectives emerged.

- To make users and politicians aware of the problems and to provide constructive solutions;
- To provide data in such a way as to support the enhancement of financial resources;
- To convince funding agencies that a maintenance organisation exists which is an adequate mechanism for implementing maintenance work in a cost effective manner.

38. Many examples were provided by tables, diagrams and photographs which typified the problem, but the conclusion reached was that the most advantageous way of encouraging an awareness of the problem was to identify the key people who have to be convinced and to arrange a series of visits to actual buildings which should include discussion with building users. There was little doubt that sponsors of good maintenance would derive considerable support from building users for any improvement in the maintenance service and that this might well encourage political support and action.

39. Reports on maintenance issues must be supported by strategic and operational data which clearly substantiate the proposals being made. Plant and equipment renewal proposals, for example, can only be supported by specific and relevant survey information including the results of detailed analysis and testing of some or all buildings affected. The constraints of limited technical resources will normally restrict the provision of a complete data bank, but the use of contractor or consultant resources should be actively encouraged in this area of work - indeed, the credibility of a third party to those who are responsible for allocating finance should not be discounted.

40. Clearly, any maintenance organisation must be able to demonstrate that it is effective and many models exist to suit particular circumstances but there are objective guidelines which can be used to assess the credibility of any given organisation.

- Is the organisation committed to a definitive maintenance policy and is there a control plan?

- Does the organisation consistently identify the categories of maintenance work, and does it attempt to minimise day-to-day and emergency works in favour of increasing planned and preventative work?

- Are there control systems in place to monitor whether asset protection has been achieved with minimal breakdowns and at acceptable costs?

- Is there an effective feedback system which will identify problems, achievements and changes to the programme of work?

- Are costs recorded and subdivided in a way that assists planning?

- Does the organisation influence designs and specifications for new works?

- Are maintenance budgets based on condition assessments?

- Is there sufficiently good communication with users and financial agencies?

- Is there a method for establishing a manpower budget?

Conclusion

41. The aim of this Seminar was to establish a strategy for overcoming the problems identified in paragraph 5. The conclusions of the Seminar are encouraging and are best expressed in the folowing action plan.

i) Establish a Condition Survey

This should be suitable for either strategic or operational objectives probably arranged on the basis of a common core information base with subsidiary files for building records, maintenance reports, energy reports, etc. This would mean that the survey could be carried out in stages - e.g. the strategic survey carried out on the basis of a meaningful statistical sample (say 1.5% to 2.5%) from which could be drawn sufficient information on which to base budget levels. Clearly, where only say 150 establishments are in ownership, then the condition survey would cover all buildings. The implications are that the introduction would be in stages and that the computer employed would either need to be large enough in the beginning (difficult to anticipate) or capable of enlargement.

ii) Establish Realistic Budget Levels

These would be carried out on the basis of either a full or sample survey of the building stock identifying the initial shortfall/backlog of work and extended to future years on the basis of theoretical prediction based on the forecast life span of individual building elements. This could apply either to a full condition survey or to a sample strategic survey.

iii) Convince Politicians

It is essential to draw attention to the problems and why they exist; answers must be found to such questions as: Why have the buildings been allowed to get into this state? Why are the buildings incurring this expenditure? Let me know when the buildings fall down!

Involve politicians in the issues and include building users - of great assistance in arguing the case - there could be votes in building maintenance.

v) Establish Dedicated and Flexible Budgetary Arrangements

The peaks and troughs of maintenance need predicted for each typical or sample building will be aggregated over the total building stock to provide a mean level of funding. This will fluctuate slightly in each year. Should the predicted maintenance cycle not occur in practice, (e.g. a boiler component may well have a life expectancy in excess of that predicted) then the budgetary arrangements must be flexible enough to take this into account. Sinking funds are not advocated, since relatively large sums would remain unused at "trough" periods.

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The budget must be dedicated to maintenance whether it forms part of an overall education budget or is authorised by organisations outside the education service department. It should not be possible to vire maintenance funds for other purposes.

v) Examine the Organisation

Convince Government or local education authorities that funds, once allocated, will be expended on priority maintenance work. This implies an examination of the maintenance organisation.

- Can it do the things we now expect of it?
- Does it have the right skills?
- Does it enjoy robust communication?
  - with politicians/users/operational staff/contractors.
- Can the organisation respond adequately in both strategic and operational terms?

vi) Establish Standards

Establish adequate and reasonably achievable standards in the beginning for maintenance staff and for designers. Ensure adequate technical feedback on the performance of buildings in the field. Look at common specifications which could be used both by designers and maintenance staff. Establish a maintenance profile for new designs and compare it with a desired model profile at the initial design stage.

vii) Review

Review monthly/annually what is happening on the ground and if the organisation or method does not work - change it.

42. An action plan based upon the strategic thinking noted in this paper is as follows:

. Establish a condition survey

. Establish realistic budget levels

. Convince politicians/key people

. Arrange dedicated/flexible budgets

. Examine the maintenance organisation

. Establish standards

. Review performance

ISSUES FOR DISCUSSION AT THE SEMINAR

The seminar was conceived as a working forum for people directly engaged in the preparation of maintenance policies and their implementation in educational buildings. It focussed on exchanges of experience around the following issues and their interrelationship.

Knowledge of the Building Stock

The existing building stock varies considerably in age, construction and condition, and current statistical data is at best unreliable and inaccurate. Before a coherent statement of maintenance policy can be made, it is essential to have a clear picture of the nature and condition of the building stock. This will ensure that scarce funds are directed to the areas of greatest priority. Such an information base will clearly rely on informed, consistent and timely survey and inspection and is likely to have to store and sort a large volume of complex information.

The questions raised by this issue centre on *how such information should be gathered, at what frequency and by whom,* and to what extent information technology can provide a ready form of accessible storage.

Assessing Needs and Priorities

The perceived increase in maintenance needs coincides with constraints in manpower and finance. Assessments of the building stock are not comprehensive or consistent; indeed, a reactive posture has been adopted in most countries and priorities are often determined on doubtful or insufficient comparative data. Realistic assessment could provide a basis for fomulating financial and operational strategies and would form a sound basis for future planning. Definitions of maintenance are required together with the adoption of more systematic, uniform and objective methods for assessing needs and identifying priorities.

The basic issues are firstly, *how to provide a better means of determining adequate levels of funding* for building maintenance, and secondly, *how to ensure that funds are spent where they are most needed.*

Budgeting

Effective budgetary arrangements are a key factor in a successful maintenance policy. Current experience is that budgetary provision is not geared to the maintenance needs of the building stock and that current budgets rarely meet the full range of priorities required to prevent serious deterioration. Attempts have been made to devise benchmarks or norms as a guide to expenditure, but with so many variables these do not provide a reliable indicator at either local or national level.

The main issue here is *how to provide a responsive and flexible budgetary arrangement based upon a realistic forecast of the needs* of educational buildings rather than up-dating for inflation previous levels of expenditure. Other matters include *the control of the maintenance budget and its*

protection against virement to other sectors of the education budget.

Programming

Maintenance programmes commonly include planned or preventative work which is identified and programmed before the start of a particular year and day-to-day or emergency work which is assessed on the basis of experience but which cannot be identified in advance. The current situation which is common to most countries, is that the volume of day-to-day work is increasing and that problems which could have been covered by planned maintenance are being deferred to be done at higher cost at a later date. The identification of major and minor improvements and the economic balance between repair and replacement together with any necessary or desirable up-gradings are all key factors in assessing the correct content and volume of planned and preventative maintenance required.

The main questions are, therefore, *how to strike the right balance between planned and day-to-day maintenance, and how to ensure that maintenance programmes take due account of related activities and broader considerations,* including the possible redundancy of particular buildings and any plans for major works. Additionally, there is the question of *how best to mobilise manpower and materials* (bearing in mind seasonal constraints) either from within the maintenance organisation or from external contractors.

Organisation and Control

The establishment of a responsive and flexible organisation to implement maintenance programmes together with effective monitoring of procedures, accounting and performances are key factors in the delivery of an efficient maintenance service. The balance between centralised control and local autonomy can affect the quality of the service provided and the main issues are those of *how to ensure the fullest co-ordination and communication between those delivering the service and those receiving it* Should there be centralised political and operational control with localised delivery points or can the quality of the maintenance service be assured within devolved systems?

Clearly, the effective deployment of technical and professional skills is essential and this raises questions of *how to determine appropriate levels of staffing and productivity.* Feedback arrangements are frequently poor with little regard given in new designs to the problems encountered in the field. *A closer liaison between designers and maintenance operatives* is important if future maintenance expenditure is to be contained. A further issue is *how to take into account the implications of life cycle maintenance costs on new design specifications and initial costs.*

APPENDIX B

EXAMPLE OF RETURN TO ANNUAL SCALA* MAINTENANCE SURVEY
AND EXTRACT FROM ACCOMPANYING EXPLANATORY NOTE

* Society of Chief Architects of Local Authorities

scala MAINTENANCE RETURN

APRIL 1985

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
		BUILDING TYPE	NUMBER OF PROPERTIES	TOTAL FLOOR AREA m²	1984/85 EXPENDITURE COMMITTED					1985/86 DESIRABLE EXPENDITURE		1985/86 APPROVED EXPENDITURE		TECHNICAL CONTROL	CURRENT CAPITAL VALUE £m.	DESIRABLE (J) AS %age OF O	APPROVED (L) AS %age OF O	DAY-TO-DAY AS %age OF H	COMMENTS including 'Priority 3' estimates for 1985/86
					GENERAL BUILDING £000	M & E SERVICES £000	OTHER £000	TOTAL £000	COST £/m²	TOTAL £000	COST £/m²	TOTAL £000	COST £/m²						P3
EDUCATION	1	Primary	401	587 000	3 070	2 026	–	5096	4.93	10445	10.12	5385	5.21	CA	468.85	2.22	1.15	39	5.187
	2	Secondary	68	445 000															–
	3	Special	69	102 000	288	109	–	397	3.89	388	3.80	347	3.40	CA	81.00	.76	.68	35	.065
	4	F & HE	7	195 000	300	160	–	460	2.35	621	3.18	583	2.98	CA	85.80	.72	.67	n/a	.036
	5	Youth	49	28 000	91	37	–	128	4.57	230	8.21	170	6.07	CA	15.40	1.49	1.10	47	.065
	6	Other	29	15 000	57	23	–	80	5.33	–	–	93	6.20	CA	not known	–	–	40	–
PUBLIC	7	Libraries	46	21 000	151	43	–	194	9.27	245	11.66	191	9.09	CA	13.65	1.79	1.39	43	.115
	8	Leisure		–	–	–	–		–		–		–	–		–	–	–	–
	9	Social Services	86	109 000	453	385	–	838	7.68	867	7.95	809	7.42	CA	49.05	1.64	1.62	42	.132
	10	Operational & HQ		–	–	–	–		–		–		–	–		–	–	–	
	11	Housing		–	–	–	–							–		–	–	–	
FIRE	12	Operational & HQ	25	27 000	99	64	–	163	6.03	193	7.44	174	6.44	CA	14.85	1.29	1.17	19	.030
	13	Housing	8	1 000	not known			–		–		–		–	–	–	–	–	–
	14	Administration	57	43 116	222	149	–	371	8.60	390	9.04	319	7.39	CA	12.40	3.14	2.15	35	.071
	15	Magistrates	14	23 000	76	23	–	99	4.50	106	4.81	106	4.81	CA	13.20	.80	.80	47	–
	16	Probation	13	1 000	1	4	–	5	5.00	5	5.00	5	5.00	CA	not known	–	–	–	–
	17	All other (non-housing)	140	–	–	–	–	520		–	–	576		*	–	–	–	–	Joint responsibility CA / CV-ES

AUTHORITY & TYPE County COUNCIL | POPULATION 1 025 400 | AREA 167 924 hectares | RATEABLE VALUE £ 178.3 million | PAGE No. 68

CA = County Architect
CV-ES = County Valuer & Estate Surveyor
M & E = Mechanical & Electrical
P3 = Priority 3

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EXTRACT FROM EXPLANATORY NOTE

GENERAL DEFINITIONS

Maintenance

Work necessitated by the deterioration of properties and which is undertaken by the Authority to retain or restore them to acceptable current standards. The definition of maintenance work specifically **excludes** improvement work over and above that which is required to bring buildings up to current day standards. That is, figures should not include items such as general expenses, soft landscape, playing field and grass maintenance, fire precautions, asbestos removal, major energy conservation initiatives etc. Where these items **cannot** be extracted, a clear note should be made.

Expenditure

The total cost should be included **irrespective of whether some of the expenditure is capitalised.** The costs exclude fees but include all costs where direct labour is employed. Debt charges on capitalised work should be excluded.

Committed - the actual expenditure or the estimated value of orders committed by controlling Chief Officer.

Desirable - the estimated value of work regarded as necessary by the controlling Chief Officer and by heads of establishments within the financial year 1985/86 at a base date of November 1984. This should be the total of priorities 1 and 2 below:

Priority 1

Any allocation for work that is likely to be required on the basis of historical experience in order to ensure the health and safety of building occupants and/or to prevent the imminent closure of accommodation or serious dislocation of activities. Expenditure that is known to be required to meet statutory contractual obligations.

Priority 2

Estimated planned expenditure necessary within the year to prevent serious deterioration of fabric or services such as is likely to lead to higher future costs of repair or renewal. This would normally include any recommended cyclical maintenance.

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In addition where available please record separately in the comments column, as Priority 3, the estimated expenditure required for work as above which could reasonably be deferred to future years, plus that required to maintain or restore the environmental quality of buildings or sites - eg internal decoration.

Approved - the sums included in the authority's budget for expenditure by the controlling Chief Officer and by heads of establishments in the year just commencing 1985/86 at a base date of November 1984.

General Building Maintenance

The sums allocated for all work on the building fabric (other than daily or routine cleaning) necessary to maintain the performance of buildings as originally designed and built, or subsequently altered. This includes day to day repairs and planned maintenance, such as redecorations, reroofing, external pavings etc.

Engineering Maintenance

The sums allocated for day-to-day work on mechanical services and electrical installations together with planned maintenance such as annual service contracts, major replacement or renewal of boiler installations and major schemes for electrical rewiring.

APPENDIX C

EXTRACTS FROM THE CARNET D'IDENTITE AND CARNET D'ENTRETIEN, AND AN EXAMPLE OF A SUMMARY SHEET, IN USE IN BELGIUM

MINISTERE DE L'EDUCATION NATIONALE
FONDS DES BATIMENTS SCOLAIRES DE L'ETAT

ADMINISTRATION PROVINCIALE DE
DISTRICT DE

CARNET D'IDENTITE

école rue nº

identification

EXISTING STOCK
(or under construction)

I. TECHNICAL DATA

Type of construction	PHASE No.	BUILDING No.				
	Traditional	Industrialised				
		Temporary	Timber	Concrete	Steel	Mixed Concrete and steel
Total Cost						
Year of construction	Before 1940	1941 to 1950	1951 to 1960	1961 to 1970	1971 to 1980	1981 to 1990
Condition	Very good		Good	Satisfactory		Bad

Area in m^2 .....

Price per m^2 .....

Volume .....

Price per m^3 .....

Frame - type .....

Roof structure - type .....

Area .....

Roof covering - type .....

Glazing - type .....

Area .....

Windows and external doors - type .....

Boiler - type .....

Output .....

Heated floor area ACh = ...

Volume heated V = ...

Overall thermal conduction coefficient KS = ...

Level of thermal insulation KG = ...

Area subject to heat loss = ...

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II. ACCOMMODATION: REFERENCE NUMBER - TYPE - AREA

N°	Type	Area	Comments
Total area:			

MINISTERE DE L'EDUCATION NATIONALE
FONDS DES BATIMENTS SCOLAIRES DE L'ETAT
PROVINCE : DISTRICT :

carnet d'entretien

ETABLISSEMENT SCOLAIRE : A

COMPLEXE SIS A , RUE N°

VISITE ANNUELLE DE 198

PERSON RESPONSIBLE FOR THE VISIT:

DATE OF VISIT:

PARTICIPANTS

NAME	CAPACITY	AREA OF RESPONSIBILITY

OBSERVATIONS :

SIGNED AT DATE ..../.../198..

THE OFFICIAL(S) OF THE F.B.S.E.

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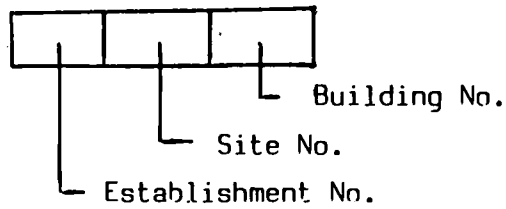
SHEET REFERENCE NUMBER:



It is useful to keep one maintenance record per site.

When structural defects are observed, such as subsidence, cracks, crevices, rising damp, or dampness due to defective zincware (*), roofs (flat or sloping) or external cladding, it is useful to:

- note the defect and specify exactly its position
- establish the causes (if necessary put in place and check periodically tell-tales)
- suggest necessary works.

It is essential to draw the attention of the provincial branch of the F.B.S.E. to possible weaknesses with regard to durability, safety, weatherproofing, heating, electrical installations, or thermal and sound insulation.

Annex if necessary to this maintenance record a report containing justifications and further details.

(*) Zincware includes besides zinc, steel, copper, aluminium, lead.

Suggestions: use lightweight paper:
only include sheets which have heen completed.

I. GENERAL WORKS FOR THE ESTABLISHMENT AS A WHOLE.

Infrastructure and fencing. — sheets I

Service networks - water - gas - electricity.

Telephone network - bells and alarm system - security.

Heating and hot water.

Miscellaneous.

II. INDIVIDUAL BUILDINGS (1 set of sheets per building): e.g. using different coloured paper for each building.

sheets II

External works.

Internal works.

III. SUMMARY AND ASSESSMENT OF WORKS TO BE CARRIED OUT.

- in the course of the year of the visit (yr.) — sheets III
- the year following the visit (yr. + 1)
- in the course of the 3 succeeding years (yr. + 2, 3, 4).

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/ea completion - year C. frequency: F years.
of renovation - year R.
of last maintenance - year M.

SHEET I/1.

ELEMENTS	Year of last work*	Degree of urgency: Very Urgent (1)	Urgent (2)	Planned maintenance (3)	WORK TO BE PLANNED: Brief description of work required; if necessary refer to annexes.	Routine maintenance	unforeseen maintenance	Estimated quantities	Unit cost	Estimated cost excl. V.A.T.
INFRASTRUCTURE		85	86	87 88 89						
Roadways										
Car Parks										
Service Areas										
Paths										
Playing Fields										
Hard-paved play areas										
Pavements										
Kerbs										
Gutters										
Rainwater gulleys										
Retaining walls										
Fencing and gates										

(1) Very urgent repair (year of the visit - e.g. in current budget).
(2) Urgent repair (year following that of the visit, for which budgetary provision has been made).
(3) Planned maintenance (in the 3 years after year under consideration).

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ar of completion: year C
equency: F years

SHEET II/1.

ELEMENTS	Year of last work*	Degree of urgency					WORK TO BE PLANNED					
		Very urgent	Urgent	Planned maintenance			Brief description of work required: if necessary refer to annexes.	routine maintenance	unforeseen maintenance	Estimated quantities	Unit Cost	Estimate of cost, excl. V.A.T.
		(1)	(2)	(3)								
		85	86	87	88	89						
XTERNAL WALLS:												
oundations												
ladding												
eather boarding												
indow-piers												
indow-sills												
indow-frames												
ornices												
alconies												
aves												
rapets												
over-plates												

(1) Very urgent repair (year of the visit - e.g. in current budget)
(2) Urgent repair (year following that of the visit, for which budgetary provision has been made)
(3) Planned maintenance (in the 3 years after the year under consideration)

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TA[illegible]MENT:
CA[illegible]T street n°
SI / /

SHEET III/1.

MMARY AND ASSESSMENT OF NECESSARY GENERAL WORKS.

NATURE OF WORK	COST ESTIMATES EXCL. V.A.T. AT THE TIME OF THE VISIT
I. VERY URGENT - THIS YEAR - (1985)	
TOTAL :	
II. URGENT - NEXT YEAR - (1986)	
TOTAL :	
III. PLANNED FOR 1987 :	
1988 :	
1989 :	

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MINISTERE DE L'EDUCATION NATIONALE.

FONDS DES BATIMENTS SCOLAIRES DE L'ETAT.

PROVINCE:

MAINTENANCE OF BUILDING STOCK MANAGED BY F.B.S.E.

ESTIMATE OF FUNDS REQUIRED FOLLOWING THE 1985 VISITS TO ESTABLISHMENTS, PRESENTED TO THE INSPECTOR-GENERAL

Annexes: - Summary by site:
- Summary by district

1. Very urgent repair work - to be carried out this year within the limit of available funds.

2. Repair work - to be carried out next year.
   a) major maintenance, see summary attached;
   b) minor repairs (*)
   c) total a) and b).

3. Planned work
   To be carried out in the following 3 years:
   in 19..
   in 19..
   in 19..

* by reference to preceding years, taking account of increase in the building stock.

E S T I M A T E S

V.A.T. EXCLUDED	V.A.T. INCLUDED

The ..... 1985.

Officer responsible for the districts,

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CT	ESTABLISHMENTS	NATURE OF WORKS	ESTIMATES EXCL. VAT				
			19..	19..	19..	19..	19..

Establishment No.
Site No.
Building No.

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SUMMARY BY DISTRICT (excl. VAT)

	DISTRICT			
1.- Work or repairs to be carried out this year, at the expense of planned or less urgent work.				
2.- Work proposed for next year:				
a) major maintenance:				
b) minor works on request:				
c) total a) and b):				
3.- Works envisaged for the 3 succeeding years:				
a) in 19..				
b) in 19..				
c) in 19..				

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FICHE N° 3

FONDS DES BATIMENTS SCOLAIRES DE L'ETAT

Service provincial de: BRABANT

Etablissement: EVERE (Colonies)

Localité: Bruxelles **Section:**

Rue av. Persuelaan **n°** 2

Owner's maintenance expenditure incl. V.A.T.

	1974	1975	1976	1977	1978	1979
A. REPAIRS LESS THAN 50,000 BF	81770	89175	74365	103985	200174	1218892
B. MAJOR REPAIRS AND EXPENDITURE OF MORE THAN 50,000 BF						
1. Roofs						
2. Waterproofing of roofs	64752				2469244	2859440
3. External walls						
4. Heating			153906			
5. Electricity	299517				691824	1487758
6. Sanitary services			99562			
7. Joinery (incl. metal)						
8. Wall finishes	89707					
9. Floor finishes						626613
10. Ceilings						
11. Drainage						
12. Miscellaneous	617789	86355	342820	227145	461680	
13. External work			293983	1317712	3476617	
TOTAL MAJOR REPAIRS	1071765	86355	890271	6057581	15011121	4973111
GRAND TOTAL	1153535	175530	964636	7095766	17681295	6192003

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APPENDIX D

EXAMPLE FROM ENGLAND OF INSTRUCTIONS FOR CARRYING OUT A CONDITION SURVEY

INSPECTION OF BUILDING STOCK
Please read carefully before starting inspection:

1.0 **Aim**

The aim of the inspection is to replace the present annual survey with a formal compatible survey undertaken in more detail but less frequently. From the information which is obtained it should be possible to extract the information necessary to prepare the planned maintenance schedule for up to five years, together with management information for general budgeting and planning.

2.0 **Scope**

The survey will include all buildings owned or maintained by the Council.

3.0 **Preparations**

The surveyor carrying out the inspection should contact the premises at least two days in advance to arrange an appointment and to ensure that any necessary ladders etc are available. Residential property should be given longer notice.

4.0 **The survey**

The information which is gathered must be as accurate as possible whilst at the same time giving the overall picture of each element, eg the inside of roof spaces must be examined where they exist to discover the condition of the roof structure rather than a mere superficial inspection. Please note, however, that surveyors should not take unnecessary risks in examining such things as pitched roofs. A pair of binoculars can provide much information.

4.1 **Filling in the inspection sheets**

Each of the more common forms of construction and materials have been listed and wherever possible these divisions should be adhered to.

A fresh block on the sheet should be used for each building on a site, or part of a building if there have been significant additions over a period of years. External toilets, stores, single garages should be included on one block.

In order to gain as much information as possible, the grounds should be broken down into lots associated with each building on site.

A site plan on the OS 1:1250 or 1:2500 scale should be used for each site, with the buildings clearly marked by numbers and linked to the inspection sheet heading, eg Block: 002. The area of the site should be shaded to indicate the association with each building. All buildings on a site should be shown whether surveyed or not.

The gross floor area is the area on plan measured inside the external walls. No deduction is made for stairwells, partitions etc. The simplest method is usually to measure the perimeter of the building, deduct the external wall thickness and multiply the area thus obtained by the number of floors.

4.2 **Grading**

The classification of an element by a particular number will be governed by the surveyor's general impression of the element being considered.

A guide to the standards which are to be applied is set out below:

Grade 1 *Dangerous* – hopefully rare, this could be flaking paint on a kitchen ceiling or an unsafe wall, presence of blue asbestos. Failure of insulation on electrical systems. No earth, bare conductors, double pole fusing etc. Limit 'stat placing in boiler plant, no safety valve etc. Fire alarm not operative.

Grade 2 *Poor condition* – a widespread outbreak of wet rot, a heavily patched area of roof, or badly worn flooring. Brittle insulation, mixture of cable type (VIR, lead, PVC etc). Widespread corrosion and evidence of leakage on wet systems. Broken and powdery lagging etc.

Grade 3 *Fair condition* – various minor defects, each of which might not be significant in itself but together need attention on a planned basis, eg some ends of timber window elements are rotten on several windows, pointing in a brick wall is powdering but the wall is stable at present, internal decorations are generally worn but not badly damaged. Alt. gauge not working. Oil tanks in boiler spaces, leaking bund valves, broken accessories etc.

Grade 4 *Satisfactory* – elements are performing their job correctly but minor repairs are required, eg a fire door is functioning correctly but the furniture requires tightening, one or two slates require refixing on a roof otherwise in sound condition. Missing junction box lids, fire doors beginning to warp, thermostat knobs missing etc.

Grade 5 *Good condition* – self explanatory, generally the top mark, eg paint recently completed is adhering well and was applied without leaving excessive brush marks etc. Good condition for its age is not necessarily a valid grade 5. Boilers recently replaced, scheme rewired etc.

Grade 6 *Excellent* – top mark and should be reserved for suitable situations, eg brickwork with dpc's in correct position, pointing not cracked etc. All cables neatly dressed and supported, everything colour coded, labelled etc. Clean plant with properly chamfered lagging, good instrumentation etc. Everything well lubricated and operating at high efficiency.

Source: "Maintenance and Renewal in Educational Buildings. Needs and Priorities", Design Note 40, Department of Education and Science, London 1985.

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

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