Design, evaluation and information feedback in the health facility planning process

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Publication Date:
1982

DOI:
https://doi.org/10.26190/unsworks/8534

DESIGN, EVALUATION AND INFORMATION FEEDBACK IN THE HEALTH FACILITY PLANNING PROCESS.

VOLUME 1

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1982

This thesis is submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

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ABSTRACT

The thesis explores problems of feedback of information in the process of planning and design of health facilities. This topic was selected because the writer was concerned at lack of coordination and sharing of information among many hospital planners and designers.

Following a review of planning and design methods, the process of planning and design of health buildings is examined with regard to inputs and flow of information. Selected building planning procedures are analysed from the viewpoint of use of information in briefing and design. Significant international developments in hospital planning and building methods since 1960 are described.

Methods of design evaluation are then explored for their potential to generate knowledge about effects of design on users. Organisation and presentation of information for health facility design are considered from the viewpoint of aiding decision making.

The results of two Australian surveys of information practice and usage are described, an important finding being that although most planners wanted information on evaluations of other planners' buildings, they were unwilling to share such information about their own buildings due to its commercial value.

Findings of several comparative evaluation studies of hospitals, wards and equipment designs conducted by the writer are presented. These illustrate the kind of feedback information such studies can generate, and which can be used in defining objectives, establishing priorities and resolving conflicts.

A framework of descriptive terms is proposed for linking input of information for briefing and design with information output from evaluation of effects. This framework is seen to offer a means of improving design by enabling evaluation findings to be used more directly in decision making.

The conclusions are that much information produced in a typical health facility planning and design project is poorly utilised, that competitive attitudes regarding design information limit its application, and that more could be done through coordination of education and research programs to promote effective planning and decision making methods.

ACKNOWLEDGEMENTS

Many people have been involved directly and indirectly in the research on which this thesis was based. Without their help much of it could not have been written.

I wish firstly to thank those with whom I worked in the architects' offices of St. Thomas' Hospital, Powell and Moya, and the Department of Health and Social Security, London. The experience thus gained helped to form concepts on which early parts of the thesis are based.

Many ideas on information classification and retrieval discussed in chapter seven were inspired by colleagues on the SfB panel of the Royal Institute of British Architects, and by members of the Construction Industry Information Group in London, to whom I owe my gratitude.

I wish to acknowledge help given by people and organisations involved in the surveys on information practices and usage, and especially to Mirella Heath who coordinated the research and wrote the report on the latter project. The funds provided by the National Hospitals and Health Services Commission, Canberra, which enabled this work to be done, are also gratefully acknowledged.

Many people were involved in the design-in-use surveys of hospitals and wards, both in Britain and in Australia, and to them my thanks for answering questions and arranging visits. Particular thanks go to those people who commented at length on draft reports of the hospital surveys described in chapter nine.

My thanks to Joy Hopetoun-Smith and Mirella Heath for survey work and report writing on the ward design studies described in chapter ten.

Funds for the research on hospital and ward design were provided by the University of New South Wales Special Studies Committee, the Faculty of Professional Studies Special Projects Committee, and the School of Health Administration. This support is gratefully acknowledged.

The furniture design study summarised in chapter eleven was supported both by the Faculty of Professional Studies of the University of New South Wales, and latterly by a two year research grant from the National Health and Medical Research Council, Canberra. I am especially indebted to John Redmond, Michael Fewchuk, Amber Maiden and Elizabeth Woods with whom I worked on this project.

Professor George Palmer and Professor 'Peter' Johnson were my supervisors. To them I record my appreciation for their painstaking review of drafts and encouragement.

Typing of drafts for a thesis is an arduous and difficult task. I wish to thank Rowan Green, Leanne Miller, Angela Peters and Beryl Ashley for their work in this respect.

Finally my thanks to colleagues in the School of Health Administration at the University of New South Wales for their interest and support.

SOURCES OF INFORMATION

Some sections of the thesis are based on material previously published by the writer. This applies principally to the section in chapter three on ward design development, chapter eight on information practice and usage surveys, the report on 'finding the way' in chapter nine, the report on comparative surveys of ward design in chapter ten, and the report on furniture design in chapter eleven. Several sections of the thesis have also appeared in a preliminary form in notes for students.

Illustrations used in the thesis have been mainly derived from the following published sources:

Architects' Journal
Architectural Forum
Architectural Record
British Health Care and Technology
Cox and Groves, Design for Health Care, 1981
Nuffield Provincial Hospitals Trust, Studies in the Function and Design of Hospitals, 1955
Nursing Mirror
Nursing Times
Publicity Brochures, Various hospitals
Thompson and Goldin, The Hospital - A Social and Architectural History, 1975
Zeidler, Healing the Hospital, 1976

These sources are gratefully acknowledged.

HYPOTHESES

1. Systematic planning procedures, briefing methods and design evaluations significantly reduce design errors in health facilities.

2. A common set of descriptive terms for organising information assists in the feedback of knowledge from evaluations of health facility designs to briefing and decision making.

A CRITERION

"The literature of environmental psychology and design evaluation is full of examples proving that the designed environment alone cannot determine human behavior. It is clear, however, that the proximate environment is indeed a strong contributor to the direction of human behavior, therefore, evaluations of interior spaces that recognize the many interactions of social variables, but focus clearly on specific aspects, can provide useful and significant data for designers. Perhaps evaluations of interior spaces, more than any other aspect of the larger field of man-environment relations, represent the most clearly tangible results which can provide the answers sought by design professionals and others commissioning environmental design evaluations."

From Friedmann A et al. (1978)
Environmental Design Evaluation
New York, Plenum, chapter 2 'Interior Spaces' p.34.

CHAPTER ONE

INTRODUCTION - Synopsis

This chapter describes events leading up to the decision to investigate information needs of health facility planners, and subsequent events in pursuing that objective.

Key words used in the title and in the hypotheses are next defined in the context of the thesis. Some quotations are used to illustrate the difficulty of giving precise meanings to words such as 'design'.

The two hypotheses are then discussed in detail and possibilities explored for testing their validity.

Finally the methodology used in developing the thesis is described, firstly in relation to the historical review section, and secondly with regard to case studies on information usage and design evaluation.

1.1 PRELUDE

A variety of factors led to the proposal for this thesis, ranging from a personal interest in design methods and information systems, to involvement in hospital design research and in education of health facility planners and designers.

The writer's experience on a number of hospital design projects in the twelve years before starting work on the thesis left the impression that many problems were presented and decisions made without knowing whether these problems had been effectively solved before, and if so whether the same solutions were appropriate to use again.

Involvement in detailed briefing for design had reinforced the view that many requirements stated as necessary might not in fact be valid or desired by the users. But who indeed were the users? Should they not have an opportunity to say what their requirements were, or be able to influence the design to some extent?

Both before and after starting work on the thesis the writer became involved in several hospital development projects in which attempts were made to investigate users' needs, and to get users to participate more actively in decision making about design. Discussions with hospital administrators and other professional staff about health facility planning and design added to the view that many decisions about design were made without the decision makers realising the likely consequences of many of their decisions.

Prior to embarking on research for the thesis a discussion note entitled 'Hospital Planning and Information Needs' was circulated to about 45 people in the fields of architecture, planning, education and information science. This discussion note included a brief historical sketch of hospital design and of information systems for design. Recipients of the note were invited to comment on the research proposals, and detailed replies were received from over half the respondents. These comments were analysed with a view to identifying those areas considered to be most important to investigate (see Appendix I[1] for Summary of Respondents' Comments).

The comments were of two kinds: 1) those which suggested that an explanation of the health facility planning process was an essential first step before one could identify what information was needed, and 2) those which suggested that the need for an information system was so urgent that it should be developed regardless of the planning process used.

To investigate both these problem areas seemed too large a task for a thesis. The decision was therefore made to study information 'feedback' in the planning/design process, briefing and evaluation methods being identified as primary targets for investigation.

The original intention was to develop a 'metasystem' for coordinating feedback information on planning and design of health facilities. Results of two surveys on information practices and usage among health facility planners and designers led, however, to the conclusion that this proposal would be abortive. While the idea of developing a feedback link between briefing and evaluation has remained, the emphasis has shifted towards making more effective use of results of evaluation studies in briefing for design. The thesis therefore explores briefing and evaluation methods in terms of obtaining 'knowledge of results' and greater participation from users.

Several studies of design evaluation methods, coupled with findings from a number of evaluation studies of health buildings in use, provided further evidence of lack of effective 'feedback' from design experience and user evaluation to briefing and design (eg Baynes et al 1969, Cammock 1973).

One possible approach to improving feedback was based on experience in setting up and using architects' technical libraries and in developing methods of classifying and presenting design information. Linking analytical processes in planning and design to arrangement of information in libraries and documents was thought to be a means of reducing the problem (RIBA* 1968, Gilchrist & Gaster 1969, University of Edinburgh 1974). Subsequent events, however, showed this to be a relatively unrewarding approach. Attitudinal factors appeared to reduce effectiveness of feedback, so the causes needed to be investigated. Studying how health facility planners and designers used information, as well as canvassing opinions on what an ideal system might be, were two other possibilities for investigating the problems.

Later research into means of improving utilisation of hospital planning information showed that comparative evaluation of specific design features was considered by many designers to be a worthwhile approach (Heath & Green 1976). A number of comparative evaluation studies of health facilities were therefore undertaken.

The problems revealed by the research suggested the lack of a synthesising framework to bring together the disciplines of planning, design, information and evaluation. This thesis proposes the basis for such a framework, and in that respect contributes an original viewpoint on the art of health facility planning and design.

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*See appendix A for key to abbreviations

1.2 SOME DEFINITIONS AND DIRECTIONS

In a subject field as wide ranging as health facility planning and design, there is no consistent descriptive terminology understood by all participants (Baynes et al 1971). The words 'health facility', 'planning', 'design' and 'evaluation', for example, appear in the title of this thesis; they also recur frequently in the text. The meaning of these and other key words used in the hypotheses are therefore defined below.

'Health facilities' include buildings such as hospitals, health centres and nursing homes as well as individual departments such as nursing units (wards), outpatient clinics and hospital kitchens. 'Health facilities' also include equipment such as beds and wheelchairs.

The Concise Oxford Dictionary (1976) gives five distinct meanings of 'plan' including 1) drawing showing relative position of parts of a building, 2) table showing times and places of intended proceedings, 3) organised method by which something is to be done, 4) to make a drawing, design or scheme, and 5) to control design of buildings and development of land. 'Planning' is also defined by Webster's (1972) as "to invent or contrive for construction; to scheme; to devise; to form in design".

These definitions are, however, not appropriate for this thesis as they suggest an historical bias towards <u>physical</u> planning. While several writers regard management as an aspect of planning, an alternative view sees planning as the decision making phase in the overall process of management (Byrt 1968). Planning also involves allocating appropriate resources to sectors and phases of a program.

One of the most realistic definitions of 'planning' was that given by Buchanan (1966) in the 'South Hampshire Study':

> "Planning" said Buchanan "is becoming less and less a matter of precise propositions committed to paper, but more and more a matter of ideas and policies, loosely assembled, under constant review, within which, every now and then some project is seen to be as ready for execution as human judgement can pronounce."

A shorter, more general definition was that given by Leach in a talk he presented to the Town Planning Institute (TPI) in London in 1968 when he said that the 'role of the planner' was

> "..to try to reduce the significance of irreversible errors" (The Guardian 1968).

One cynical view of planning is that it is a device to delay or avoid taking decisive action (ABC 1975). But plans produced in a hurry due to political pressures or budget deadlines may be ill-founded and cause unnecessary waste and frustration. Much time of planners is therefore devoted to arranging information and formulating ideas so that alternative proposals can be made and responsible decisions taken. This is where 'plans' in the sense of graphical means of representation come in. Most people cannot visualise proposals unless they are in a form that can be easily analysed and evaluated. Describing ideas in words alone can be very inhibiting. Diagrams and models of various kinds are therefore often the principal means of communication between the parties involved.

The distinction between 'planning' and 'design' is seldom clear-cut. Planning tends to refer to higher level issues such as national and regional development. Design usually concerns physical products such as buildings, vehicles and equipment. Buildings, however, are 'planned' in terms of their layout, and the process of building construction is 'planned' in the management sense of the word. Yet management systems are said to be designed!

Archer (1971) defined design as:

> "..essentially concerned with making decisions, deeply concerned with making and following through the value judgements, the importance of one consideration being set off against another, and the merits of one outcome being weighed against another."

Thus Archer saw evaluation as being an important part of designing, the purpose of which is to satisfy human or personal needs such as comfort or safety.

A more pragmatic view was taken by Lawson (1980) who said:

> "Design is often a matter of compromise decisions made on the basis of inadequate information... Designers, unlike scientists, do not seem to have the right to be wrong."

'Briefing' means the process of defining and explaining requirements and conditions which a design is intended to meet.[1] A 'design brief' is a document or set of instructions specifying the design requirements, it may also be the basis on which the design proposal or design outcome is evaluated.[2]

A definition of 'evaluation' was provided by Deming (1975) in the Handbook of Evaluation Research:

> "Evaluation is a pronouncement concerning the effectiveness of some treatment or plan that has been tried and put into effect." (p 53)

Deming commented that it was fascinating to observe how people often applied some treatment hoping to produce an effect, proclaiming their success if events went favourably, but suppressing the results if they failed!

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(1) In the USA the word programming is equivalent to 'briefing'.
(2) Some British authors use the word 'appraisal' instead of the more common term 'evaluation'.

'Design evaluation' was defined by Black (1968) in an article on the appraisal of buildings as:

> "...intending to provide a measure of fitness for its purpose of the thing being evaluated".

A rather different interpretation of evaluation was given by Law (1981a):

> (the) "difference in value between what was intended and what actually happened". (p 4)

Law (1980) also commented that:

> "If the evaluation of the performance of buildings is to provide feedback to the designers of future buildings, it must be recognised that it is a means to an end only... Through evaluation...a balance may be achieved so that... repetition of bad design decisions, failure to interpret accurately the needs of users, and the unnecessary high cost of building maintenance, can all be analysed more effectively."

Law's comments applied particularly to post-occupancy evaluation of buildings, but he made the point that evaluation also applied to the process of design (or planning) itself, as well as to the selection of options during the decision making process.

A planning 'process' is the sequence of activities which together lead to the realisation of a plan. Although many attempts have been made to describe the processes which occur during conception, development and realisation of a plan or design, few of these descriptions agree. Each tends to stress either a specialist point of view, or a particular type of problem. Jones (1981), for example, stressed the iterative nature of design processes as distinct from the procedures required to produce design documents and control construction.

Where several people of different professions work together as a planning team they need some kind of framework or language as the basis of transactions between them. Lack of such a framework can result in poor communication between members of a team (Moss 1972).

One purpose of planning 'procedures' evolved by many public building authorities is to serve as such a framework (eg Great Britain DoE 1976, USA DHEW 1978, NSW Health Commission 1981). If the procedures are followed systematically by all concerned then progress is facilitated and approvals are more likely to be quickly obtained (Gt. Britain DHSS 1969).

The process of planning, designing and constructing a building is, however, more complex than can be represented adequately by procedures specifying the data and documents needed to control allocation of resources. Procedures may, for example, require that design drawings must be to a particular scale and show certain types of information; they do not describe how to decide what to provide. A distinction between process and procedure has perhaps not been made sufficiently clear in the past in discussing methods of planning and design.

'Information' is used in the second hypothesis in the sense of organised and meaningful data, whether communicated verbally, graphically, in publications, or by electronic means.

'Feedback' is a term derived from cybernetics. In 'closed' mechanical or organic systems it is the means of controlling the functioning of a system by linking the output to the input so that stability is preserved. In more complex 'open' systems where change is desired, the means of control lie partly outside the system being controlled. The concept of feedback is used in planning and design in the general sense of obtaining information about effects of a plan or design. This information is then available for use in future decision making, firstly in selecting planning policies based on outcomes of previous plans, and secondly in deciding methods of implementation based on experience of the process of planning. Feedback from design evaluation thus links decision makers with consequences of their decisions so that better decisions can be made in future. This topic is discussed further in chapter 12 under the heading 'A Framework for Feedback'.

1.3 THE HYPOTHESES

The first hypothesis expresses the idea that systematic methods of planning, briefing and evaluation result in improved design of health facilities such as hospitals and health centres.

Much of the literature on planning theory, design method and evaluation supports the principle that systematic approaches to problem solving and innovation are worthwhile because they produce 'better' solutions than non-systematic approaches. The thesis explores this contention in the case of health facility design.

The hypothesis involves three phases of design activity: 1) planning, which is preparing for and organising the overall process of designing, constructing, commissioning and operating a facility, 2) briefing, which refers specifically to methods of gathering and analysing information used in design, and 3) evaluation, which is not only part of designing, but which also occurs after the design has been implemented and is in use.

The question of 'degree' arises in respect of two words in the hypothesis: 'systematic' and 'errors'. Systems are sets of elements which are organisationally related according to a set of rules. In the case of planning, briefing and evaluation, the elements are the topics to be considered. The degree to which these topics are related systematically in any particular planning procedure, briefing method or technique of design evaluation depends on several criteria. One is whether the same approach is used each time a particular type of problem is investigated. Another is whether the same sequence of design activities occurs in each project. A third is whether similar concepts are referred to in communicating ideas between the people involved in each phase of planning and design.

Errors occur in most types of human endeavour. They are serious to the extent that they cause human suffering or waste of resources. Errors in health facility design will be reflected, for example, by higher capital and running costs compared with other designs, by the frequency of injuries and accidents due to design factors, by the number of modifications which have to be made to physical structures, and by the number of complaints or adverse comments made by users of a facility. These and other indicators of error are discussed in the chapters on evaluation, and in the case studies of hospital, ward and furniture design. Perception of errors also depends on people's standards of success or failure, and on the prevailing economic or cultural conditions.

The first hypothesis therefore seeks to establish whether 'organised' methods of planning, briefing or evaluation, have helped to control costs, prevent accidents, reduce unnecessary changes, or improve user satisfaction.

A problem in exploring this hypothesis is that even if systematic methods do help to reduce design errors, this does not necessarily mean that non-systematic methods cause errors to increase. The test for the first hypothesis is whether systematic methods, as such, yield worthwhile benefits, or whether other factors have a greater effect, either beneficially or adversely, on outcomes.

The second hypothesis deals with means of effecting improvement in health facility planning and design by use of a common set of descriptive terms. The issues are 1) whether using the terms in briefing and decision making can help to ensure that all relevant factors are considered in a useful sequence, and 2) whether appropriate data for decision making are made easily accessible as and when needed.

Three main means of organising information are involved: 1) use of check lists and procedure guides in gathering information on design requirements and conditions, 2) use of classification schemes and key-word indexing systems in libraries and document collections, and 3) format of guidance information used in planning and design. The problem is to establish what methods of organising information are most 'effective', and what particular organisational characteristics are significant.

Three main ways in which organisation of information can help designers are, 1) by presenting all relevant data in an appropriate manner for decision making, 2) by promoting both innovative and logical approaches to problem solving, and 3) by enabling new information to be added, and obsolete or irrelevant information to be discarded. Each criterion requires flexibility in methods of organising information according to the nature of the project and the types of people involved.

The significance of the second hypothesis is whether a particular set of descriptive terms common to three phases of design (namely briefing, decision making, and evaluation) provides an effective 'framework for feedback'. The assumption is that a common set of terms is likely to be more easily remembered and used, and that this will help improve feedback. Using a particular method of organising information may however inhibit innovative approaches to designing, and this could adversely affect design results.

The issue boils down to whether using a common set of terms is effective in linking evaluation findings, design requirements, and decision making. This issue depends on the first hypothesis in that a 'framework for feedback' must take account of the process of planning and design if it is to facilitate information flow throughout the progress of a project and between projects in a program.

1.4 METHODOLOGY

A number of methods of examining the hypotheses were considered. Comparisons could be made, for example, between systematic and un-systematic methods of design in terms of their effects on costs, defects, or user opinions. A longitudinal study could be made of several projects which used different planning methods, and their evaluated effects related to organisational characteristics of the planning methods used. Alternatively, a comparison could be made between selected projects or products in terms of their performance, and an attempt made to relate their 'good' qualities to methods of design, decision making or information processing.

Due to inevitable difficulties in obtaining sufficiently detailed information from a selection of health facility planning projects, the overall comparative approach was not considered practicable. Comparative evaluations have, however, been made in several of the case studies described, and the longitudinal approach was used in personal involvement in planning (and evaluating) one of the case study hospitals, and in respect of using various types of information filing and retrieval methods.

User opinion surveys form a substantial part of the case study material, both in respect of effectiveness of design, and of information retrieval methods. Several methods of survey were themselves compared for ease of application and usefulness of results.

The method of exploring the first hypothesis is partly by an historical review of planning and design methods in general, and of health building planning procedures in particular. These methods and procedures are taken both from a selection of literature sources,and from experience in health facility planning and design. The different approaches adopted in planning and design are examined in relation to their emphasis on systematic methods, and on opportunities to learn from past experience.

For the second hypothesis selected methods of gathering and analysing information for design and decision making are reviewed and compared, particularly with regard to means of linking problems with their solutions. Both the sequence and range of topics used are explored in order to identify a common set of themes to facilitate feedback to decision makers.

The context for the thesis is set by describing significant recent developments in design of health facilities with regard to methods of formulating requirements and implementing proposals. The effects of 'program building' are also considered with respect to benefits offered in continuously improving design as a result of feedback within a relatively closed system.

Comparisons are made between selected methods of evaluating building designs, both in planning and in use. Applications of these methods to health building design, especially wards, are reviewed in some detail. A distinction is made, firstly between evaluating design options as part of the decision making process, and evaluating the effects of the decisions. A further distinction is made between objective measures of performance or cost, and subjective opinions and attitudes of users. Several types of evaluation methods are then compared for their value in producing useful data on requirements.

The more commonly used methods of organising information on design and health topics are analysed in relation to their potential for producing and presenting information in a useful way for planning. The criterion of freedom of choice in how information is applied is used as a measure of suitability. Different methods of feedback are also considered in terms of effectiveness in making designers aware of consequences of their decisions.

To test whether a particular method of organising information is effective depends on whether it leads to appropriate solutions to the problems which generate enquiries. Various methods of filing and retrieving design data are therefore compared with respect to user opinions on their helpfulness in problem solving.

Research into methods of information usage by health facility planners includes some personal experiments in filing and retrieval methods. The findings are, however, mainly derived from questionnaire and interview surveys of information users in the planning and design fields.

A case study evaluation compares three different approaches to planning large hospitals. The comparison includes a review of planning and briefing methods used, and a description of the resulting designs. Effectiveness of the three buildings is compared, both with respect to objective measures such as capital and running costs, and in terms of user opinions.

Another case study describes developments in ward planning, particularly with regard to nursing supervision and patient privacy. This aspect was selected because it typifies the conflicts involved in health facility design between needs of different groups of users. Comparisons are drawn between wards built before 'systematic' design methods were developed, and wards designed more recently.

A third case study describes design of furniture for handicapped children. The aim was to show by example what could be done to improve design by a systematic approach to evaluation and briefing. A survey was conducted to establish user criteria for effectiveness of seats and tables for handicapped children requiring posture support. Selected examples of seats and tables were then evaluated in detail, and a performance specification derived from the evaluation findings. Examples of designs to meet the performance requirements were then developed.

The final chapters aim to bring together the two main issues in the hypotheses, namely development of systematic methods of planning health facilities, and organisation of information which supports planning and decision making. The key factor is whether findings from evaluation studies of design can be arranged and presented so that they significantly reduce incidence of errors occurring in future. A method of organising information is proposed which aims to encourage analytical and constructive decision making, but which is adaptable to a variety of personal approaches, types of problem, and professional interests.

CHAPTER TWO

PLANNING AND DESIGN METHODS - Synopsis

This chapter discusses a variety of approaches to planning, firstly in general, and secondly as applied to buildings, especially buildings for health. The process of planning is described in terms of three phases: investigation, synthesis and evaluation.

Problems of planning for change and uncertainty in a changing world are discussed next, some methods of designing indeterminate buildings being outlined.

The need is argued for a team approach to planning and design of complex buildings such as hospitals. But because the team approach generates communication problems between different professions in the planning team, a variety of methods of communication are compared for their ability to reduce misunderstandings.

Section six reviews a number of design methods used in architectural and industrial design. Interactions between function and design are discussed in section seven with particular reference to the design of health facilities.

Section eight considers the 'problem of problems', that is the degree to which a problem can be described before its solution is investigated.

2.1 APPROACHES TO PLANNING

There are many approaches to planning, Blum (1974, 1976), for example, lists eight. At one extreme is 'non-planning' where one just sits back and lets things happen of their own accord. Problems are avoided or left for so long that they are forgotten about or become irrelevant.

Next is the planning approach which responds to obvious and uncomfortable problems by trying to reduce them, but only in order to make life more tolerable. This is known as 'disjointed incremental' planning.

'Allocative' planning seeks to determine priorities for action on the basis of their likely dividends or effectiveness. Current problems may be reduced but new problems may also be made evident.

The fourth approach is 'guided incremental problem-solving' which attempts to find out why problems exist and then seeks the best ways of tackling them. Future problems are predicted in addition to known current ones.

These four approaches to planning tend to be more concerned with solving problems in the shorter term. The remaining four approaches look further ahead.

'Exploitive' planning tries to predict what is likely to happen in future from a study of the past. Knowledge is used as a means of trying to defy fate. Resources are allocated according to likely benefits and opportunities are exploited to the full.

'Exploitive' planning seeks to plan <u>for</u> the future by looking at possibilities and testing their feasibility. The best plan is then selected in the light of available resources.

The planning approach which tries to define a desirable future is known as 'normative' planning. Necessary changes are then identified and resources organised to achieve the changes.

Last is 'totalitarian' planning in which an ideal state is pursued regardless of the costs or other consequences. Absolute control is both the means and the end.

The planning approach adopted obviously affects how problems are viewed. At both extremes problems are ignored as far as possible. In the centre problems are the reason for planning and the basis for decisions on what to do.

Change is implicit in all but the first kind of planning which is essentially conservative and restrictive in outlook. Totalitarian planning seeks to make sweeping changes, but once the plan is decided any changes to it are resisted.

The degree of participation by the planned-for is most evident in 'exploitive' and 'guided incremental' planning; it is less evident in 'exploitive' and 'allocative' planning; and non-existant in totalitarian planning. 'Non-planning' may be seen by some as offering the ultimate in 'user participation', but it isn't really planning.

The extent to which planners are prepared to look into the more distant future depends largely on whether they have the opportunity to do so. Government agencies are usually so hard-pressed with current problems that there is little time for 'strategic planning'. Hence problems arise as a consequence of not looking ahead far enough or not being sufficiently imaginative (Friend and Jessop 1969).

Knowledge is essential to success in most types of planning. Decisions made without knowledge of trends or resources are likely to disappoint. Feedback (or knowledge of results) is implicit in making decisions on particular courses of action assuming the actions have predictable effects (Benne et al 1976).

Many planning decisions are made with inadequate, conflicting or misleading information. Too much information may however only increase confusion and conflict. Too little, while making decisions easier, may nevertheless result in failure (Parkinson 1958, Raiffa 1968).

Because knowledge is essential for rational planning, it is often thought that more knowledge means better decisions. But knowledge without understanding is like knowing that one has a temperature without understanding its significance, and hence what to do about it.

Two approaches to application of knowledge in solving problems can be identified - comprehensive and incremental (see also Jones 1970 p259):

1) in the comprehensive approach as much knowledge as possible is acquired about needs, resources and techniques in the hope that this will provide a means of understanding how to solve <u>all</u> problems,

2) in the incremental approach our limited capacity for organising information, and understanding it, is recognised; the most pressing problems being identified, analysed and solved first.

Acquisition of comprehensive information, and its storage in computers and libraries, is intended to aid planning. Planners are then expected to use this information in making 'good' decisions (Cater 1974, Cowie 1974).

The incremental approach relies more on obtaining information relevant to particular known problems so that they can be understood and appropriate solutions found. Experience rather than 'book' knowledge is often more helpful in knowing what information is most relevant to particular problems (Havelock 1969, Ginsburg et al 1975).

In practice most planning adopts some of both approaches, being guided by the amount of information available rather than by a deliberate choice (Leigh 1975a, 1975b).

Blum (1976) described planning in the form of a link diagram in which 'values' are the starting point of a process which leads to the desire for change.

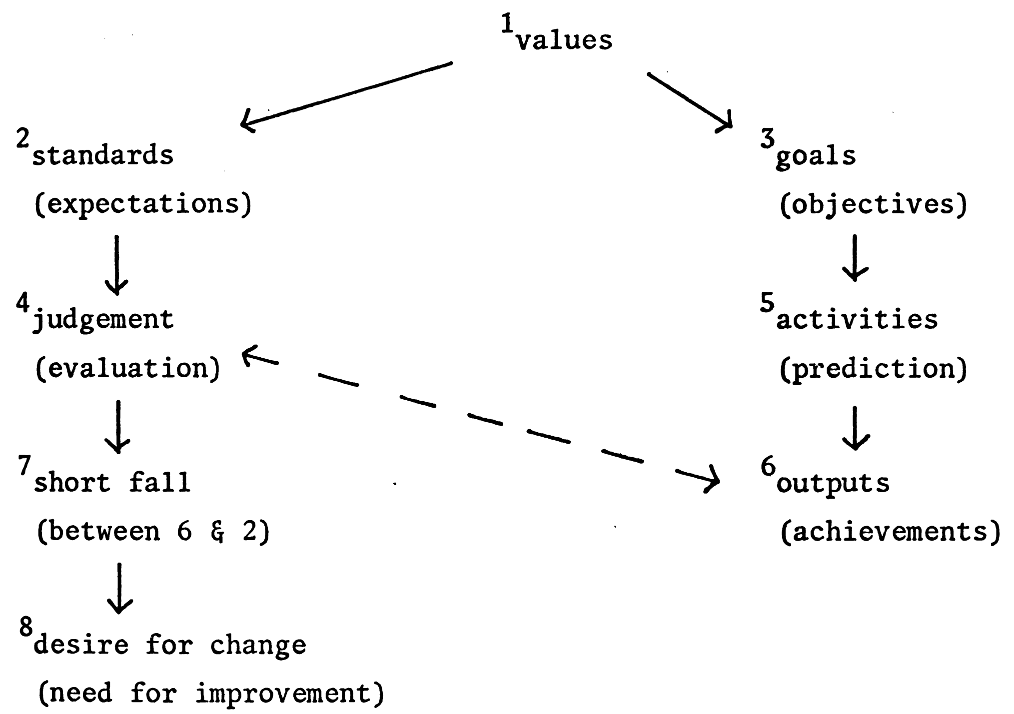


Fig 2.1 The origin of a desire for change (from Blum (1976) p.71).

Change is implicit in most types of planning, and it is happening relentlessly all the time. It can however be modified for better or worse. Development of <u>values</u>, both in individuals and in society, is how directions of change are selected. The amount of effort put into planning will depend partly on the availability of resources and partly on the benefits expected (Warwick and Kelman 1973, Perraton 1974).

Values act as a generating factor in another diagram adapted from Blum which described the planning process from identification of aims through to evaluation of results:

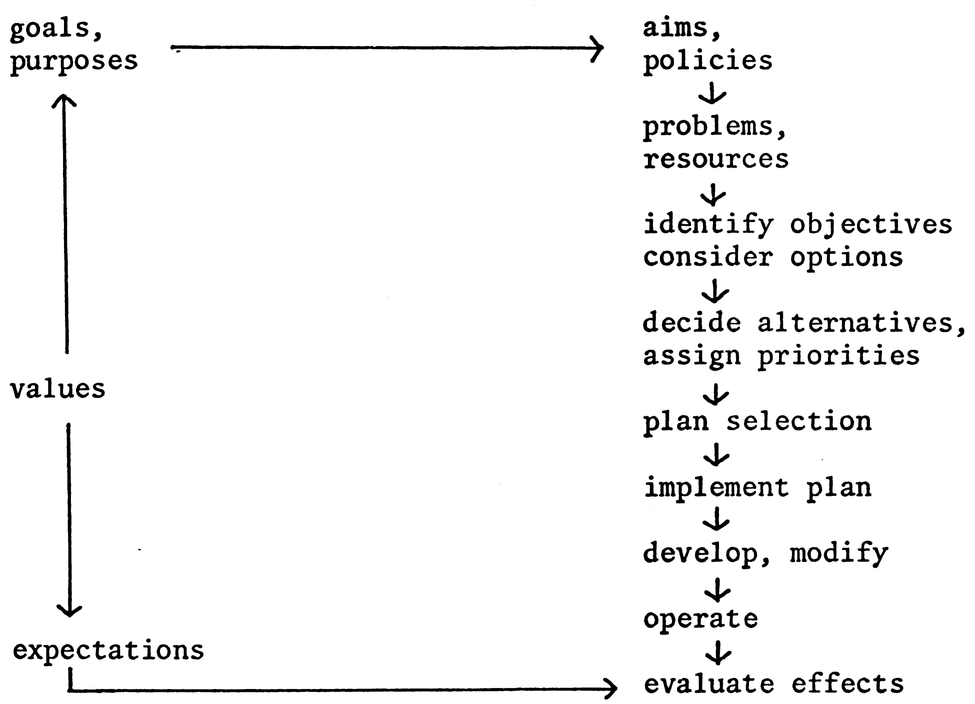


Fig 2.2 The health planning process (adapted from Blum (1976) p.75).

In this model a succession of decision-making stages is evident. 'Values' exert influence both at the beginning and at the end when 'effects' can be compared with what was intended. But options also need to be evaluated and a 'plan' selected which will produce the best effects.

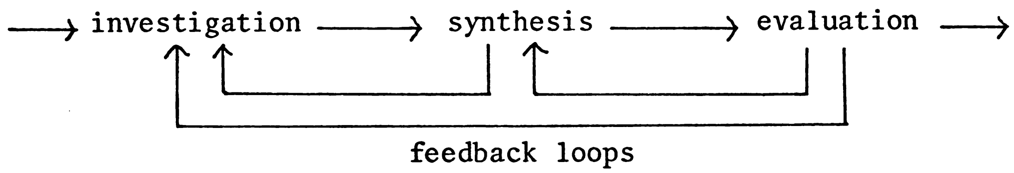
While these kinds of process model are widely used to explain methods of planning and decision-making they rarely bear much similarity to how it is done in real life. Nevertheless, such models make it easier to discuss the kinds of problems encountered in planning, and what can be done about them (Perraton and Baxter 1974).

2.2 THE PLANNING AND DESIGN PROCESS

Souder et al (1964) described the process of planning in terms of three distinct phases:

1. investigation of requirements, resources and constraints
2. synthesis - invention of patterns to satisy the requirements
3. evaluation - decision and selection of preferred solutions.

A diagram included with the description shows 'feedback loops' linking the phases (p 32). These loops represent a return to the earlier phase to sort out problems, rethink requirements, or synthesise further ideas:



Each phase depends on the preceding phase for information concerning the operational system being planned and the physical effects of the design on the operators. Three types of architectural <u>function</u> are identified by Souder et al, which are labelled:

1. utility - functions of the hospital in providing health care services
2. amenity - personal satisfaction of users
3. expression - symbolic impact on the community at large.

These functions are then split down into <u>properties</u> viz:

1. utility - space for people and equipment
spatial arrangement, layout
communications between spaces
movement control
2. amenity - health and safety
comfort
access and convenience
privacy and relaxation
3. expression - aesthetics
conformity
commercial image

Some of these properties can be measured either directly (eg dimension) or indirectly (eg noise level); others, such as aesthetics, can only be given some general indicator of quality or satisfaction. The factors involved in design are often confusing, but Souder et al suggest there are three groups:

a. variables - which can be measured either objectively or subjectively

b. constraints - which are either acceptable or unacceptable

c. immeasurable determinants

Separating the immeasurable from the measurable simplifies the evaluation problem, leaving constraints to be sorted between those which are acceptable and those which are not. Evaluations of the performance of possible design can then be made in terms of these three factors for those functional properties which are relevant to the problem to be solved.

A 'framework for planning' was then described by Souder et al in the form of eleven propositions which were together based on two axioms or assumptions viz:

"a) The hospital planning process is basically an orderly rational endeavour.

b) The planning process can be considered as a three-phase process of investigation, synthesis and evaluation." (p35)

The propositions (paraphased below) were:

1. requirements at any level in all organisations are influenced by any or all of the other levels
2. utility requirements are met in general at the technical level, amenity requirements at the managerial level, and expression requirements at the institutional level
3. most aspects of hospital performance can be measured either objectively or subjectively
4. hospital performance can be affected by choices made in planning, and alternative choices can be evaluated in terms of their likely effects on performance

5. the satisfaction of the requirements of utility, amenity and expression cannot be evaluated by a common unit of measurement
6. because expression is the most difficult function to measure, decisions should be made first to satisfy the needs of expression, then amenity and lastly utility
7. better access to information on hospital operation should result in better planning decisions
8. scanning a wide range of possible operational and design patterns should improve the quality of the solution finally selected
9. the wide range of variables to consider makes it desirable to evaluate a large number of possible solutions to each problem rather than to rely on simple guidelines and models to copy.
10. space and cost limitations may limit the range of possible solutions
11. organisational and physical planning should occur concurrently and interactively. (pp 35-36)

The remainder of Souder et al's book 'Planning for Hospitals' described applications of the planning process recommended, especially in relation to the 'commerce sub-system' and its effects on hospital layout and traffic systems.

The building planning process is often described as a series of approval steps or stages, but it is perhaps better regarded as a succession of inter-related, overlapping, hazily defined and changeable phases of activity. There is no one obvious sequence, nor is there general agreement on the procedures to follow, as demonstrated in chapter three.

Most descriptions of the planning/design process include 'briefing' as one of the early phases of activity. This is usually followed by 'design', 'construction', 'commissioning' and 'operation' in that order, although other activities, such as evaluation, may be interspersed: Short cuts may have to be taken if time is an important factor, but higher cost or less satisfactory performance may result. The diagram below is a general explanation of the building planning process:

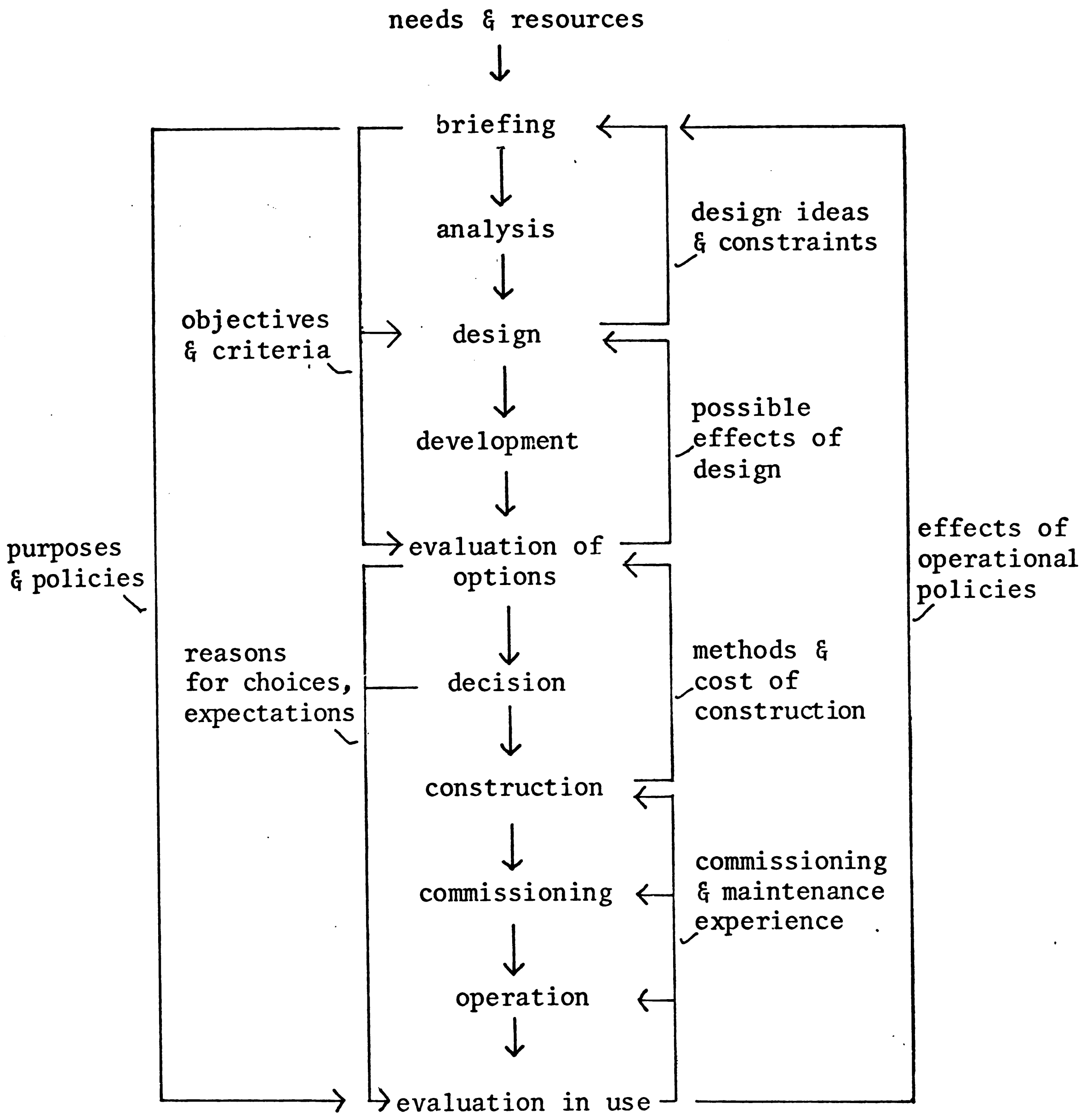


Fig 2.3 Building planning process

Representing briefing as an early phase in design is however both false and misleading. Ideally both briefing and evaluation are continuous activities which proceed concurrently with design and development.

This concept of the planning/design process suggests that briefing and evaluation together perform a monitoring function, and that this should therefore be regarded as a separate set of activities from the decision making which takes place in the analysis, design, construction, commissioning and operation phases.

Users' 'needs' have been discussed by Alexander & Poyner (1970) in terms which raise serious doubts that anyone can adequately describe anybody's needs specifically enough for a suitable design to be produced. Observations of peoples' behaviour do not necessarily accord with what they describe their needs to be. In addition, the different needs of one person may conflict, or the needs of different people may vary in their importance. A further difficulty is that descriptions of users' current behaviour or activities are not necessarily the best prescription for answering their needs in future. Opportunities to discuss preferred ways of doing things with other users may alter ideas on what needs are to be met by a proposed design. The designer may provoke new ideas in the users' minds by asking such questions as "Why do you have to do it this way, how about if you did it that way". Thus the development of design ideas may modify the users' concept of what their needs really are. With the completion of a design, and its operation or use, the users may discover new needs; or they may modify their preconceived ways of doing things as they experiment with their new environment.

A good designer will understand many of the user needs he is designing for better than the users themselves. A user will, for example, only know that he needs to be able to see clearly to perform a task satisfactorily and without fatigue or strain. The user doesn't usually know what kind of light fittings, surface colours, window arrangements, desk positions etc. will provide the best visual conditions for performing a given task. This information may be known to the designer from previous experience of similar situations, he may consult appropriate publications or experts in the field, or he may conduct experiments to find what he considers to be the best arrangement to fit the requirements. In the final analysis the design may have to be compromised because cost or structural considerations have had to take precedence. Thus the ordering of priorities between conflicting requirements may determine how well particular users' needs will be met, or indeed whether they will be met at all.

Various methods of obtaining statements of users' needs as a basis for design are discussed in chapter 4 on Briefing, but an important consideration which affects health building design and construction methods is the point at which users' needs are discussed and defined, and the extent to which some decisions are left open, or are delayed until later in the design, construction or commissioning phases (Claridge 1974).

In many health building projects identification of user needs is frequently left to the project team leader to determine in consultation with department heads or expert consultants. Alternatively, previous projects and published guidelines are used as the basis for design proposals and decisions. More rarely, operational policies and methods may be discussed <u>prior</u> to designs being developed, or the operational aspects may be considered <u>in parallel</u> with design development (Green et al 1971). Not infrequently the more detailed aspects of operational procedures will be decided <u>after</u> all design decisions have been made, any changes in design which result being charged as extras.

When designing buildings, spaces or equipment for particular groups or types of users such as children, the aged, the disabled, the sick or migrants, it will usually be difficult to get effective user participation in discussing requirements (Friedman 1972). Even in the discussion of requirements for hospital ward design it has mostly been the exception rather than the rule that nursing staff at all levels have been able to contribute to decisions on nursing or design policy. The author has personal experience of one major hospital in Australia where it was proposed to convene a committee comprising about twenty people to discuss a new ward block without any nursing staff being present. In the event the director of nursing was brought onto the committee, but only after protest at her proposed exclusion.

Another problem is the influence of senior hospital personnel with strong ideas and voices, but who have little conception of the needs of other users. Some recent hospital buildings would seem to reflect this pecking order in the hierarchy by evidence of omissions of facilities for junior staff amenities in new ward blocks. Absence of adequate toilet facilities for the disabled in public buildings, including hospitals and universities, is quite common (RAIA 1980), and the needs of children are often not considered in hospitals designed specifically for them (Lindheim 1972).

More recently Lindheim (1979/80) has commented on the effects that technology has had on society, on medical care, and on hospital design in particular. The soaring costs of medical care in the USA are, Lindheim suggested, at least partly due to the way society operates. How can one

> "develop a rational approach to the design and operation of hospitals within the context of an irrational society" (p 62).

2.3 PLANNING FOR CHANGE AND UNCERTAINTY

Changes occurring in society are the reason for changing goals and attitudes in planning. Changes now occur with such widespread and unpredictable effects that an adaptive approach to planning has to be adopted. Whereas specific objectives and standards are used as criteria of achievement, they can also unduly restrict the range of choice and hence the opportunity for making improvements. Development of more adaptive approaches to planning means that several alternative goals and strategies are explored, not so much with the aim of choosing one of them as the sole basis of a plan, but to make apparent the range of possible futures which the plan should be able to accommodate (Faludi 1973).

Rose (1974) lists a number of what he regards as essential features of an adaptive approach to planning. These are:

a) integrating in approach and multi-disciplinary in character,
b) normative and self-directing; concerned with choice, preference and goals,
c) adaptive to change - continuously modifying ends and means, preferences and goals,
d) democratic and participatory,
e) based on adequate information and consideration of alternative courses of action (p27).

This assessment suggests that both planning, and planning information systems, depend on adequate input from the results of studies into the effects of previous decisions, and hence what changes in direction further planning decisions should seek to implement.

An important factor in designing for change was referred to by De Bono (1969):

> "Until today ideas have always lived longer than people, but now people live longer than ideas. As a result there is a great need for mental tools that make possible the reforming of ideas." (p 9)

One might also add that buildings should encourage the reforming of ideas for the sake of advancing knowledge. But sometimes ideas or policies become impossible to change because they have become fixed by buildings or procedures.

Rose (op cit) said "We are being forced to make decisions in the face of uncertainty. Data is not always available, rarely is it reliable" (sic). Although Rose was primarily concerned with problems of "environmental deterioration, hunger, resource depletion, and war", the uncertainty principle still applies at the levels of ergonomic design and building planning (Broadbent 1973 p67-71).

Faludi (1973), in discussing methods of solving ill-defined problems, drew attention to two forms of uncertainty identified by Friend and Jessop (1969). The first is uncertainty about the environment, whether this be social, political, economic or physical; the second is uncertainty concerning values or policies. Recognising that clear definition of goals or objectives in an ill-defined situation is impossible, Faludi suggested that 'general directions' can nevertheless be identified which are likely to reduce problems (eg build more houses to reduce the number of homeless people rather than aiming to build a precise number of houses by a certain date). The process of planning then becomes the means of discovering more precise objectives. Above all it helps to fulfil a function which Faludi saw as the primary purpose of planning i.e. "to promote human growth".

In building planning some types of user requirements are only satisfied by particular design forms, auditoria for example. Most building designs are a compromise between the extremes of flexibility and fixity. Weeks (1970) used the term 'multi-strategy' to describe the ability of buildings to accept a limited range of possible layouts and functions.

Some buildings may, however, remain virtually unchanged without restricting their users' freedom. Weeks (1964) referred to this approach as 'duffle-coat planning' (after the war-time standard size overcoat). If a simple building layout can accommodate different functions satisfactorily, then detail design decisions can be delayed until the building is almost ready for occupation. 'Bureaulandschaft' (office landscaping) exemplifies this approach, but it needs to be well designed acoustically and visually otherwise privacy and comfort are sacrificed (Manning 1965, Duffy et al 1975).

Prolonging the research and briefing phase in building planning, by overlapping it with design development and construction, is one means of allowing more time for investigation of requirements and possibilities; but it demands a more open-ended approach to decision making, design documentation, cost control and construction compared with conventional methods. Some client authorities have realised the potential benefits of this approach and have 'bent the rules' to achieve longer-term benefits in functional adaptability (Weeks 1969, Blandford 1975). Office, factory or shop tenants expect to be able to design and rearrange their accommodation <u>after</u> such buildings are virtually completed. This approach also allows the users easily to visualise the functional and environmental effects of design proposals.

But as Broadbent (1973 p69) pointed out, physical science is full of uncertainties, and many architects have reacted to this realisation by trying to create environments in which users' needs can be discovered afterwards rather than defined beforehand. Indeed the principle that an objective method can even be devised for scientific investigation of physical phenomena was challenged by Fayerabend (1975) who considered that some of the most important discoveries were the result of irrationality and anarchism. Fayerabend believed that the only principle which does not inhibit scientific progress is 'anything goes' (p28).

Defining the problem is often said to be more than half way to finding a solution, but problems are to a large extent products of the minds of people engaged in trying to find appropriate answers. An infinite number of possible answers exist to most planning problems. The fact that one plan is finally selected is more likely to be due to the personalities of the participants than to the inherent nature of the stated problem.

Health facilities can influence patterns of organisation of health care services in both desirable and undesirable ways. Hospital siting and location, for example, induce patterns of patient use due to accessibility; and policy decisions on size and content of departments are often derived from existing out-of-date institutions which have inherited operational methods from the Florence Nightingale era. Hospital planning is mainly evolutionary because buildings change at a far slower rate than the factors causing change (Whyte 1967).

2.4 THE TEAM APPROACH

Many projects are planned by what might be called the 'letter-box' method: the client instructs the planner to prepare a plan; the planner produces ideas and sends them back to the client for comment; the client selects a plan and asks for it to be developed in detail; the planner produces detail proposals and specifications; the client makes comments on detailed preferences and cost options; and so on. This process runs the risk of many misunderstandings; it is also time wasting (Friend and Jessop 1969).

The team approach on the other hand encourages joint discussion between 'clients' and planners, both at the investigation stage and during development of proposals. Client representatives may also be involved during the implementation stages, and in evaluation-in-use studies.

The size, organisation and professional make-up of a planning team depends on the nature of the planning task. For a large building project, such as a teaching hospital, the team needs to reflect the range of interests involved. The 'one man' system may have the merit of simplicity and speed of decision (Harrell 1970), but when a variety of interests are involved in decision making the solution is likely to be more acceptable. Coordination is the key to effective decision making on a large scale project where a democratic approach is adopted (Blandford 1975).

Whatever method is adopted for corporate planning some kind of committee structure will be needed. This will usually be a hierarchical structure of three or four levels of decision, each lower level focusing on a progressively narrower field of application (see fig 2.4).

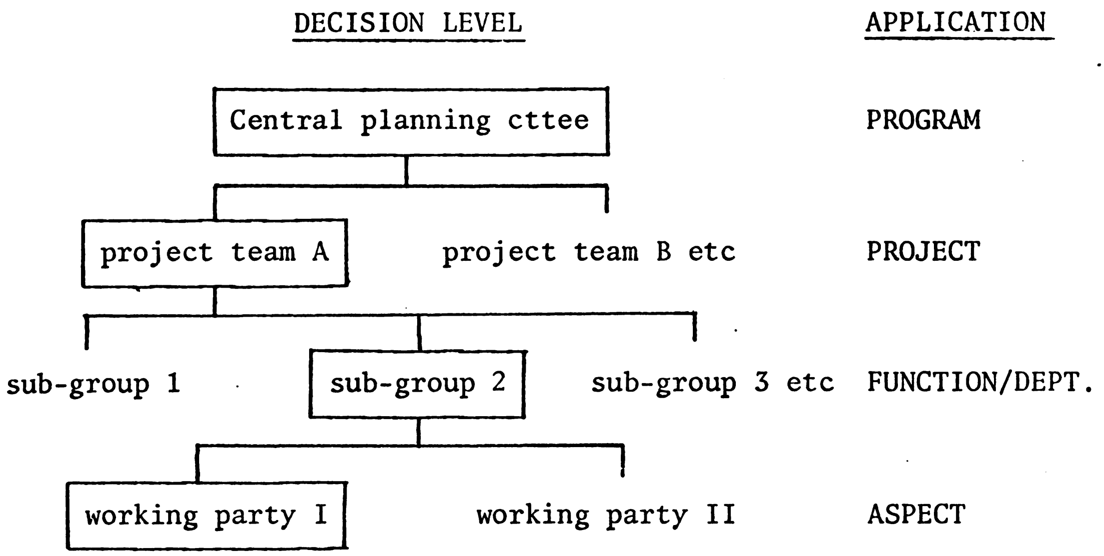


Fig 2.4 Four levels of decision making

Where several projects (a program) are being planned concurrently by one authority there needs to be a central steering and coordinating committee whose task is to set down principles which each project is to follow. This central committee also provides the initial statement of objectives for each project and acts as a continual referral and supervising body for all projects under its control.

Project teams are responsible for detailed planning and implementation of each project. They will generally have wider professional representation than the central planning committee and will be responsible for day-to-day management of project planning.

The third level is made up of departmental committees or 'sub-groups' responsible for functional parts of a project. In a hospital building project each committee would be responsible for detailed planning of a department, or for functions such as 'communication' or 'maintenance'.

A fourth level may sometimes be necessary for short periods to deal with particular problems or aspects occurring within the area of interest of one or more 'sub-groups'. A communications sub-group for example might set up a working party to investigate aspects such as lifts or nurses' call systems (Green et al 1971).

Flow of information between each decision level may be in either direction. Guidelines and instructions flow down from upper levels, information and questions on detail requirements flow upwards from lower levels. Requests for further information may flow in either direction. An efficient planning management information system aims to make information at each level accessible to each of the other levels (Eldin and Croft 1974).

The concept of planning teams is relatively recent and may not be regarded as essential by some client or planning authorities. In the public building field, and especially in health facilities where the client/user is difficult to identify in one person, the 'development group' may take on the role of an expert client/user. An alternative approach, widely adopted in North America and Europe in more specialised forms of building types is the 'planning consultant' (Bottelli 1969). The intermediary thus introduced between client/users and designers is intended to make access easier to specialised knowledge on user requirements and planning solutions. The development group may also carry out design research on its own account, or commission research from other agencies, eg universities and commercial firms.

Perhaps the most notable development groups in the public building fields have been those associated with health and educational buildings in Britain immediately after World War II. Both the then Ministry of Education and subsequently the Ministry of Health established development groups which included both user advisers and designers. The Nuffield Provincial Hospitals Trust (NPHT), in conjunction with the

University of Bristol, also established a research and development team in 1949 to carry out studies in the Functions and Design of Hospitals (Nuffield 1955). The team consisted of an economist, an architect, an historian, a statistician, a medical doctor, a nurse, an operational research scientist, an accountant, and a varied team of supporting professional field workers and academics. In the introduction to the classic work of its kind (Nuffield op cit) the case for the team approach to innovative design was expressed thus:

> "Hospital problems may be approached from two directions. One way is from the accumulated knowledge and experience of those whose daily work has been within the hospital or in hospital design; the other is by bringing to bear fresh minds and fresh methods from outside because people working in hospitals are often too close to their problems to view them dispassionately. These two approaches are complementary." (p.XIX)

The idea of a planning project team thus fulfils two needs: a) to represent the full range of interests of people involved in both the process of planning and the results of planning, and b) to mix both subjective and objective viewpoints so that the results may be more universally applicable over a wide range of situations. In centrally organised and financed systems such as the British schools and hospitals building programs the team concept is virtually unavoidable. In North America, where a much smaller proportion of such building programs are directly financed and controlled by national or federal authorities, specialist planning and design consultants have found a field worth exploiting. Despite this difference in organisational relationships between North America and Britain there has been an increasing acceptance of the multi-disciplinary team approach to planning health facilities in the USA (American Hospital Association 1973, Rea et al 1978).

In Britain the team approach to building design (as distinct from planning involving user interests) has been fostered by the York Institute of Advanced Architectural Studies and by the (then) Ministry of Public Buildings and Works (now Department of the Environment). Project-centred short courses involving teams of several architects, engineers and quantity surveyors were a continual feature at the York Institute. The Department of Health and Social Security and the Nuffield Centre for Health Service Studies at Leeds University organised a number of similar courses in team planning involving users (medical, nursing and administrative) as well as design professionals. Other courses in planning team collaboration were organised by the Bartlett School of Architecture (1964) and by the King Edward's Hospital Fund (McNab 1969).

The benefits of the multi-disciplinary team approach to planning and design education have perhaps been under-recognised. The separate education of social and institutional planners for fields such as urban planning, university planning and hospital planning, has caused a lack of understanding between the professions concerned (Amos 1973).

Having behavioural scientists, such as sociologists and psychologists, on a planning team has been suggested as a means of making architects more aware of human problems in design (eg Gutman 1972, Conway 1975). But because of the special language each professional group uses, and their specialised ways of thinking, one of the problems often encountered is that neither group can fully understand what the other half is talking about, or why or how certain decisions have been taken (Purcell 1980).

2.5 COMMUNICATION PROBLEMS

For planning to be participative and responsive it has to be understandable. The development of specialised professional languages is perhaps due more to a wish to appear erudite than to a need for new or different words because the ordinary ones aren't good enough (Desoutter 1967). When people of several different professions are brought together in a planning team they need to be able to understand each other's viewpoints if later confusion and conflict are to be avoided. In the beginning each team member tries to establish their position while the purpose of the project is temporarily forgotten. To start a project with a clear and simple statement of objectives, factors to consider and proposed methods of proceeding is the ideal, but is seldom attained (Gregory 1972).

Many methods of investigating planning requirements and developing design proposals have been proposed (eg Moore 1970, Jones 1970), but few have become widely adopted. Planning and design guides for various types of buildings and spaces have been published by many professional, commercial and government organisations over the last twenty years. The RIBA Management Handbook (1964), for instance, included a guide to various stages of the Plan of Work to get design teams to approach their work systematically. The plan has also formed the basis for educational courses for design teams (Moss 1972), and for developing procedures for planning particular kinds of buildings (eg Great Britain, DHSS 1969). In presenting a general view of the building planning process which each professional group can relate to, it has provided an effective framework for inter-professional communication.

Many social benefits of planning, as distinct from energy or cost savings, would seem to occur as a result of the personal interactions established during the process of planning. Creation of an interactive planning system can thus help to bring about improvements without necessarily producing any results in the form of buildings (Lindheim 1972). Evaluation of planning proposals may, for instance, reveal that a new building is not the best answer, and that a better use of resources would flow from reorganising services within existing facilities.

Creation of a planning team can generate new ideas and new relationships, the benefits of which far exceed the sum of the individual team members' separate contributions. Effective communication between the people involved may be a key factor in achieving desired results (Crichton 1966). More important still may be the personality of the team leader and the organisational environment in which the team operates. But if people involved in planning are uncertain as to their objectives, responsibilities and tasks, this affects their performance in carrying out the project (Crichton op cit).

Interruptions to information flow between planning team members occurs in several dimensions: 1) through the chronological phases of work in briefing, design, construction and use - the longer it takes the more changes will occur, 2) between the levels of decision and application in a planning hierarchy - the more levels the greater the risk of errors, 3) between people with differing functions and roles - causing problems of terminology and values, and 4) between varying viewpoints about the purposes of the project - social versus technical goals. Reducing the communication barriers between these four kinds of division and between categories within each division, would thus appear to be a means of improving information flow, and hence achieving greater understanding.

The variety of means of communication used in planning and design contributes to many misunderstandings, especially where new and unfamiliar words, symbols or techniques are employed. Inconsistency of meanings, terminology, graphic conventions or coding adds to the problem. Expressing an idea in different ways can however help to make it clearer.

The use of three dimensional models, flow diagrams, questionnaires, mock-up rooms and visits to existing buildings can help understanding between team members. But effective communication of new or unfamiliar ideas requires expenditure of time, a) because the more realistic aids to visualisation take longer to prepare, and b) because new ideas need time for assimilation.

Planning large systems such as transport, education and health encompasses both macro and micro levels of organisation. The problem is how to link the various levels in a complex system so as to facilitate decision making. When information is passed from one level to another there is a risk of misunderstanding and error. Within a health service system one can identify at least five or six interacting levels:-

National
State
Regional
Local
Institutional
Functional

Within an institution the levels of department, unit, room, workspace and equipment item are identifiable. The two sets of levels overlap at the institutional level where failures in communication often occur (Sheldon et al 1970, Rowbottom 1973).

Planning a whole building is clearly a bigger task than planning one of its departments. Planning a department includes planning the functions and rooms it contains. Within each room workspace design and equipment selection have to be considered. A means of differentiating between levels of application and decision is needed however, although physical size is not the vital factor. A workspace problem, for example, can be decided at national level, or a national issue be debated at local level.

In making planning decisions one may apparently be going round in ever-decreasing circles leading to an appropriate decision. In reality interim decisions will be taken in outline before assessing other factors which lead to a more detailed decision, perhaps rather different from the first.

2.6 SOME DESIGN METHODS COMPARED

An international conference on Design Methods in June 1968 held at MIT included a paper by Alexander and Poyner (1970) which attempted to define what was meant by the word 'needs' as applied to building design. The authors began their paper as follows:

> "... there are two things wrong with design programs (briefs). First of all, even if you state clearly what the building has to do, there is still no way of finding out what the building must be like to do it.... Second, even if you state clearly what the building has to do, there is no way of finding out if this is what the building ought to do..... There is no way of testing what the program (brief) says."

The issue which Alexander and Poyner were trying to debate was whether the design suitability of a building for its intended purpose was a matter of fact or opinion. They said that they believed it to be a matter of fact. Furthermore they considered that it was possible to write a brief "which is both objectively correct, and which yields the actual physical geometry of a building". (p 309).

After a discussion of how user needs could be observed, recognised and defined, the authors pointed out that conflicting requirements or 'tendencies' were the only reason why designers were necessary at all. Otherwise all the user had to do was to adapt to a given environment and all would be well. This was followed by an example of design 'relationships' which were in conflict, and which therefore required the agency of a designer to resolve the conflicts. As experience was gained in resolving such conflicts a language of satisfactory relationships or patterns could be developed. This 'pattern language' then formed the designers' and the users' vocabulary for resolving any conflicts that arose in living in the physical environment.

The principle underlying Alexander and Poyners' approach was that designs for a given purpose differed because their designers differed in their order of values. If there was general agreement on 'one basic value' on which all others depended, then there would be no conflicts and all designs could be based on fact and not opinions. This 'basic value' was that

> "The environment should give free rein to all tendencies: conflicts between peoples' tendencies must be eliminated." (p 314)

With this utopian viewpoint anything is likely to be considered possible. Alexander's later books on 'The Pattern Language' (1977), and 'The Timeless Way of Building' (1979), were an attempt to catalogue for universal use all the significant patterns in the physical world which worked well and were therefore considered worth repeating. The process of briefing in one form or another depends ultimately on feedback of information from past or present experience. It does not however offer a safe way of recognising how to avoid conflicts in future unknown situations.

Alexander and Poyner (op cit) suggested one way round this problem was to observe people's 'tendencies' and to devise environmental systems to permit these tendencies to operate with the least amount of resistance or conflict. 'Architectural programming' based on analysis of specific human activities then becomes almost irrelevant, except insofar as it may indicate the space, time, cost and quality parameters within which the design and the functions may interact.

Some of these ideas have affected the way in which requirements for health facilities are expressed, and how briefing statements affect, and are affected by, the development of design solutions. Best (1969), for example, described how relationships between departments in a large teaching hospital project were defined by asking representative hospital staff what they thought the physical relationships between departments should be within a broadly defined context. The results were rather different from those previously assumed by the architects from their experience on other hospital planning projects. It then transpired that the meanings given to 'hospital departments' differed between the staff representatives and the architects. The problem was essentially due to what Best called 'encoding' or labelling of elements. The staff were describing 'functions' while the architects were thinking in terms of 'zones' and 'areas'.

In his introduction to a report on a 1967 conference on 'Design Methods in Architecture' Ward (1969) commented that none of the other speakers at the subsequent Design Methods Conference at MIT in 1968 'seemed remotely interested in the real world of the people they were supposed to be designing for...". This has since been remedied by an expansion of the literature on architectural and environmental psychology (eg Sommer 1969, 1972, Canter 1970, 1975, Proshansky et al 1970, Honikman 1970, Architectural Psychology Research Unit 1972, 1974, Mehrabian & Russell 1972, Lang 1974, Deasy 1974, Lee 1976).

Jones (1970), in discussing choice of design methods, distinguished between a) creative or 'black-box' methods, b) rational or 'glass-box' methods and c) controlled or self-organising methods. He also emphasised the importance of 'externalising' the design process (making it public) so:

> "that other people, such as users, can see what is going on and contribute to it information and insights that are outside the designer's knowledge and experience." (p.45)

To do this the designer either seeks to explain the process by which ideas are generated and decisions reached by representing the process as a logical series of steps or events in a network or chain; or he has to establish a broad strategy for reaching an objective, perhaps only dimly perceived, and which is constantly being refined and modified in order to find short cuts across unknown territory.

One of the weaknesses of both the black-box and the glass-box methods:

> "is that the designer generates a universe of unfamiliar alternatives that is too large to be explored by the slow process of conscious thought. He cannot make an intuitive, or black-box, choice (for that would re-impose the restrictions of previous experience from which he is trying to escape): neither can he use a high-speed computer to search automatically (for the computer program requires fore-knowledge of objectives and criteria of choice that are themselves dependent upon the alternatives that are available)." (Jones op cit p.55)

To overcome the problem the designer can divide the design task in two: 1) search for a suitable design (innovation), and 2) control and evaluation of the search strategy (regulation). Design now becomes a consciously steered activity dependent upon accuracy of feedback from a) the situation that the design is intended to meet (the objective), and b) the performance of the design method adopted (the strategy).

The purpose of this new method (of strategy-plus-objective):

> "is to enable each member of the design team to see for himself the degree to which the search actions decided upon do, or do not, produce an acceptable balance between the new design, the situations influenced by the design, and the cost of designing. This is done in two ways: firstly through creation of a 'meta-language' of terms which are sufficiently general to describe relationships between a strategy and the design situation, and secondly, through the evaluation, in this meta-language, of a model which will predict the likely results of alternative strategies yet to be undertaken so that the most promising can be selected." (Jones ibid)

A brief explanation of Matchett's Fundamental Design Method (FDM) was given (pp.178-190) and the comment was then made (by Jones) that:-

> "FDM could be described as the learning of a meta-language that exposes the pattern of thinking and makes it easier to match this pattern to the pattern of the problem."

Students of this method are firstly encouraged to analyse their own design methods and are then gradually introduced to Matchett's method which is based on two definitions of designing:

> "a) good design is the optimum solution to the sum of the true needs of a particular set of circumstances, and
> b) designing means discovering and reconciling conflicts in a multi-dimensional situation."

Five modes of thinking are used by Matchett to perceive, control and extend the patterns of thought about design problems. These are 1) 'Thinking with Outline Strategies' consisting of a) deciding a strategy in advance, b) comparing achievements with intentions, and c) producing strategies for producing strategies (planning the planning). Other modes are 2) 'Thinking in Parallel Planes' (levels of consciousness while designing), 3) 'Thinking from Several Viewpoints' (about possible solutions), 4) 'Thinking with Concepts' (relating problems, processes and solutions, and 5) 'Thinking with Basic Elements' (action alternatives in a problem solving process). The last mentioned mode consists of seven groups of words in the form of check lists which represent a problem solving process.

Although mainly concerned with engineering design problems, many of the design methods described by Jones are more concerned with methods of creative thinking and problem analysis than with engineering design as such. Many of the methods depend upon statements of requirements which are themselves the result of experience of previous design solutions.

This works when the designer's task is to improve or develop an existing design, but is unhelpful where no precedents exist. The linear or sequential approach was compared (by Jones) with the circular or iterative approach, neither of which he regarded as ideal or universally applicable. The self-organising approach demands an element of iteration as some false trails are likely to be followed before it is apparent that they are profitable. Yet many models of planning and design processes and procedures are represented as continuous uninterrupted linear decision chains (eg Great Britain DHSS 1974, Royal Institute of British Architects 1964). For this reason it is appropriate to distinguish between planning as an administrative procedure concerned with the stage by stage progress of documenting and managing a project, and planning as an exploratory problem solving process (Jones 1981 p xx).

Archer's 'Systematic Method for Designers' (Archer 1965) attempted to provide a means of reviewing the full field of possible solutions to a problem and at the same time induce logical decision-making. Luckman's methods of Analysis of Inter-connected Decision Areas, or AIDA (Luckman 1967, also referred to by Jones, and included in Broadbent 1969), is one means of narrowing the field; but it has limited application and is more an analytical tool where a narrow range of possibilities for a small number of known linked solutions have to be optimised. Jones (op cit) commented that Archer's method is very time consuming and tedious, and it needs a computer to solve many of the mathematical problems involved. But it helps to ensure that no gaps in decision making are left, and therefore is applicable where absolute reliability is highly rated and where design time and cost are of less importance. Luckman's AIDA has been applied to a varied range of problems from designing a ball-point pen to selecting a preferred strategy for improving hospital based maternity services in a given locality (Luckman 1973). In both methods the pattern of decision-making (and of information searching) is largely 'pre-fabricated'; ie it employs factual and quantitative data produced in response to specific questions regarding alternative policies or solutions.

In theory the development of alternatives and their evaluation is a continuous cyclic process which only ceases when all outstanding problems, conflicts and uncertainties have been resolved (Markus et al 1972). In reality the cycle may not even begin, or it may be cut short by lack of time, information or personnel, in which case the resulting design may fail to meet the criteria.

Lack of definition of problems which a design is intended to solve may also cause failure, mainly because no adequate basis for evaluation then exists. This results in what Norton (1970) termed the 'vicious circle' design sequence (adapted from original):

problem revealed ←
↓
ideas sought to solve problems
↓
preferred idea selected & developed
↓
new problems revealed
↓
improvements made to overcome new problem
↓
further problems revealed → start cycle again

Fig 2.5 Vicious circle design sequence

To overcome this 'vicious circle' Norton proposed a 'linear' design sequence (adapted from original):

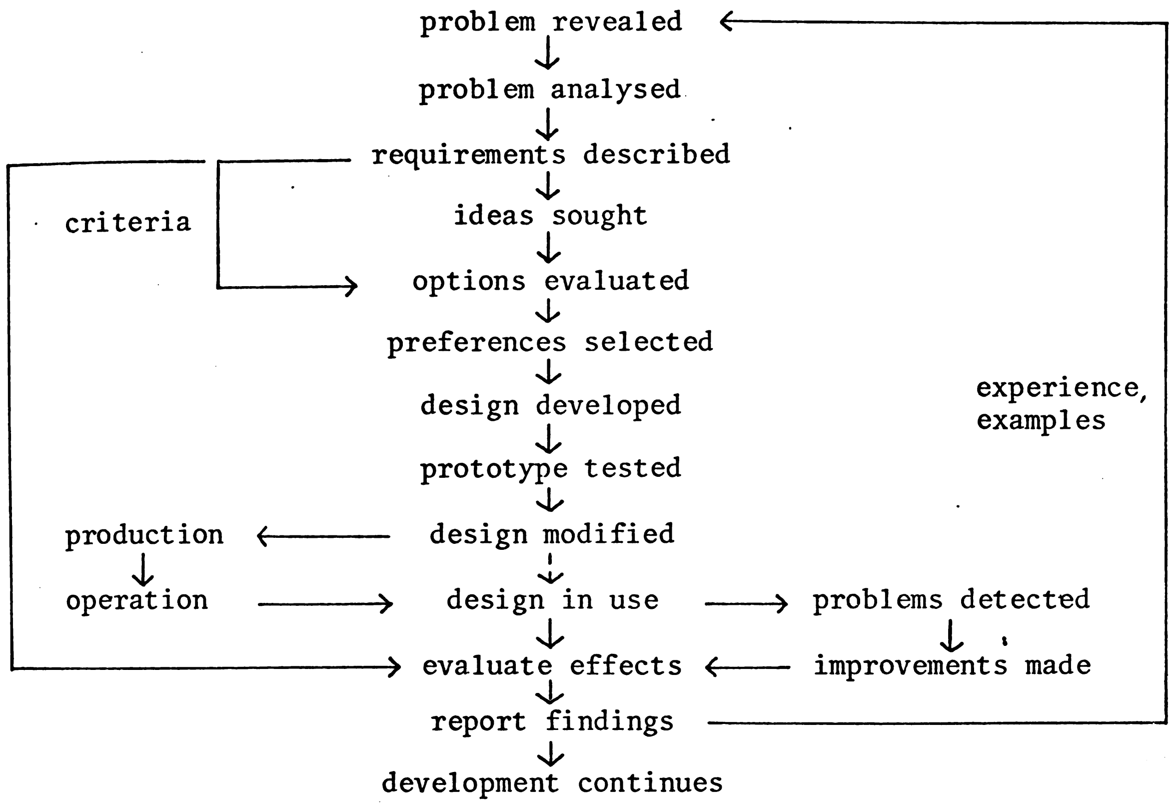


Fig 2.6 Linear design sequence

Norton's comparison of design methodologies was revealing for two reasons, firstly because it was conducted by a user (a nurse) rather than by a designer, psychologist or statistician; secondly because it showed the importance of systematic design method on the effects of design in use. By comparing design methods for simple products such as walking aids and lifting devices, Norton was able to show how the method of thinking about problem solving affected the outcome of the design process.

The idea of 'participation in design' was the theme of a conference of the Design Research Society held in Manchester in 1971 (Cross 1972). Many of the speakers described methods by which users could become more involved in the planning and design process. Friedman (1972), for example, suggested that the designer should adopt the role of a technician who provided a 'repertory' of environmental aids together with a feedback or warning system to keep those involved aware of what was happening. Friedman also criticised most design processes for 'separating decision-making from risk-taking' - designers made decisions but users bore the consequences.

Page (1972) was another speaker at the Manchester conference who described a spectrum of methods by which designers and design processes involved users, either in defining their needs, or in the decision making process. The distinction was made between private and public client organisations, and especially the influence of profit in commercial projects and the ballot box in public sector programs. Various forms of feedback mechanism were described including dissatisfaction by users which resulted in subsequent legislative changes aimed at preventing repetition of past mistakes. But as Page said "Design by retrospective feedback doesn't help the existing design", although "one can get a long term design improvement by retrospective feedback" (p 116).

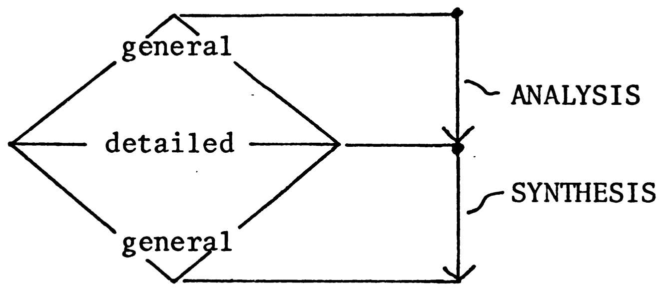
Because thinking is a sequential step-by-step process, any design task which includes more than one level of complexity begs the question of whether to start with higher level general issues or with lower level specific aspects. The first approach exemplifies the deductive method, the second proceeds by induction from parts to the whole. Markus (1973) called this procedural problem the 'double pyramid paradox'.

The analytical phase of design is normally represented as proceeding from generalities to particularities, ie it breaks the task down into progressively smaller parts. The synthesis phase of design then inverts the process and reassembles the whole from the various elements. Marcus suggests however that there are in fact at least three ways of proceeding with the analysis and synthesis phases of design:-

1. start from the 'general' in the analytical phase until the required level of detail is reached, then reverse the order of levels in the synthesis phase
2. start by analysing general issues, then synthesise general solutions, followed by analysis and synthesis at each more detailed level in turn
3. start by analysing general issues and proceed progressively to more detailed issues, then start the synthesis phase at general issues and follow the same sequence as in the analysis.

The diagrams below show the three approaches (adapted from Markus' original version):

1.



2.

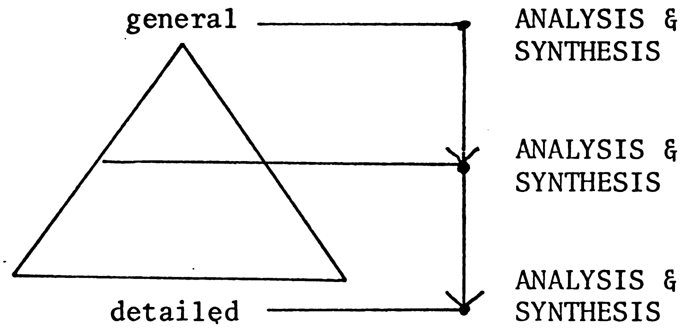


Fig 2.7a Analysis and synthesis procedures (1 & 2)

3.

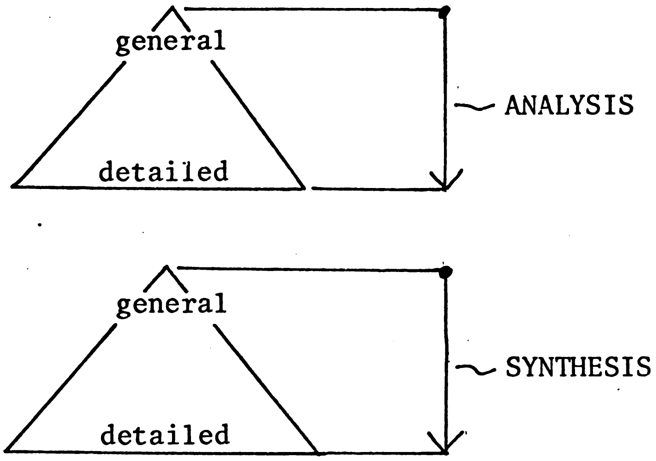


Fig 2.7b Analysis and synthesis procedure (3)

Other approaches would be to start in the middle of the analytical pyramid and then proceed up (or down) followed by a similar or reversed order for synthesis. With a system comprising several levels the options for an order of procedure are virtually limitless.

Whichever order of approach is adopted for analysis and synthesis in any particular planning project, the order of thinking about the various problems and their solution has to be sequential (a), although a number of sequential processes can occur in parallel (b), (see fig 2.8).

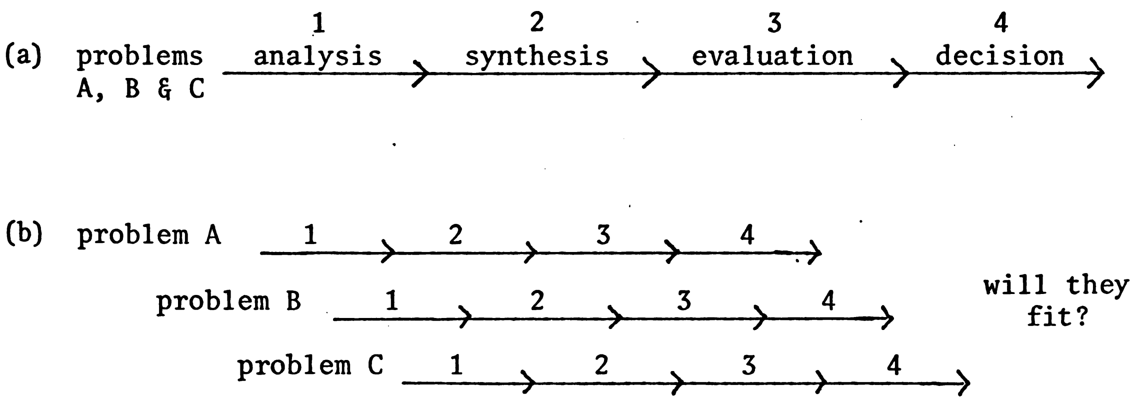


Fig 2.8 Multiple problem solving process alternatives

In whatever order the levels of complexity are analysed and synthesised in the planning process, the thinking processes of the planners will, to some extent at least, be affected by the way information on needs and problems is arranged and presented.

2.7 FUNCTION AND DESIGN INTERACTIONS

Designing cannot properly be undertaken without defining the purposes which the design is to serve. Function and design interact in a way which is however often difficult to explain adequately. The statement of functional requirements logically precedes exploration of design possibilities or consequences, although sometimes an article designed for one purpose is converted to another purpose with unexpected success; perhaps more success than a purpose-designed product might have achieved (Leach 1968). An easily adapted building, for example, enables its users to work out a method of working in it as they use it. The design thus helps in developing ideas about better working methods.

Although design should aim to satisfy functional needs it may not be practicable for financial, structural or legislative reasons fully to achieve that ideal. Both functional and design aspects of planning therefore need to be considered together, eg how social, administrative and organisational aspects affect buildings, engineering services or equipment, and vice versa.

The idea of an interactive model of design, which relates activities and functional needs to ways in which designs serve those needs, has preoccupied many design and planning theoreticians over most of the last 20 years (see Jones 1970, Gregory 1972). The intermeshing of functional planning and 'hardware' designing is a fundamentally different concept from that represented by the catch-phrase "form follows function" which was a guiding principle of architects and designers in the 1930s. Realisation that satisfactory environments could not automatically be derived from detailed analyses of functional requirements may have been sparked off by Alexander's classic exhaustive study of the design of an Indian village (1964 , see also Hanson 1969, Studer 1969, Daley 1969). Studies of ways of relating rooms or departments in buildings as a result of their traffic links are as notable by their abundance (eg Moseley 1963, Archer 1963, Levin 1964, Souder 1964, Whitehead and Eldars 1965, Black 1966, Great Britain MoH 1966, Tabor 1969, Applied Research 1973) as by their apparent lack of success in making significant improvements in layout. The fact that building layouts induce traffic, just as roads do (Buchanan 1963), seems to have escaped the notice of many of the seekers of rational design methods based on mathematical analysis.

Designers who believed that 'acceptable' social behaviour and 'good' housing or city design were causally related were challenged when it was shown that the reverse was often the case (Sennett 1973, Goodman 1972, Gans 1969). While engineering design and design in nature would seem to follow fairly clear-cut principles of gradual optimisation or natural selection in response to functional needs (Jones op cit, Whyte 1951), there are nevertheless many instances where new functions or capabilities have emerged as a result of accidental or mutative design changes. Functional efficiency also seems to be less related to the 'functionalism' of design than to the ability of users to adapt themselves to the designs. 'Loose fit' is a concept which has been explored for its capability to 'prolong useful life' of buildings (Weeks and Best 1970, Gordon 1973). It avoids the need clearly to define functional needs or to design specifically for them. Instead the range of functional possibilities of a design are explored. This design is then developed and refined, possibly adding unsought-after functional capabilities as a bonus by 'accidental insights'.

Psychological experiments have shown how people have mental blockages about objects which are too rigidly associated with their normal purposes, and therefore are not used in abnormal ways to help solve problems (Birch and Rabinowitz 1951). Labelling a room 'treatment room' or 'store' can have the same effect in inhibiting flexible use of space (Sommer 1969). De Bono (1969) suggests a variety of ways in which the mind can be freed of preconceptions in order to find new solutions to old problems which, when looked at in retrospect, seem painfully obvious.

The design of laboratory workspaces for pathology technicians (Moss 1971, Great Britain DHSS 1973) demonstrates an approach to design for a range of possible activities. This study showed how previous experience of designing laboratory buildings, together with a detailed survey of existing laboratory activities, were too limiting in concept. Experiments with a mock-up benching system prompted several new ideas, and gave a better understanding of user needs, which would not have been discovered otherwise. This kind of discovery makes suspect those design procedures (and information systems) which rely wholly on a logical deductive method.

In a new review section of the beginning of his classic book on design methods, Jones (1981) made a few significant comments on changes in his thinking that had occurred since the book was first published in 1970. For example the importance of 'muddle' in helping to see new possibilities is often undervalued in helping to solve design problems, as is the need to 'step back' periodically and review the progress and direction of a design project or program. The goals and objectives for design may become unduly fixed and need to be periodically renegotiated with clients and users. The interdependency of problem and solution is insufficiently recognised in many planning and design procedures, and emphasises the need for design methods and processes to allow for continual reassessment, both of problems and of the means of answering them.

Models of various kinds, which can be used to test design methods, design ideas and design effects, are widely used in designing, yet Jones maintained that they can distort the understanding they give because they present a picture "of some reality which is being changed but is not directly present". Caution was therefore advocated in relying on conclusions derived from modelling. Nevertheless Jones said "'test it' is perhaps the best-design method there is" (p xxv).

Many of the newer methods of designing, covered by Jones in the original edition of the book, permit or encourage collaboration between a variety of professional designers, and between designers and users. What they also did, Jones realised, was to permit this collaboration to occur before the design concept is frozen. The new methods of collaborative designing:

> "release everyone from the tyranny of imposed ideas and enable each (person) to contribute to, and act upon, the best that everyone is capable of imagining and doing. This is not easy. It requires not only new methods but a new conception of the self." (p xxvii)

The implications of the foregoing section (and especially Jones' recent review) for health facility planning and design is that many of the planning and design 'methods' now in use may not produce the desired results and effects. If this is true then it is important to know this as soon as possible before too much irreversible damage is done. The means of finding out for certain what effect a particular design decision may have is to build it, use it and assess it. This takes a long time, too long to be of much use in the design process. Therefore the design must offer the opportunity to correct mistakes discovered in using it.

.8 PROBLEM SOLVING AND DECISION MAKING

There are many different potential answers to most planning problems. Planning and designing are therefore concerned with finding 'reasonable' solutions to 'apparent' problems. But the nature of a problem may not become clear until various solutions have been explored. Sometimes 'solutions' generate new problems worse than the initial one, i.e. cure worse than disease (Norton 1970). Conflicts can arise between incompatible solutions or requirements, and a compromise may have to be accepted. In this sense many design solutions are, to a degree, failures (Pye 1969, see also Luckman 1969).

The need for architects to know more about the human consequences of design was put forward by Manning (1965) of the Pilkington Research Unit study team on office buildings. Many designers thought that the things they found desirable were also desired by their building's users, which was obviously not true. There was thus a need for architects to learn more about human environmental psychology. Otherwise there was a 'danger of industrialising the obsolete if knowledge of human requirements could not keep up with technical developments'. (Architects' Journal 1965).).

Other designers have argued for industrialised building methods, suggesting that if good design answers can be found to common human problems then the best approach is to 'serialise' whole buildings, thus making better use of design skill for a wider group of users.

Page (1965) said that design could not be represented as a linear sequence of events, but that 'information and decisions must be recycled'. He also expressed the view that no problem had a unique solution and that any design method had to permit a range of possible solutions to be considered. A further difficulty was caused by the time taken in briefing, design and building so that projects were frequently out-of-date before their users could occupy them. The proposition of a 'two-stage' design was put forward by Page in which 'a separate permanent envelope' enclosed a more easily changed interior. The need to spend more money on provision for flexibility was emphasised, and this also offered the opportunity to delay making some decisions until the last moment.

Decision making about the future is largely based on predictions derived from past events and trends. Yet evidence from all spheres of planning (social, commercial, technical and political) suggests that the past is not a good indicator of the future (Terreberry 1968). The degree to which a planning organisation should a) encourage change, b) allow for change, or c) suppress change, depends upon the overall objectives of the organisation concerned. Beer (1975) suggests that many organisations react against pressures for change because it threatens their existence. The idea of participative planning may be used as a political gesture to divert criticism of autocracy by government departments rather than as a matter of democratic principle or policy (Stretton 1974).

Many decisions are taken unnecessarily by building planning teams, either because information on design proposals and their costs is required by the approving authority for budgetting purposes, or because detailed information on construction has to be produced for tendering and to provide a basis for negotiating contract variations (RIBA 1964).

Some well-meaning but fruitless design decisions may be made in the hope of influencing or 'improving' the user (Broady 1968). The alternative approach is to provide users with a kit of parts and leave them to work out their own environmental solution. The PSSHAK (Primary Support Structure and Housing Assembly Kit) system by the Greater London Council (Hamdi 1971) attempted to involve public housing tenants in the design of flats, and provided flexibility to meet changing needs as they arose in subsequent use.

Many tentative design decisions are made early in planning so that budgets can be allocated to projects, and to their component parts. Cost planning and control are therefore inherent in any design method. The (then) British Ministry of Health's hospital building procedures in the early 1960's, for example, were founded on a method of allocating building costs to 'functional units' (such as beds, operating theatres, meals and clinic sessions) (Great Britain M of H 1961).

Whyte (1967) discussed model-building as a means of making planning and decision making more effective. Most people apparently can visualise only a small number of models resulting in too narrow a range to choose from. Analysing the activities to be performed, as well as the needs of the people involved, was suggested as a better means of understanding requirements and implementing changes than innovation by more arbitrary means.

When asked for their requirements users tend, however, to describe design solutions rather than state the problems to be overcome. This means that designers who need to know what they are designing for, have to ask many questions about the problems to be solved (see chapter 4).

Collecting information about 'problems' is made difficult because the concepts about which information is to be collected are often obscure. It is easier to collect information about solutions, which is why it is more often done that way.

Rather than propose simple and direct remedies to these problems, Woolley (1970) discussed the nature of the creative process called designing. This somewhat poetic discussion was aimed, one suspects, at non-architects in the hope that they would better understand what went on in the architects' mind when designing. Creativity for instance was described in terms of Wallas' (1926) four steps:

preparation
incubation
illumination
verification

Because nearly all design involves a variety of professional skills and types of knowledge, the need exists for both theoretical and practical aspects to be included in any information systems for decision making. Wade (1980) describes methods of representing the design process using what he calls five 'levels' of description which are related in an 'ends - means' spectrum:

person or institution
purpose or intention
behaviour or attitude
function or activity
object or tool (from p 65).

These five levels are used, for example, in defining the difference between briefing, planning and design:

> "Programming (briefing) converts purpose into behaviour information; planning converts behaviour into function information; design converts function into object information" (p 53).

Wade, an architect, goes on to quote Studer (1972), a psychologist, who contrasts the approach to problem solving of behavioural scientists and designers. The designer usually starts with 'behaviour' requirements and proceeds via 'functions' to descriptions of 'objects' that induce the required behaviour. The behavioural scientist, on the other hand, starts with environmental stimuli or objects which affect functions which influence the behaviour he is interested in (p 65).

Wade then describes (p 70) the approaches to problem solving of three designers (Asimow 1962, Archer 1967 and Honey 1969) whose methods are analysed in terms of five 'segments' or problem solving steps:

1. demand input (requirements)
2. supply system input (resources)
3. matching process (decision)
4. selection (evaluation)
5. supply output (demand input to next phase)

Wade (op cit) also discusses the 'circularity' between problems and solutions:

> "One of the great difficulties in architectural design is that a statement of a design problem already supposes that the answer is a building" (p 35),

and later

> "A problem statement almost always has in it the seeds of its solution" (p 36).

The dilemma that this circularity of 'problem affecting solution affecting problem' causes can, Wade suggests, be resolved with the aid of information classification systems. These systems should be based, not on scientific or academic disciplines, but on relationships between 'ends' and 'means' (p 62).

CHAPTER THREE

BUILDING PLANNING PROCEDURES - Synopsis

An overview of health building planning procedures in Britain, North America and Australia introduces the chapter. This is followed by a list of criteria for evaluating planning procedures.

The main health building planning and design procedures in Britain, USA, Canada, Australia and New South Wales are described in the next four sections, followed by planning procedures at regional level in NSW.

The final section considers the requirements for a rational planning process, and especially the ability of the various procedures described to change, to involve users in decision making, and to facilitate feedback to briefing and decision making.

3.1 HEALTH BUILDING PLANNING PROCEDURES - AN OVERVIEW

In 1963 Clive Wooster et al in the then Ministry of Works Research and Development Group in London, proposed a 'Plan of Work' which building design teams could use for programming building projects from inception through to completion and evaluation. This 'Plan' was subsequently adopted by the Royal Institute of British Architects (RIBA 1964) and described in detail in the Handbook of Architectural Practice and Management. A much modified form of the 'Plan of Work' was developed by the Department of Health and Social Security (Great Britain, DHSS 1971) for its Hospital Building Procedures and published under the title of CAPRICODE (see next section and appendix H^1).

Reasons for the DHSS procedures differing from the RIBA 'Plan of Work' stemmed from a number of studies on the planning of hospital building schemes carried out by inter-board study groups in Britain in the early 1960s (Great Britain MoH 1962). The case for varying the planning process when applied to hospitals was that the RIBA plan was orientated mainly towards buildings designed by private architects for commercial clients, whereas in the health building field the roles of architect and client were less clear cut as some architects worked for government authorities and some were employed as consultants. The hospital building planning procedures also reflected a greater number of levels of decision making involving the DHSS, the Regional Hospital Boards and the individual project planning teams.

In New South Wales the Hospitals Commission and the Department of Public Works (1969) adopted a modified form of the original RIBA Plan of Work, rather than the DHSS Procedures, for organising health building planning work, and for approval and cost control purposes (see section 3.5 below and appendix H^2).

In 1973 the Australian Commonwealth Government attempted to introduce common planning procedures for all health buildings involving federal government money (Australia 1974). This initiative was however subsequently modified with the change in government in 1975 to recommending a "sequence of activities necessary to develop an integrated planning procedure for the provision of any health facility" (Australia 1976). The 'Action Sequence' has since been turned into a detailed network of all documentation and decision activities necessary for the planning, design and construction of a health facility (Kleist 1980).

Most Government health building authorities in countries such as Britain, South Africa and Canada have produced recommendations for planning procedures based either on Wooster's original model, or on developments of it (eg Great Britain DHSS 1974, Gt.Brit. SHHD 1976, NSW HC 1971, Ontario 1972, South Africa 1975). Some of these procedures emphasise cost control, others are more concerned with rational procedures for decision making based on evaluation of previous projects and on predictions of likely trends. Those procedures based on the RIBA Plan of Work tend to emphasise the information needs of the design team, while those modelled on the DHSS health building procedures reflect more concern with administrative and approval processes.

Procedures have also been developed for hospital planning in the USA and these tend to reflect a greater concern with fund raising and with quick decision-making and construction (AHA 1966, CHI/SMP 1976, USA DHEW 1978, Hardy & Lammers 1977). The different approaches adopted in these various procedures are described in more detail in the following sections of this chapter.

The purposes of establishing a standard procedure for planning health facilities on a national or state basis can be summarised thus:

1. to help ensure that knowledge, people and finance are effectively and fully utilised.

2. to enable comparisons to be made between individual projects or between alternative policies and proposals.

3. to enable funds to be allocated to projects on an equitable basis.

4. to help provide information on the likely effects of particular policies or designs.

5. to encourage logical and objective decision making based on all available evidence.

6. to permit the progress and performance of projects to be monitored and remedial action to be taken if necessary.

7. to facilitate communication between the various professions involved in planning, design, commissioning and using health facilities.

8. to provide a framework for education and training of health facility planners and designers.

9. to provide a means of supplying the various people involved in the planning of a project with the information they need when they need it.

The procedures and processes discussed in the following section have been developed in varying political, economic and organisational circumstances and in response to a variety of needs. Nevertheless their suitability can be assessed in relation to the broad criteria outlined above, and more particularly in respect of the opportunity for modifying the planning process on particular projects according to local needs and circumstances. Most importantly the procedures should promote feedback from evaluations of options in the course of planning and design, and should avoid the risk of imposing solutions without an adequate investigation of problems to be solved.

.2 BRITISH PLANNING PROCEDURES

The British health building planning procedures originated in the immediate post-war period following the setting up of the National Health Service in 1948. The (then) Ministry of Health provided funds directly to Regional Hospital Boards for individual capital building projects costing over a specified minimum amount (£ ½M in 1973). Up to the mid 1960s all aspects of design were carefully scrutinised by the Ministry of Health before approval for funding was given, but after about 1967 the approval procedures were simplified leaving responsibility for detailed design in the hands of the regional authorities. This change was caused partly by expansion of the capital building program and the impossibility of scrutinising the details of all major building proposals. A greater degree of standardisation of design, and better guidance from the DHSS, also made detailed examination of design unnecessary (Goodman 1969).

Prior to the publication of the first of the Hospital Building Procedure Notes in 1969, the (then) Ministry of Health in England provided guidance to Regional Hospital Boards on the planning of hospital buildings in a document entitled 'Processing and Approval of Hospital Building Schemes'. In 1963 an inter-Regional Board Communications Study Group, which included representatives from firms of private architects, produced a report entitled 'Coordination of the Process of Design' (Alex Gordon & Partners 1963). This report proposed a five stage model of the design process, based broadly on Wooster's 'Plan of Work' for design team collaboration, and which could be applied to major hospital building projects planned by Regional Hospital Boards (and/ or their consultant architects and engineers) and centrally financed by the Ministry of Health (see appendix H^3).

Further work on development and planning methods by the Ministry of Health, Inter-Regional Board Study Groups, and various consultant firms, led eventually to the DHSS Hospital Building Procedure Notes, the first of which appeared in 1969. These procedures varied considerably from the RIBA's 'Plan of Work' based on Wooster's proposals in 1963, especially in terms of the approval procedures necessary for central financing of hospital building projects. The 1969 DHSS procedures split the process up into eight stages:

- pre A. establish need and regional policies
- stage A. functional content, site and shape, cost and phasing
- B. program, project policies, development plan, budget
- C. departmental policies, space and cost plan, room data, sketch designs, equipment and component lists, design cost
- D. detail design and specification
- E. contract and construction
- F. commissioning (concurrent with D & E)
- G. evaluation

Each stage A to C culminated in the DHSS approving the proposals, costs etc. before authorising the project team to proceed to the next stage. This procedure involved the three main parties (the DHSS, the Regional Board and the project team) in much detail design and discussion in order to obtain approval to proceed with the project. While the DHSS was considering whether to give its approval, it was likely that the project team was in any case progressing with the next stage of work, otherwise time and labour would be wasted.

When the proposal to reorganise the British National Health Service was first made public in 1971 it was realised that this would alter the relation between the DHSS and the new regional authorities, not least in respect of planning hospitals and other health buildings. Realising the need to reassess the planning and building procedures in the context of reorganisation, the DHSS appointed a consultant, Herbert Cruickshank, who had wide experience in the building contracting industry, to produce a report on improving the management of the hospital building program which was then predicted to be approaching nearly £200 Million a year for the next five years.

The 'Cruickshank Report' (1973) made a number of important recommendations, the most relevant to this thesis being:

1. that more thorough evaluation be made of the direction of the building program in general, and of the costs of individual projects in relation to their benefits.
2. that the current program of standard department designs, and standard room and activity data, be continued, but that a reassessment be made of standardisation of construction systems.
3. closer collaboration between architects and engineers.
4. clearer distinction between mandatory and advisory guidance.
5. the Capricode procedures be revised, particularly in report of stages A and B.
6. client briefs to be frozen at an early stage and variations in requirements to be kept to a minimum.
7. studies to be made on selective rather than comprehensive evaluation of new buildings.
8. development of training courses for members of multi-disciplinary planning teams.

Recommendation (5) on the planning procedures was to the effect that the earlier planning stages be drastically simplified to avoid unnecessary detail work and consequent delay to projects which caused excess cost. Cruickshank suggested six stages (1 to 6) instead of the previous seven:

1. outline intentions
2. planning
3. design

4. contract and construction
5. commissioning (concurrent with 4)
6. evaluation

stage 1 consisted of decisions on project objectives, population to be served, content, siting, phasing, capital and operating cost estimates.

stage 2 included project program, project policies, development plan, contract methods and budget.

stage 3 include all items previously in stages C and D, ie detail design documentation.

Proposals were to be submitted to DHSS at the end of stages 1, 2 and 3 in the form of statements of content and costs sufficient for the DHSS to evaluate the desirability of proceeding with the project. It was envisaged that the DHSS would provide guidance on the design and cost standards expected, but that only three formal submissions would be made instead of the previous four.

Cruickshank made particular reference to evaluation of design, both in terms of cost and value of design proposals, and also in respect of evaluation of design in use. He suggested the problem was essentially one of communication, and of the availability of suitable evaluation methods. Selective evaluation of particular problems was recommended, but it was realised that changing circumstances could render some evaluation findings obsolete before they could be implemented in new buildings.

A second point emphasised in the report was the need to shorten the time spent on briefing, and to make good use of the experience of professional staff, such as doctors and nurses, in building up standard well-tried solutions to particular user requirements. Changes in requirements were to be avoided after the 'client brief' had been presented.

Much of the Cruickshank report was written against the background of the Best Buy and Harness hospital projects. One of the consequences was the development of the Nucleus hospital program (see Chapter 5). With a greater emphasis on standard designs for departments, and indeed standard hospitals, in the late 1970s, there has been less need for detailed and lengthy briefing on each project, but an increasing need for systematic evaluation of each design decision, both before its implementation and after it has been put into use. Feedback was thus an essential component of the planning system recommended by Cruickshank. Cruickshank's proposals were substantially embodied in the revised Capricode procedures issued by DHSS in January 1974.

With the development of the 'Systems and Standards' approach to hospital planning and building as represented by the Harness project, the DHSS developed a modified form of the planning procedure stages. This procedure recognised the increasing use of generally applicable data derived from research and from previous projects in the program (Moss 1975, Drake 1976). Six stages were identified in the 'Systems and Standards' approach:

1. Briefing
2. Design
3. Production
4. Construction
5. Commissioning
6. Evaluation

In addition to the six planning stages, five levels of 'activity data' were identified:

1. whole hospitals
2. departments
3. activity spaces
4. activity units
5. components

The 'activity data base' (ADB) has been continually developed and updated as feedback from evaluation studies and experience has occurred, thus providing a tested input to the briefing and design stages.

The briefing, design and feedback stages in the 'Systems and Standards' approach are defined as follows:

Brief "To provide the brief for the project team, establish the budget cost, determine the outline development plan on the selected site."

Design "To develop the detailed design from the material in the brief and establish the design cost for the product."

Feedback "To carry out a systematic examination of the performance of the various aspects of the building in relation to the design brief, and feedback the information to appropriate parts of the system and data base." (Drake 1976)

Activity data is divided into two types: Type A concerns the activity space and provides data on personnel involved in the activity, environmental requirements, location, special equipment, internal finishes, engineering services, doors and corridors. Type B data describes the activity requirements in terms of workflow, fixed and loose equipment relationships and critical dimensions. These data are available for each project team to use and adapt as necessary according to the particular needs and constraints of the project. Costs can be accurately estimatedonce decisions have been made on the content, space and quality of building.

While evaluation is an important element in such a planning system it nevertheless occurs mainly at the end of the process. There is apparently little evaluation of options other than for a restricted range of policies, size and content of hospital, layout of department, and types of equipment. Many detailed decisions are, in effect, taken in the context of the program rather than the project. There is thus no effective user participation in such a system with the consequent risk of lack of adaptability and sub-optimal performance. While a 'big system' philosphy may enable a large building program to be maintained within tight cost constraints, it nevertheless tends to bring all projects down to the lowest common level. There is little opportunity to innovate and to learn by experiment, there is also likely to be lack of incentive to develop different approaches because to do so takes resources away from the systems and standards approach. Economic incentives to standardise designs thus have a more profound effect on planning processes for health facilities than the technical information needs of the building design team.

In Scotland, the Scottish Home & Health Department (SHHD), following its own approach to rational planning, has produced a substantially different version of revised health building procedures for adoption north of the border (Great Britain, SHHD 1976). This procedure was based closely on the RIBA's twelve stage Plan of Work rather than the DHSS's Capricode procedures. The Scottish Health Building Code (SHBC), part 1 describes the Procedure for the Preparation and Approval of Individual Projects in Scotland in considerable detail. Page 40, for example, lists the 'references to Department' which have to be made to maintain progress. This list includes four mandatory submissions (and one possible one if the tender price exceeds the budget); it also includes a number of informal discussions with the Department and the provision of information on actual costs in the later stages of construction. The final stage 'Feedback" requires that information on final building and equipment costs be provided. There is very brief mention of evaluation of design in use, but no detail description of what the feedback stage involves. There is however some emphasis on the need to consult potential users (para 3.17), but there is also a warning (para 3.19) that:

> "consultation does not necessarily imply acceptance of the wishes of the individual who may not be fully conversant with the principles of planning health service buildings... and who may even have moved elswhere by the time the building is constructed."

On briefing the SHBC states (para 4.4.2):

> "The drafting of a brief is an evolving process which allows the various factors to be considered, problems resolved, and decisions taken.... For each department the brief should contain a full description of function and a schedule of accommodation with information for each room detailing its function, equipment and furniture..."

Para 4.5.5 describes assessment of design in maintenance terms and emphasises the problem of choosing between high construction cost or high maintenance cost. The 'present value' of the estimated annual maintenance cost of a particular building element should be compared with the capital cost. No guidance is given on which cost consideration should take precedence, but the Building Division's advice should be sought as necessary. No definition of 'present value' is given.

Commissioning the building in stage L includes consideration of the policies expressed in the brief which governed the design of the building. These are to be used as a basis for preparing operational policy guidance for staff who will use the building. It might be added that such briefing information is often inadequate or outdated, consequently commissioning teams may find themselves having to develop operational policies and procedures to fit in with the design in any case.

Apart from the DHSS and the SHHD in Britain, the Department of the Environment (DOE) Property Services Agency (PSA) carries out hospital building projects for the Armed Forces, several of which were built in the 1970s (Beesley 1978). The building planning procedure adopted by DOE-PSA (1976) is similar to the RIBA 'Plan of Work', but the stages are rather differently defined (see appendix H4).

3.3 NORTH AMERICAN PLANNING PROCEDURES

In North America the United States Government's Public Health Service building program following World War II, and the Canadian Government's concurrent support for provincial governments' health building programs, are rather closer to the current Australian federal situation than is the centrally controlled British system. The Hill-Burton and Hill-Harris programs in the USA originally required much detailed information from state hospital planning councils before funds were allocated to support new building proposals. Subsequently funds were allocated more generously to assist in modernisation and replacement of both public and non-profit private hospitals and other facilities and there was thus less need for extensive documentation to justify funding (Reinke 1972, p.708).

In Canada the National Health & Welfare Department provided funds to provincial authorities on a one to one basis for capital development of hospitals containing teaching and research facilities, while community hospitals were allocated funds on a one to two basis, such funding being partly based on evaluation of estimated running costs (Billings 1972).

In 1975 the US Department of Health, Education & Welfare, Division of Health Facility Planning, and the office of Facilities Engineering & Property Management, commissioned a 'state of the art' study on Health Facility Planning & Development from the firms CHI Systems, and Stone, Marraccini & Patterson (1976). This study followed recommendations in a report of the US General Accounting Office (1972) on Health Facilities Construction Costs which drew attention to the need to rationalise the process of planning and design of new health facilities which received federal government aid.

The 163 pages of the CHI/SMP report described in detail a recommended process for planning health facilities from the establishment of a philosophy and planning framework to the beginning of design development. Five levels of decision making are identified: 1) Federal authorities, 2) State health authorities, 3) Area health service agencies, 4) Institutional, and 5) Functional and space. Levels (3) and (4) are shown sharing data and technical assistance resources. On the functional and space planning process the report stated (p.124) that it is not a relay race:

> "...it is a team activity which requires an orderly framework to provide for overlapping activities and interaction between participants."

On page 126 it advocated a more systematic approach to functional and space planning "to provide an essential framework for an improvement of facilities to support health services". A warning was given that:-

> "undue emphasis on space program standards (meaning accommodation schedules) whether based on previous experience or regulations... will have limited life and consequently may contribute to inappropriate functional and space programming."

The report went on:

> "Space should be a product of the activities to be performed within it and, in medical care in particular, these activities frequently change."

Thus the report challenged a widely practised characteristic of many building planning procedures - ie the use of accommodation schedules as a starting point for design development. The problem is partly caused by the need to produce a building budget in the early stages of facility planning, and this budget is most easily derived from an estimate of building space requirements. The DHSS health building procedures in Britain initially recognised this danger and therefore related cost allowances to units of function rather than space wherever this was practicable. The more recent Capricode 'cost and area guide' however emphasised building space as the primary determinant of building cost rather than the functions and activities which the building is to provide for.

The CHI/SMP report went on to discuss the 'interlocking and cyclic nature of the functional and space planning process" (p.127). A diagram of this cyclic process of programming (briefing) and design is given below:

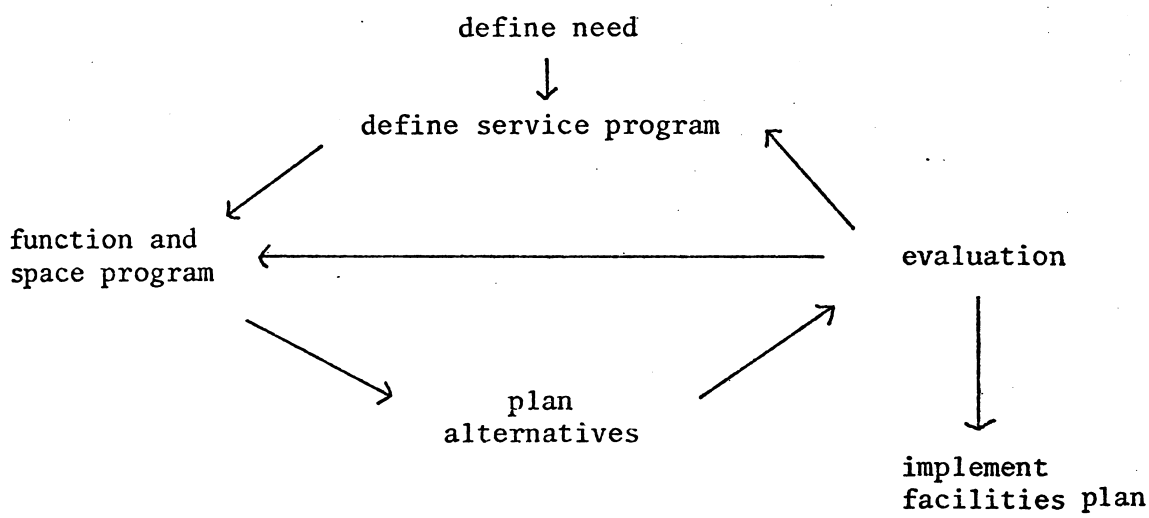


Fig 3.1 CHI/SMP planning process

This explanation of the process emphasises the role of evaluation in analysing and revising alternative proposals before deciding on implementation. The statement "Needs to be met remain constant while function, space and physical feasibility are evaluated... " is perhaps questionable. This would imply the inviolability of statements of need, whereas there may be occasions when evaluation of alternative design proposals suggests that a redefinition of the need is required because the original statement was too hidebound by tradition.

The term 'function and space program' should of course be interpreted as 'the brief' in British or Australian English rather than North American English. The above diagram thus emphasises the close link between briefing and evaluation with feedback forming part of the cyclic process.

On p 128 of the CHI/SMP report it said that some architects/planners tend to rely on standard solutions, and that this tendency is a characteristic of inexperienced planners as well as some experienced ones. The report went on to emphasise the value of a rational approach in which the processes to be accommodated are first analysed before deciding on a space budget. Leading up to the 'facility concept plan' are a number of planning studies which are grouped under the three headings of functional, operational and physical concepts. These studies include work flow analysis, growth trends, interdepartmental relationships, workload statistics, operational philosophies, activity analysis, equipment, communications, engineering services, finishes, transport and staffing. No guidance was however given in the report on how these studies, or the data deriving from them, are to be used in producing the facility concept plan. The report in fact stated "typically there is no order which regulates or organises the individual studies which are performed as part of the conceptual facility planning".

The facility development process is summed up in the CHI/SMP report on p 140 in the form of a network (see fig 3.2).

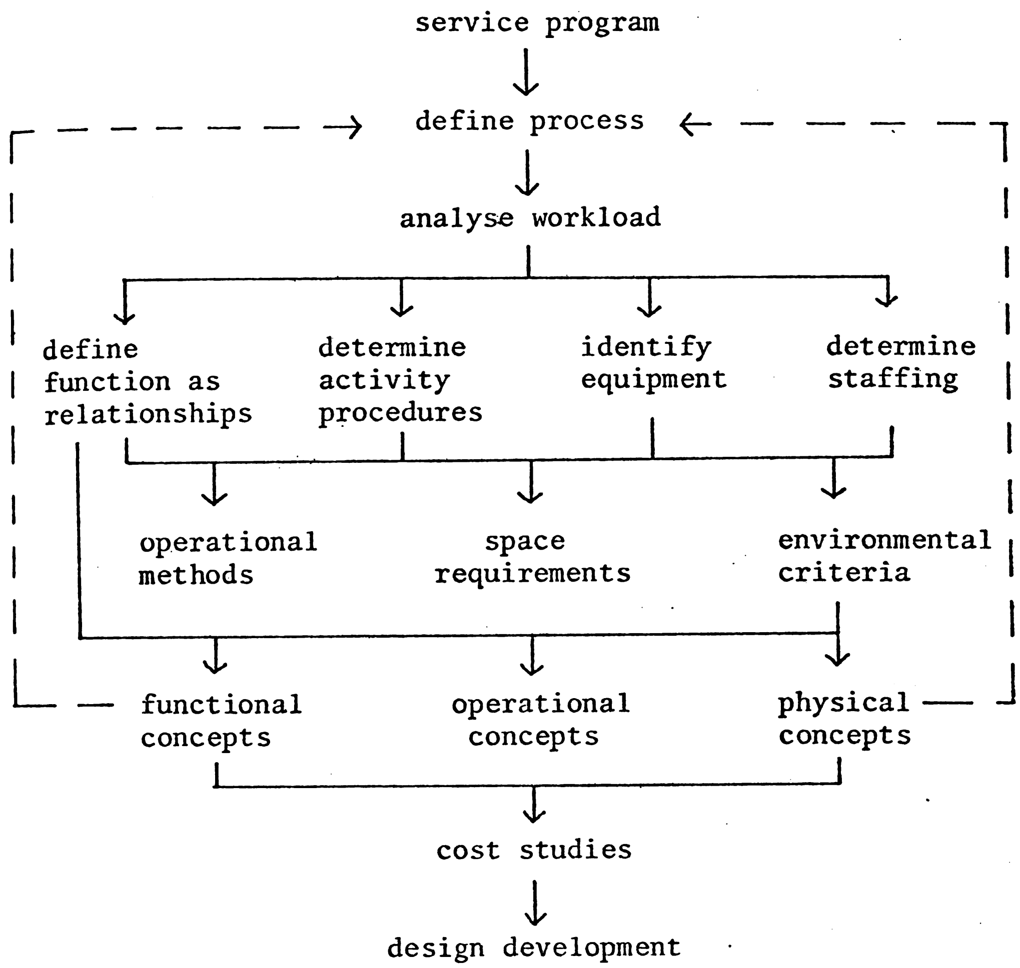


Fig 3.2 CHI/SMP facility development process

The dotted lines leading back to 'define process' from 'functional concepts' and 'physical concepts' are presumably meant to indicate 'feedback' although this is not explained in the report.

A brief reference is made (on p 149) to provision for adaptability by reference to the need to separate the 'permanent' from the 'changeable' elements of buildings, so as to provide for change in response to user needs, and to prolong useful life.

This is as far as the CHI/SMP report went in a rather wordy and inadequately illustrated report. Much of what it said would be fairly obvious to anyone who was familiar with the guidance on planning and design published by DHSS in the preceding years.

Another report by Building Systems Development and Stone, Marraccini & Patterson (1972) on a feasibility study for the Veterans' Administration Hospital Building System had earlier proposed an 'integrated building system procedure' for use in the Veterans' Administration hospital building program then under way. This procedure was arranged in 13 stages with strong emphasis on feedback (see appendix H[5]).

Apart from the health facility planning procedures published by (or for) the US Government authorities, there have been a number of descriptions and explanations of health facility planning and design processes and procedures by organisations such as the American Hospital Association (1958, 1966) and Aspen Systems Corporation (1977). These descriptions were primarily aimed at planning consultants, architects and client organisations working on private hospital projects with or without financial assistance from government sources.

The lengthy publication by Hardy & Lammers (1977) for Aspen Systems, for example, described 'the planning and design process' for hospitals in terms of a rational decision-making process involving:

> "the testing of alternative courses of action against facts, authoritative opinion, or the findings of research, in order to select the most feasible one." (quoted from Dewey 1933)

A sequence of rational decision making previously described by Hardy (1971) consisted of four steps or phases:

1. diagnosing the problem and defining the mission, objective or goals
2. determining and setting forth alternative courses of action
3. analyzing and testing the relative feasibility of each alternative course of action
4. selecting the most feasible plan.

The 'systems approach' to planning was described by Hardy & Lammers (op cit) in a diagram (see below in simplified form) in which alternative approaches to attaining objectives were evaluated:

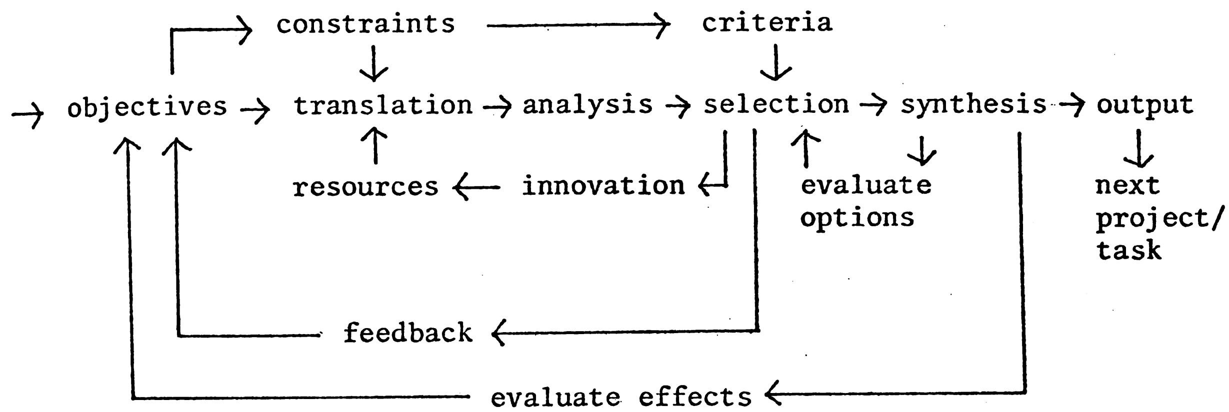


Fig 3.3 Hardy & Lammers' systems approach

Three basic aspects of the systems approach were emphasised by Hardy & Lammers: 1) a deliberate methodology, 2) problems are analysed as part of the total process (rather than individually), and 3) problem-solving is an interdisciplinary activity. Lack of a conscious definitive planning methodology was suggested as a cause of much poor planning, especially in respect of lack of coordination of the diverse individuals involved. No universal model of planning was put forward by Hardy & Lammers, but they suggested that:

> "derivations of either the rational decision-making process, the reflective thought process, and/or the systems approach can be adapted to individual situations." (p.5)

Hardy & Lammers' approach was mainly directed at managing the planning, design and construction process within the constraints of time, cost and space. Despite the initial emphasis on the systems approach, on evaluation, and on team working, there was only brief discussion of these aspects. (See appendix H[6] for activity network.)

Canadian developments in hospital planning have been mainly concentrated at provincial level with Ontario being more forward than other provinces in developing a systematic approach to planning. In 1972, for example, a joint procedures and planning sub-committee of the Ontario Association of Architects and the Ontario Ministry of Health, Hospital Planning Branch, produced a Summary of Hospital Planning Process Approval Stages. For a typical project these stages were anticipated to be:

stage A Role Study (by planning consultants)
B Master Program (by planning consultants)
C Master Plan (by architect)
D Functional Program (by planning consultant including operational policies and procedures, workloads and space requirements.

Stages A to D constitute the 'pre-design' phase! (A Feasibility Study might be carried out by the architect as part of the Master Plan.)

stage E Block Schematics (architect)
F Sketch Plans (architect)
G Working Drawings (architect)
H Tender, Contract and Construction (architect)

The emphasis was mainly on the documentation to be produced for funding approval and for contract execution and cost control. No mention was made of options, evaluation or feedback.

Subsequent developments in Canada have concentrated on realistic estimates of running cost consequences of planning and design proposals, particularly staffing. One interesting product of the Canadian hospital planning system was McMaster Medical Centre in Hamilton, Ontario by Craig, Zeidler, Strong (Zeidler 1976). The planning process adopted on this building allowed construction design to start concurrently with department design. Construction work on site was started within a year of commencing the project, and the whole building was completed within an overall period of about four years from inception. It was one of the first major hospital building projects to employ the 'fast-track' process of planning and building (Heibert 1972).

A more recent publication from the Ontario Ministry of Health (1978) emphasised the need to evaluate alternative arrangements for space lay-out, systems and organisation. Criteria were suggested for evaluation such as functional effectiveness, ease of implementation, patient care safety standards and estimated total capital and operating costs "with particular emphasis on staffing requirements". There was no apparent mention of follow-up evaluation of effects, or of feedback to subsequent projects or to guidance.

3.4 AN AUSTRALIAN FACILITY PLANNING PROCEDURE

In 1976 the Hospitals Facilities Services Branch (HFSB) of the Australian Departments of Health and Construction proposed an Action Sequence for Health Facility Planning which was described as"

> "the sequence of activities necessary to develop an integrated planning procedure for the provision of any health facility.'

The foreword to the descriptive document further explained its aim as to:

> "set out, step by step, a logical and orderly planning procedure...to ensure that a facility can be designed and built in the most efficient and economical way."

The Action Sequence divides the health facility planning process firstly into seven stages:

stage 1 feasibility and initial briefing
2 development briefing
3 detail briefing
4 documentation
5 tendering
6 construction and commissioning
7 evaluation

A secondary structure runs through this process which consists of four streams which relate to 'broad discipline areas' thus:

stream A policy and organisation
B design and construction
C staffing and equipping
D approval and authorisation

Activities in streams A, B and C are to be completed for each stage before being approved and authorisation obtained to procede to the next stage. Interaction between A, B and C in stages 1 to 3 is regarded as essential, while in stages 4 to 6 it is not so necessary. In stage 7 (evaluation) interaction varies according to the aim of the evaluation. Stage 1 of the sequence is preceded by 'the Proposal' in which the intention and scope of facilities for a project are defined.

HFSB proposed a further dimension for the planning process in which there are eight levels:

1. whole facility
2. service categories
3. service groups
4. services
5. activity groups
6. activity spaces
7. activities
8. activity components

Levels 1 to 4 are combined in the initial brief, levels 4 to 6 in the development brief, and levels 6 to 8 in the detailed brief. Thus planning and decision making proceed progressively from higher levels to lower levels. A comprehensive and detailed hierarchical classification of health facility services and activities was proposed by HFSB (Australia 1980) as the basis both for project documentation and for information retrieval using Hospital Information File (HIF) code symbols (Australia 1978), (see chapter 7 and appendix C[4]).

The whole Facility Planning System (FPS) was later described by Kleist (1980) in a paper delivered at a seminar on Briefing for Health Facilities held at the University of New South Wales, Graduate School of the Built Environment. In this description the number of streams in the planning decision making process was increased to five, namely:

1. Hospital Board
2. Hospital Executive/Project Team
3. Functional and Operational
4. Design and Construction
5. Staffing and Equipping

Thus the 'Approval and Authorisation' stream in the 1976 version of the Action Sequence is replaced by two planning and decision making bodies. "The Final Approving Authority stands over and above these five streams." The 'Policy and Organisation' stream is renamed 'Functional and Operational' in the later version, presumably to reflect a wider range of interests.

Kleist (1980) reported that the Action Sequence was found:

> "difficult to use as a 'generic planning system' because the activity sequence and the activities themselves were unseparably related."

Instead a 'planning system framework' was developed which was intended "to illustrate the sequence of activities only". A reproduction of the planning system framework appears below:

	stages		outputs
	identify need	⟶	statement of intent
approval ⟵ ↓			
⟶	1 feasibility	⟶	report
approval ⟵ ↓			
⟶	2 define project	⟶	report
approval ⟵ ↓			
⟶	3 design concept	⟶	report
approval ⟵ ↓			
⟶	4 detail design	⟶	documentation
approval ⟵ ↓			
⟶	5 tendering	⟶	contract docs.
approval ⟵ ↓			
⟶	6 construct, commission	⟶	(facility)
	↓		
	7 evaluate	⟶	report

Fig 3.4 HFSB Planning System framework

The first 3 'stages' of the FPS are shown as the 'briefing phase' while 'evaluation' is shown as stage 7. The process is essentially a linear one, although proposals and approvals are shown passing and returning through the five streams at each of the seven stages.

While the Action Sequence as described in the 1976 version was relatively comprehensive and detailed it lacked coherence and logical developmental structure. Developments since then would appear to have remedied some of these omissions, but as yet there is little evidence available on how the Facility Planning System has performed on any particular project. The Australian federal Departments of Defence and Veterans Affairs' health buildings, being subject to central financial control, are the only spheres where the Facility planning system is applied, although the

West Australian and Tasmanian governments have collaborated with the federal Departments of Health and Construction in planning hospitals at The Lakes, Perth, and in Launceston. Some other state hospital projects have been selected for experimental development of the federal Facilities Planning System, but so far no feedback has been published on the results.

One criticism of the FPS is that it is inconsistent in the concepts it uses for 'streams'. Dividing the original 'Approval and Authorisation' stream into the three bodies: Final Approving Authority, Hospital Board/Governing Body, and Hospital Executive Project Team, has resulted in the streams containing a mixture of both 'bodies' and 'aspects', whereas these should (in the writer's opinion) be entirely separate concepts. A more valid basis for 'streaming' would appear to be:

- user functions and activities
- design
- construction and materials
- staffing
- equipment and supplies
- costs
- management

The various bodies involved in planning approval etc. could then be designated by the level at which they operate thus:

- national
- state
- regional
- hospital/institution
- project
- department

The 1976 Action Sequence version provided detailed guides on initial briefing in stage 1, development briefing in stage 2, and detail briefing in stage 3. Initial briefing includes establishing the project team, determining the scope of the whole project, deciding the facilities required, and considering interactions between major functions. This outline statement is then used as the basis for establishing design feasibility with regard to site selection, shape and size of buildings, and communications and engineering systems. Staffing and equipment costs, and feasibility, are also established in outline at this stage, especially regarding opportunities to save on staff by substituting equipment.

Development briefing is primarily concerned with establishing what activities are to be included in each department and their relative spatial disposition. Movement patterns for people and supplies are then identified and operational policies for each department are established. Activity spaces and activity units are determined for each activity group within each department. Preliminary design then proceeds with the refinement and finalisation of shape and building requirements for each departmental zone. Preliminary staffing and equipment schedules are then produced, together with refinement of departmental operational policies and the development of operational procedures.

Stage 3 includes detailed development and coordination of data from each of the two previous stages and for each stream. Design of building components is settled and the methods of construction to be used are decided. Staffing and equipping requirements are estimated and then confirmed prior to design documentation in stage 4, tendering in stage 5, and construction and commissioning in stage 6.

Stage 7, evaluation, includes determining the scope and organisation of proposed policy, building, staffing and equipment evaluation studies. Significantly no mention is made of any evaluation studies relating to user satisfaction or patients' opinions. Consumer reports are however included with time and motion studies in examples of information to be obtained for evaluation purposes. The main emphasis is on relating results in terms of functions, building and engineering system, staff ratios and equipment performance, to the intentions established in the original brief. The "project specific action sequence" and "management procedures" are also included as potential topics for evaluation.

The Australian Health Facility Planning System is potentially one of the most advanced systems for health facility planning yet developed, although much of it was derived from the British Harness Hospitals Project and its supporting Activity Data Base (ADB). The three facets of the FPS namely: stage, stream and level, are intended to make use of the Health Facilities Information File (HIF) in such a way that HIF data should be easily applicable to any project using FPS. Yet both in the UK and in Australia there seems to have been relatively poor acceptance by planners and designers of the 'big system' approach, partly because it removes a sense of individual achievement and participation from the planning/ design team, and partly because it is too complex and unwieldy to manage (Green 1974a, 1979b).

3.5 PLANNING PROCEDURES IN NEW SOUTH WALES

Following the development of planning procedures for hospital buildings in Britain in the 1960s the New South Wales Government Architect in conjunction with the (then) Hospitals Commission introduced a Planning Procedure for new public hospital buildings in New South Wales. This procedure was described in Hospital Building Guidance Note no 1 (NSW Hospitals Commission 1971). It had however been preceded by an earlier discussion document entitled Programming of Hospital Building Projects (NSW Department of Public Works, Government Architect 1969).

The NSW procedures particularly emphasised the importance and role of project planning teams in defining requirements and in assessing the cost consequences of planning decisions. The Hospital Commission's role in providing information and in approving planning proposals was outlined. Project teams were adjured to draw up functional briefs as part of the Feasibility stage. The brief was to include a general schedule of accommodation for the whole hospital or department involved. The future organisation and operational policies of the hospital were also to be considered at this stage. In stage 3, Outline Proposals, the accommodation schedules were to be refined, the functions to be performed studied in detail, traffic and work flow considered, equipment lists prepared, various outline solutions tried out and modified as necessary, and one general approach decided upon. This 'general approach' then formed the basis for a cost plan and a submission to the Commission to proceed to stage 4. In stage 4, Scheme Design, the brief was to be completed in detail and after approval by the Commission was not to be altered. The project team was to "approve the 'final brief' and accept NO changes after this point".

The remainder of the stages 6 to 11 concerned tendering, construction and completion of the building. The purpose of stage 12, 'Feedback and Evaluation was:

> "To study the hospital buildings in use, ...to evaluate the effectiveness of the planning and design decisions, (and) to record information about the planning, briefing, design, construction, cost and use of the hospital which will be used to help in planning future projects."

To help give effect to the NSW Planning Procedures the Hospitals Commission and the Public Works Department set up in 1970 a joint Hospital Building Research Group staffed by a hospital administrator, an architect, a nurse, and with part-time involvement of a doctor, an engineer and a quantity surveyor. This group subsequently produced six design guides and reports on departmental design, construction and engineering aspects before being wound up in 1974.

With an expanding program of hospital building being foreseen in consequence of the election of a Federal Labor government in 1972, the NSW Health Commission and Government Architects Branch set up in 1974 a Joint Working Party to produce Health Building Guidelines on a wide variety of aspects including cost and area standards, planning of departments, room layouts, construction, engineering and equipment details. The Guidelines were intended to set standards and to provide feedback from experience of previous projects. It was however not always clear in practice whether they were intended to be mandatory or advisory.

Prior to the demise of the Hospital Building Research Group in 1974, proposals were developed by the Health Commission and the Public Works Department to establish an advisory organisation on the lines of the King's Fund Centre in London and the Scottish Hospital Centre in

Edinburgh. As a result the NSW Hospitals Planning Advisory Centre was established in 1973, being mainly funded by the Health Commission and staffed by a manager from the Commission, an architect from the Government Architect's Branch, a nurse from the Commission, and with other specialists as required.

The NSW Hospital Planning Advisory Centre (subsequently known as HOSPLAN) was intended to carry out research on behalf of the Health Commission, provide advice to individual hospitals, produce its own series of guidance notes, hold seminars, and provide a library and information retrieval service on all aspects of hospital planning and design. It was also made responsible for providing planning project managers for a number of hospital building projects. HOSPLAN's guidance publications on topics such as Fire Safety, Medical Gases, Signposting, Ward Planning etc. were intended to "be integrated with and related to the planning process adopted by the Health Commission". In addition:

> "the Centre's continuing involvement with current building projects would allow Hosplan Notes to be evaluated and supplemented as necessary." (NSW Hospital Planning Advisory Centre 1977, inside front cover)

At about the time that HOSPLAN was established the Health Commission decided to review its planning procedures and in particular formally to establish its role as 'the client' for all capital works projects. This review was presented in a draft submission for discussion within the Commission in 1975. The aim of the review was "to produce an overview of planning procedures (to) satisfy the following criteria":

"1. A system of planning whereby the parts are related in a whole (sic).

2. The use, to the fullest extent, of planning documents which have been produced by the Health Commission viz:

   Health Building Guidelines
   A Guide to the Preparation of Development Briefs
   Briefs of Major Hospital Projects - Operational Policies
   Evaluation of Hospital Buildings.

3. A system to which projects already in the planning and design process can be related.
4. Consistent with the philosophy of regionalisation.
5. Consistent with the administrative structures which already exist and avoid the need for additional staff.
6. Anticipate the convening of the Inter-Bureau Review Committee (capital works)."

The method of reviewing the procedures was 1) to determine the stages of planning and approvals, 2) to establish the flow of information at each stage, 3) to state the objectives of each stage, and 4) to describe the activities involved and the personnel likely to undertake each stage.

A major feature of the review was to differentiate between 'acceptance' and 'authorisation' as the two aspects of 'approval' at any stage. Acceptance was defined as agreeing that a plan conformed to the Commission's established policies; authorisation was conditional on availability of funds and the priority of the project.

The planning procedures proposed in the review report consisted of eight stages:

1. Regional Planning
2. Feasibility (including prepare primary brief)
3. Outline Proposals (including prepare development brief)
4. Sketch Plans
5. Tender Documentation
6. Tender Procedures
7. Construction
8. Commissioning (including procedure manuals, evaluation study and feedback to data base)

A concluding comment stated:

"The final stage of the design and construction process should ensure that there is feedback to the data base available for all new proposals."

In a detailed description of activities at each stage the review report specified activities for stage 3 as:

1. prepare operational policies
2. consider 'Brief for Major Hospital Projects-Operational Policies' and 'Guide to the Preparation of Development Briefs' (documents prepared by the Commission)
3. prepare schedules of accommodation and a schedule of engineering services
4. consider the Health Building Guidelines
5. prepare outline solutions
6. evaluate and adopt one solution
7. estimate the provisional cost limit
8. prepare a design and construction program
9. assess possiblities for phased development

No guidance was given on how the briefs, operational policies or guidelines were to be used in the evaluation of the outline solutions, or how decisions were to be made on selection of a preferred solution. 'Evaluation of the building in use' was included as a commissioning activity to be carried out by the Commissioning Team and the staff of the hospital. Evaluation results were to be documented and fed back to Head Office. A fold-out chart of the planning procedures explained the process in terms of information inputs and outputs at each of the eight stages.

Apart from some developments at Regional level in NSW (see next section) nothing else of consequence to this thesis happened until June 1980 when the Health Commission Head Office presented a long-heralded document entitled "The Process of Planning Health Care Facilities". This document specified seven stages of the planning process and placed increased responsibility on Regional Offices for planning and procurement of health care facilities. Individual hospitals could however become the client "under certain circumstances" (unspecified). The seven planning stages were described in terms of a cycle rather than a linear process, influenced perhaps by the British DHSS's Annual Planning Cycle (see Dunnell 1976). The Health Commission Head Office was shown as the pivot of the cycle, approval being given at each of stages 1 to 3, while the Regional Office was to be made responsible for work at stages 4 to 6. The results of evaluation at stage 7 were to be fed back to Head Office to serve as inputs to stage 1 on subsequent projects.

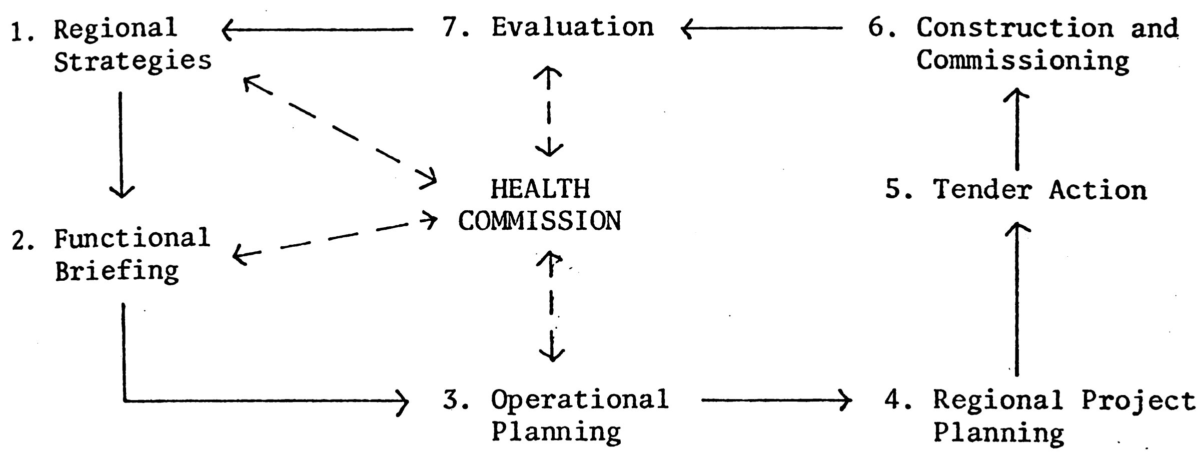


Fig 3.5 NSW Health Commission, Facility Planning Process (1981)

The intention of the new procedures was to eliminate unnecessary delays, and an organisation chart was shown wherein a Conjoint Planning Group acted as a link between the Health Commission Head Office, the Regional Office, and the Regional Planning and Development Committee. The Project Planning Team was to be responsible to the Planning and Development Committee, both of which included representation from the hospital or institution involved:

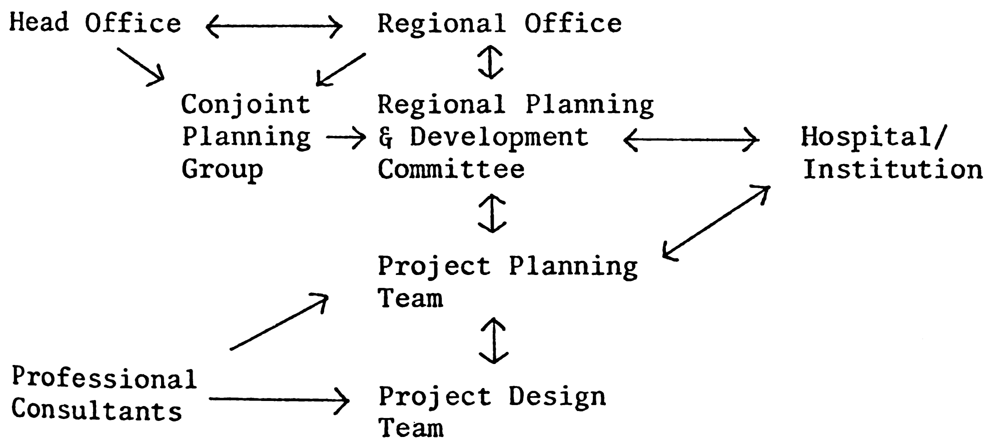


Fig 3.6 NSW Health Commission, Planning Organisation Structure

The 1980 procedures document also explained in some detail what is to be included in a 'functional brief', viz the organisation and membership of the Regional Planning & Development Committee together with an Introduction describing the historical, geographical, demographic and health service context of the project; justification for provision of new services required, together with a full list of the kinds of facilities to be provided (the sample list of 46 items ranged from Accident and Emergency Services to Cleaning Services, and from Medical Gas Services to Kiosk); general design requirements and environmental factors; and statistical information on staffing, population, utilisation and demand. The functional brief should end with 'recommendations and priorities' as directives to the design team.

Stage 3, Operational Planning, included Design Briefing which should specify the following (condensed from original):

1. References to information sources
2. Description of facilities to be included and departmental operational policies
3. General design requirements and environment factors
4. Room data, including engineering services and equipment
5. Primary engineering services systems
6. Cost check against estimate

The Schematic Design section of stage 3 was to include an evaluation and comment on the brief, preliminary design drawings, and a review of design proposals based on consultants' advice and briefing data.

At a 'workshop' organised by the Western Metropolitan Region of the NSW Health Commission on 24 May 1981 the new Procedures were described by some of its authors. Following review sessions by the thirty or so participants at the workshop, suggestions were made that the new procedures should be simplified and give more attention to evaluation and user participation.

3.6 PLANNING PROCEDURES AT REGIONAL LEVEL IN NEW SOUTH WALES

With the need for an expanding program of hospital development in the Western Metropolitan Region of Sydney, the Health Commission of NSW authorised in 1974 a comprehensive and detailed review of hospital planning needs and proposals for the region for the ensuing decade. Two preliminary reports for discussion were published in December 1975, one on 'Planning hospitals for the west of Sydney', and the other 'A handbook for project teams (on) developing hospitals for the west of Sydney'.

The former report was concerned primarily with the types of hospital services and facilities to be provided over the ensuing ten years; the latter was a more detailed study of how the plan could be implemented. It included a detailed description of "a Management Information and Evaluation System (MIES) for the briefing, design, documentation and construction of regional projects". The aim was to explain to project teams the "procedures appropriate to designing a project, and (the) methods, checks and procedures involved in constructing and commissioning a facility" (p1). The system of 'Hospital Planning Units' (HPUs) was used in providing information on the content, floor areas and costs of projects and this was set out in detail to the nearest bed, square metre and $100 cost increment.

The basis of project team organisation roles and relationships was then described together with the MIES procedure stages and the proposed method of briefing design teams. The Introduction emphasised that the standard range of procedures and the HPUs should be adopted "so that comparisons between projects (could) be made" and their value for money assessed.

Briefing was described in terms of three types of brief - 1. Development Briefs, 2A. Planning Unit Briefs and 2B. Technical Briefs, and 3. Room Data Sheets. The Development Brief was described as a 'performance specification' and it was intended that the three stage briefing process should avoid the delays caused with traditional briefing methods.

> "The brief must be a neutral document... rather than a description of a favourite built solution." (p99)

On briefing generally the handbook said "all briefs are to be referenced and stored for feedback purposes" (p104).

The MIES procedure stages 1 to 8 were then set out in tabular form and each stage described separately in terms of inputs, procedures, drawings and models, reporting and approval. Alternative sequences were indicated for sequential design (traditional) or concurrent design (fast-track). The MIES procedure was based on the 12 planning stages then used by the Health Commission, but amended to have "the minimum number of separate stages to ensure good project management"(p107).

Two sections in the handbook dealt with evaluation: Section 11 was on evaluating existing hospitals, while Section 14 dealt with evaluation of detail design drawings under two headings - planning evaluation and cost evaluation. The HPUs and the Health Commission Guidelines were the standards against which proposals were to be evaluated. Emphasis was placed on the need to evaluate design options for their cost implications and "to ensure that excesses in one area do not cause defficiencies in another". The last stage in the procedure was 'Feedback and Evaluation' but no further guidance was given on what it contained or who was to do it. The handbook made no reference to consumer participation in planning or design, and no mention was made of the need to consider priorities or user satisfaction from the patients' viewpoint.

At about the time that work was proceeding on the two planning and development reports for the Western Metropolitan Health Region there was considerable activity on the planning for the new Westmead Teaching Hospital to be built in the Region. This project, which originally started in 1967 with a budget of about $50M for a 1,400 bed hospital, had run into difficulties in 1974 with a likely building cost of around $250M and the decision was made to start again with a new planning team and a new design. Accordingly the British hospital planning consultants Llewelyn Davies, Weeks, Forestier-Walker & Bor were brought in to compile a Functional Brief which was presented in April 1975.

For the planning of Westmead Hospital the Sydney office of Llewelyn Davies, Kinhill (LDK) in conjunction with the NSW Health Commission and Public Works Department adopted a twelve stage planning process:

1. Outline brief
2. Development plan
3. Detailed brief
4. Department plans
5. Room data and main equipment
6. Design development
7. Production information
8. Bills of Quantities
9. Tender
10. Construction contract
11. Commissioning
12. Evaluation

This process differed somewhat from the 12 stage RIBA Plan of Work then used by the NSW Health Commission as the basis for its planning procedures, although stages 6 to 10 of LDK's process were almost identical to RIBA stages E to K. LDK's process was based on Llewelyn Davies & Weeks' international experience of planning hospitals elsewhere in Australia and in several overseas countries. It also depended on using design data from several previous projects including the new Flinders Medical Centre in Australia on which Llewelyn Davies' firm had acted as planning and design consultants.

3.7 RATIONAL PLANNING FOR HEALTH FACILITIES

The above selection of planning procedures advocated or used by various authorities in different parts of the world suggests that there is little agreement on what constitutes a good procedure for the planning and design of health facilities. Some of the earlier procedures for example gave greater emphasis to briefing, evaluation and feedback than some of the later ones. The planning 'processes' adopted on individual projects by their project planning teams may in fact bear little resemblance to the decision making processes assumed in the 'procedures'. Nevertheless the existence of the procedures, in specifying the information to be submitted to the approval authorities, inevitably influences the way the planning and design process is conducted on those projects subject to the control of funding authorities.

There are clearly dangers in relying too much on a decision making process in which an error in the early phases can upset the validity of later decisions, and thus precipitate a subsequent disaster. Either the decision making process must allow for such errors, and for changes in the data due to changing circumstances, or the decisions must be adhered to and the resulting facility design must allow for changes to be made and errors to be corrected.

None of the planning processes and procedures so far examined appear sufficiently to acknowledge the 'certainty of uncertainty'. The requirements of cost control procedures often force an undue degree of precision on many planning and design processes with the consequence that the facility design constrains the way it is used rather than 'form following function'.

Lack of recognition of the close and continuing interaction between function and form in planning and design would appear to be the cause of the failure of many planning and design methods to achieve their objectives (Jones 1981). Development of more responsive means of evaluation feedback could possibly help to correct this potentially wasteful and damaging situation. But perhaps the first two steps in this direction are 1) evaluate the economic and social effects of present methods, and 2) demonstrate by examples what could be achieved with a more responsive and rational planning process which followed well-established cybernetic principles.

Perhaps more significant than any other finding, in this admittedly brief and selective survey of health facility planning and design processes and procedures, has been lack of evidence that any of the more recently developed planning and design procedures have been based on systematic comparative evaluation of the earlier procedures. If this is so, it may either be argued that it doesn't matter what procedure is used so long as it 'works well enough' and facilitates effective communication between the parties and people involved; or that it does matter how procedures work in practice because they influence how people think, organise their information and make decisions. If the decisions do not produce the intended results, then either 1) the data may have been wrong, or 2) the decisions did not use the data appropriately, or 3) the procedures used caused people to make unsuitable decisions. A fourth, and perhaps more important conjecture, is that the 'information systems' used by the people operating the procedures did not adequately reflect their various interests, nor the rationale of various types of thinking processes, nor the state of knowledge in the relevant subject fields.

CHAPTER FOUR

BRIEFING FOR DESIGN - Synopsis

The chapter sets out some of the reasons why particular methods of briefing have been adopted and discusses their merits. The purposes of briefing are first defined, after which problems of briefing in a number of projects are described.

The third section describes a number of approaches to briefing, based mainly on the literature. Several briefing methods for building design are then reviewed, using both British and American sources. A comparison is made between methods of briefing which are separate from designing, and those which are integral with it.

Section five discusses briefing methods for hospital buildings, using South African, British and Australian health authorities' recommendations as examples.

A briefing method for health centres is then described. This method was based largely on the results of evaluating health centres in use, and is an example of feedback from 'effects' to 'needs'.

Section seven describes the approach adopted in a selection of guidelines on health facility design. Ward design guidance is used to illustrate the range of formats used in presenting information for briefing.

The final section discusses the issue of whether briefing and design are separate processes, or are merely different phases of problem solving. The possibility of a 'general' approach to briefing is considered.

4.1 PURPOSES OF BRIEFING

The word 'brief' is derived from the Latin 'brevis' meaning short or concise, and the dictionary definition includes "a short statement of any kind". Many briefs are however anything but short. For a large and complex building such as a major hospital with many aspects to consider, it may be considered desirable to produce a voluminous brief which sets down everything in minute detail. There is however little apparent relationship between length and degree of detail of a brief, the size of facility for which it was produced, or the degree of success of the project.

Two contrasting descriptions are given below which seek to explain the purpose and nature of briefing for design. Neither description was related specifically to health facility design, although the second is more relevant to complex buildings such as hospitals:

1. "Any serious attempt to make the environment work must begin with a statement of user needs.... Before starting to design a building, the designer must define its purpose in detail. This detailed definition of purpose, goals, requirements or needs can then be used as a checklist. A proposed design can then be evaluated by checking it against the checklist." (Alexander & Poyner 1968 p 309)

2. "The briefing procedure, by which the designer collects information as to the client's requirements and policy, involves in principle an iterative communication process in which the client describes his requirements and his own constraints to the designer, who in turn submits proposed solutions to the client for decision.

   It is essential that full information is obtained in a way that can reveal the functional and cost implications of every decision. It is also desirable, so far as possible, that the resulting brief is in a format suitable for input to the subsequent design programs, including those of consultants and other specialists." (Great Britain DOE 1971 p 18 para 4.7.3)

Briefing therefore is the process of collecting, analysing and presenting requirements of a design and about the conditions for its realisation. (In North America it is called 'functional programming'.)

Briefs are prepared for a variety of purposes, and in varying degrees of detail and kinds of format. The following are the principal purposes for which briefing has been undertaken in health facility projects:

1. to establish a case for provision of a new facility
2. to justify allocation of funds to a project
3. to state the basis for considering alternative courses of action, eg to rebuild or renovate
4. to explain the functions to be provided so that estimates of space needs and costs can be made
5. to list the departments and rooms in a proposed building so that its feasibility within predetermined cost constraints can be established
6. to provide a basis for determining operational and design policies
7. to explain the functional requirements so that a suitable design can be developed
8. to establish objectives and criteria as a basis for evaluation of design proposals
9. to establish the operational policies and staffing implications for estimates of operating costs

Not all these purposes are necessarily followed in the briefing for a particular project. Some projects may indeed proceed without any formal brief being prepared or submitted. Briefing on most well-planned projects will however encompass a majority of the purposes listed.

How briefing is conducted on any particular project will be a matter for the planning team or the planning team leader to decide. The project funding authority may however stipulate the form in which information on requirements and proposals is to be presented for approval. This will inevitably influence the way in which information on user requirements is obtained and analysed by a planning team.

Examples of selected briefing procedures and check lists are included in appendix B.

4.2 PROBLEMS OF BRIEFING

Briefing is primarily concerned with the set of problems for which a planning team is responsible for finding solutions. There are however many ways of briefing depending on whether they are orientated more towards defining problems or describing solutions.

A brief which defines problems and needs may be called a 'functional brief' if it explains what functions may occur in a facility. A 'design brief' on the other hand describes the kind of design which can accommodate the functions. A 'planning brief' may embrace both functional and design aspects; or it may describe how a project is to be planned, ie the decision processes to be followed.

The solution orientated approach to briefing may work if one can match the needs and situation being planned for sufficiently closely to the needs and situation that were met by a previous solution, and then copying that solution as closely as possible. But if the needs or situation differ from those of the previous solution then the nature and extent of the differences must be defined. It may be possible to modify a previous solution to match the perceived differences, but this implies producing a different solution to a different problem. Changing the emphasis still further comes increasingly nearer a problem orientated approach to briefing and design.

The problem orientated approach is more concerned with aims and objectives than with possibilities or 'products', ie with activities and functions rather than with equipment, rooms or departments. Yet many people, if asked to state functional requirements of an activity such as writing,will specify 'a desk' rather than describe how they wish to write and the conditions required for writing.

The writer's interest in briefing was originally aroused by the opportunity to work in the architect's office of a London teaching hospital. One of our tasks was to collect information on user requirements by interviewing hospital staff in their working environments, and by observing what went on in various departments of the hospital. All this was carefully noted down with the help of checklists developed for the purpose (see appendix B[1]). Layouts of existing buildings, rooms and equipment were drawn up on squared paper and filed for reference. Using these data as a guide, sketch designs of new departments were developed, partly by attempting to improve on the old designs and eliminate obvious problems, and partly by seeking new ideas.

Schedules of accommodation were then prepared from these sketch designs. The schedules were later submitted to the Ministry of Health for approval to proceed to the next stage - preparation of sketch plans! Only parts of the designs were built however, the rest were scrapped along with the briefing information when the hospital Governors decided to change architects and start planning again for the third time in ten years.

The next job was in a private firm of architects who were planning a totally new district general hospital. As no hospital staff had yet been appointed, the main user requirement input was from Regional Hospital Board and Hospital Management Committee specialist medical consultants appointed to look after the new hospital's interests. A firm of hospital planning consultants also provided expert advice as a result of their earlier experience investigating functions and design of hospitals.

Draft sketch plans of the hospital and of each department were evolved with the help of the planning consultants. Once these plans were approved in principle each room was separately identified and a list of questions drawn up concerning its use, population, equipment, finishes, fittings and services (see appendix B[2]). No design or operational policies were however stated or written down as a basis for design.

Opinions were then sought on what the design should be like and the ideas incorporated as planning progressed. Some aspects, such as storage equipment, were investigated in detail, the aim being to develop general purpose systems which would fit a variety of users. Some ideas were developed by visiting other hospitals and talking to the users. There was little published guidance except the 1955 Report of the Nuffield Investigation Team, some of whom were acting as planning consultants. Other hospital projects in the architects' office also provided a basis for comparison.

The next job was in the Ministry of Health Architects' Branch investigating deep-planned ward design (Great Britain MoH 1965). This study was carried out by a multi-professional team including two nurses, two doctors, two architects, two engineers, a quantity surveyor, and a work study officer. A number of different ward design ideas were explored and a comparative evaluation made of six basic layout types, all serving the same functions and with similar standards of accommodation. As the nurses and doctors involved in the study disagreed on some of the functional requirements it was necessary to design a general purpose ward which could accommodate their preferences without undue compromise. Factors affecting efficiency were compared, but the effects which could actually be measured were few (see appendix B[3]).

The ward design study later evolved into a study of whole hospital design. Using earlier experience of planning several hospitals and departments, the planning team began investigating how to redevelop a new hospital in several phases on a existing site, thus allowing the existing hospital to continue functioning during building work.

The methods of briefing and design used on this project have been fully explained elsewhere (eg Holroyd 1968, Green et al 1971, Keep 1972; see also chapter 9 and appendix B4). The main innovations in the project were:

1. to involve staff at all levels in discussions on requirements and policies

2. to focus on functions, such as inpatient care and catering, as the main topics of enquiry

3. to establish a standard sequence of asking questions about problems, needs and possibilities, and to keep a detailed, classified and cross-indexed record of all discussions held

4. to produce a general 'design idea' for the whole hospital and for each department within which operational policies could be tested and developed

5. to translate descriptions of ideal sequences of functions and activities into 'functional diagrams' which would form the basis of operational procedures and commissioning manuals

6. to use the functional diagrams as a means of testing the design proposals in detail and to develop job descriptions

7. to make mock-ups of all key rooms and to simulate their use with the help of hospital staff prior to finalising construction drawings

8. to design the building structure and engineering services so that room layouts could be altered without unduly disrupting design, construction or operation.

The building which resulted from this approach formed the basis for a number of other management, design and construction developments, but the detailed briefing methods have not been repeated, so far as is known. The briefing process was curtailed in some departments with the result that they were less thoroughly planned. The relative success of areas where user requirements were more thoroughly investigated appears to justify the detailed briefing methods used (see chapter 9).

The main benefit of the foregoing experience has been in research and teaching. The main conclusion is that there is still a communication gap between users and designers which needs to be bridged. Briefing methods intended to improve the 'fit' between function and design do not appear to have answered the problem.

4.3 APPROACHES TO BRIEFING

Growing interest among many architects and designers in systematic design methods during the later 1950s and early 1960s resulted in a variety of techniques being developed for component parts of the design process (University of Aston 1965). Some of these techniques tended to focus on spaces and equipment, while others concentrated on functions and activities as the main aspects for analysis and decision. Most of the techniques nevertheless aimed to produce design data related to user requirements rather than to state the problems which the design was meant to help solve (Cowan & Goodman 1960, Great Britain MPBW 1966).

Failure by designers to produce designs which meet human and functional requirements has often been blamed on lack of understanding of the requirements by both users and designers (Norton 1970, Sommer 1972, Hughes 1981). The statement of 'user requirements' by the 'client' in a definitive written brief is rarely a satisfactory means of providing clients' instructions to an architect. This is especially true in large and complex problems, such as hospital design, where many user professions are involved, and where few if any users have had previous briefing or planning experience (Dudley 1970, Quarry 1973, Lundeberg 1977).

Two main approaches to briefing for design are apparent. In one the 'client' instructs the designer what sort of building to provide. In the other approach the designer takes the initiative and investigates the 'clients' needs putting forward ideas for exploration by discussion or simulation. Briefing in most planning projects comes somewhere between these two approaches. The approach adopted in any particular situation will depend not only on the knowledge and experience of the people concerned, but also on the degree to which the project is breaking new ground.

Using 'off-the-peg' designs may do away with briefing altogether in theory, but a wise client will try to ensure that available ready-made solutions match the project's particular needs and problems. A danger is that standardised solutions can inhibit progress, but to go through the same detailed investigation and design process on each new building project is clearly unnecessary and wasteful. Development of new ideas, and of better solutions to old problems, often depends on testing several different ideas for design solutions, first in theory and then in practice.

'Briefing' is often regarded solely as the investigation process preceding the production of a document called The Brief. Briefing is however better regarded as a continuing process of interchange and exploration of ideas and policies between users and designers. Looked at in this way it becomes a learning process which may not need to be recorded in detail, so long as understanding is achieved between the people involved (Markus 1970).

Planners sometimes put forward provocative ideas to get people's minds working creatively. These ideas may however be taken too literally and are therefore condemned outright as being impracticable. Useful innovations and improvements may nevertheless be developed by this approach (Page 1971).

While users' experience is often helpful in briefing, it needs to be leavened by 'common sense' plus creative thinking. This is likely to be easier to achieve in informal discussions rather than at formal meetings or by questionnaire surveys. Getting heads of departments to produce planning briefs tends to lead to tailor-made designs which become outdated. On the other hand seeking views of department users individually results in conflicts of opinion (Dudley 1970). Getting several users to discuss needs and ideas together with designers can sometimes present a totally new outlook (Macdonald et al 1981).

Discussion of conflicting views in public does not necessarily remove conflicts of opinion, but it can help to explain the reasons for different viewpoints. A solution may then be more easily found which satisfies everybody. If designers discuss functional needs and design ideas with the users, both parties may better understand what design is capable of achieving. If a designer participates throughout the briefing process, he or she can advise on the information needed in order to produce a satisfactory design. The designer can also contribute ideas from a different and perhaps more objective viewpoint than that of users who tend to think only of their particular needs rather than the needs of all users (Friedman 1972).

Briefing ideally involves discussion by both users and designers of how things may function as well as the physical facilities needed for efficient operation. Often however a client merely produces lists of rooms for each department. The designer then attempts to arrange the rooms to fit a preconceived building shape and structure. Many faults of hospitals in use are attributed to this approach to briefing (Heath & Green 1976).

Another tendency is for clients to attempt to do the designing. Alternatively the designer may try to influence the client's operational policies. While both approaches may help to open up new possibilities, they do not use the special skills of each to best advantage. Clients should know how to run their own departments or services, designers should be able to design facilities to meet their users' needs.

An inter-active briefing discussion seldom occurs however. Either no one represents the user, and the designer tries to imagine how a facility may be used; or else there are several users who cannot agree what they want to do, or how they want to do it. In health facility planning the real users are seldom represented in briefing discussions. There may be at least two or three different types of professional interests involved in stating user requirements for any one department, each professional representative tending to interpret 'consumer' needs in their own way. A community representative or a sociologist may occasionally be co-opted to advise the team, or to be a full-time member (Jefford 1967). Whatever method is adopted it is desirable to solicit public opinion and to get active participation from local comsumer groups in deciding operational aims and policies and in commenting on proposals (Meier 1978, Sandercock 1975).

A problem with defining 'user requirements' in 'The Brief' is that the 'client' is often an amorphous body of people with vague and conflicting views on needs. The result is that no clear agreed concept of user requirements is possible. As Peter & Hull (1969) put it:

> "The Edifice Complex tends to afflict philanthropists wishing to improve education, health services, or religious instruction. They consult experts in these fields and discover so many at their respective levels of incompetence that formulation of a positive programme is impossible. The only thing they agree on is to have a new building." (P 107)

4.4 BRIEFING METHODS

'Briefing', as compared with 'evaluation' and 'information feedback', has received relatively little attention in the literature. Much of what has been written concerns lack of an accepted methodology and the need to improve this aspect of planning and design (Conway 1975, Wade 1977).

Briefs take a bewildering variety of forms. A comparison of hospital 'development briefs' shows little similarity in sequence or format (see appendix B[5]). Yet the documents were produced for the same basic purpose and they share much information in common. It has been suggested that a standard approach be adopted both for collecting and for arranging information in a brief; on the other hand many people reject such 'guidance' as too authoritarian.

Guidance on briefing may aim either to help a planning team to develop its own method or to impose a standard method. In either case the method will be influenced by the team's approach to planning; ie whether it is democratic and participative, or authoritarian and dictatorial.

One of the early conferences to explore the wider issues involved in briefing for design was entitled 'Building for People' and was sponsored by the Ministry of Public Buildings & Works (MPBW) in 1965 (Architects' Journal 1965). Ian Moore, of the MPBW Development Group, used the opportunity to describe the Activity Data Method (ADM) then being used on several military building projects being designed by the MPBW. Moore condemned the traditional approach to briefing in which a schedule of accommodation is the first step because it 'generated a presupposed solution'. ADM on the other hand supplied the designer with information about activities so that choices could be made on how they could best be grouped, and thus a building form was developed which housed the activities in an optimal relationship.

Information on environmental requirements of each activity was also recorded in ADM, together with any special equipment or services essential to the activity. Association charts were used to indicate traffic flow of people and goods between activities, and whether the conditions required for their performance were compatible or incompatible.

It was pointed out that one important benefit of ADM, or any other design method that focused on functions, was that the client was 'caused to think in great detail about his activities and methods'. This caused him to appreciate present faults which were used to help define desirable conditions. Analysis of activities was preferable to simply recording activities which only tended to perpetuate them.

A review in the Architects' Journal (1966) suggested that there were two difficulties with ADM, 1) it did not identify all the activities which the client organisation was likely to indulge in, and 2) it did not show how activities were related to one another organisationally and spatially.

In the year following the 'Building for People' Conference, Robert Gutman, a sociologist on sabbatical at University College, London, identified four problems in 'Briefing and the design process in architecture' at a talk he gave to the British Sociological Association Design Group (Scher 1966). These problems were:

1. the need for continual revision of briefing information
2. lack of responsibility by clients in defining their requirements
3. clients' needs as expressed in a brief do not truly represent needs of the real users
4. architects and designers are unclear what information they need to obtain in a brief

Architectural education apparently was not much help in this respect as theory and practice differed markedly (Scher op cit). The logical design methods described in Archer's Systematic Method for Designers (1965) or Alexander's Notes on the Synthesis of Form (1964) were rarely if ever followed, either in the office or in the studios of design schools. Despite this, many textbooks and design guides have described briefing and data analysis as though they were amenable to a 'cookbook' approach in which there was an ideal sequence of asking questions, recording answers, putting the data thus acquired together, and making a good decision.

In practice architects and designers tended to focus on ideas rather than data, on design concepts rather than user requirements. Previous solutions were sought which appeared to fit the outline requirements. One solution was provisionally selected and this then formed the basis for the collection of further information on requirements. At least this was how Gutman saw it from a sociological viewpoint (Scher op cit).

In 1969 the American Institute of Architects published a guide on Architectural Programming in its Emerging Techniques series. This 70 page book by Evans and Wheeler consisted mainly of examples of forms, checklists and diagrams which were used by a number of architectural firms for collecting information on requirements, or analysing data for design. The introductory section by Evans listed four parts of the preliminary programming (briefing) process:

1. client philosophy and objectives
2. functional and organisational relationships
3. facility space requirements eg activities, equipment, traffic etc.
4. commercial, economic and staffing implications.

This stage was followed by consideration of a number of detailed aspects such as:

site development and details
description of occupants
location and interrelation of spaces
functional requirements
flexibility and growth
priority of needs
restrictions and limitations
budget

No two architectural firms seemed to tackle the task of 'programming' in the same way and there were different opinions on what it should include. However the guide attempted to describe some of the problems often encountered, such as clients who did not know what they wanted, who changed their minds, or who could not give guidance on the order of priorities.

The difficulty was also recognised of establishing "a hierarchy of design items that presents the total range of problems in such a way as to permit easy evaluation". This was nevertheless seen as desirable if sensible decisions were to be made which would fit within the budget.

The problem of 'information overload' was also recognised. "The cost of collecting trivia is high, the cost of analysing it is even higher." The value of having a capable and experienced designer was axiomatic, although too much experience in one field could lead to stereotyped answers. A less experienced architect could possibly be more innovative.

Evans considered that a systematic method of data collection was necessary, although it would not produce good design without a good designer. The value of employing specialist 'programmers' was mentioned and was already becoming (in 1969) a sizable profession in its own right.

Lastly the importance of evaluation studies was stressed in terms of providing the necessary input to briefing and design, and without which mistakes were likely to continue to be made.

In the introduction to another American guide on briefing McGinty (1977) described five methods of 'architectural programming'. In the first method 'A' computers are used to process large amounts of data for both programming and design. Method 'B' emphasises design development and the retrieval of information in relation to space and performance requirements. In method 'C' programming and schematic design are pursued alternatively on a trial-and-error basis. Method 'D' combines programming and schematic design, thus allowing the client to affect design decisions, and design ideas to affect the client's ideas. By contrast method 'E' completely separates programming and design and makes the assumption that the design problem can be completely defined before offering a design solution.

The last mentioned method was then explained in detail by Peña (1977), a Principal in the architectural firm of Caudill, Rowlett, Scott (CRS) which has planned a number of major hospitals and other large projects in the USA and elsewhere over the last 30 years. CRS's programming method has five steps:

1. establish goals - what is to be achieved and why
2. collect and analyse facts - about the goals
3. uncover and test concepts - how to achieve the goals
4. determine needs - money, space and quality
5. state the problem - conditions and directions

Programming specifically concerns stating the problem, while design is concerned with developing solutions. "You can't solve a problem unless you know what it is" (p 15). The theory that one person cannot be both programmer and designer is advanced because analysis and synthesis require different mental capabilities and they are seldom equally well developed in one individual.

The problem statement is seen as "one of the most important documents in the entire chain of the total project delivering system". A clear written statement is the last step in programming and the first step in design.

The five 'steps in programming' are not apparently seen as having a fixed sequence - they are heuristic not algorithmic. Nevertheless the statement of the problem is dependent on the first four steps. Four considerations (or design determinants) indicate the kinds of information needed for each step:

a. function
b. form
c. economy
d. time

Each of the four 'considerations' is divisible into three 'key words':

FUNCTION	people acitivities relationships
FORM	site environment quality
ECONOMY	building costs operating costs life cycle costs
TIME	past present future

Thirty-six 'pertinent questions' are then derived from the interaction of the first three steps (goals, facts and concepts) with the twelve 'key words'. This interaction matrix "provides a framework to classify and document information" (p 33). The classification can also be used as a checklist, and as a wall chart, to help the planning team members see what is missing. An example is given below of sub-headings in one of the 20 squares of the complete interaction matrix:

GOALS

- FUNCTION
  - people
    - mission
    - numbers
    - identity
  - activities
    - interaction
    - values
    - security
    - progression
  - relationships
    - segregation
    - encounters
    - efficiency

The aim of the matrix is to provide a means of filing information so that it can be assembled into the programming document which represents "the epitome of organised, edited information free of irrelevance" (p 39).

Programming is seen as a two-phase process related to the two design phases - schematic design and design development. Information flow to the designers must however be controlled otherwise the system becomes clogged. Intuition and experience are necessary to decide what information is relevant to the design development.

Users are apparently considered to be useful members of the project team. "The building should benefit by intensive user participation in the programming process" (p 48), although "the users' first concern is how his needs will be met when the building is occupied" (p 49).

The project team "should be led by two responsible group leaders - one to represent the client and the other to represent the architect". Their role is to coordinate, to make decisions, and to maintain communication between the client and the architect groups. Clients are becoming increasingly involved in programming and in consequence "the programmer must keep the client from making premature design decisions during programming" (p. 52).

Much of the rest of Peña, Caudill and Focke's 'Architectural Programming Primer' was taken up with more detailed aspects of programming and of examples taken from CRS's practice. Twelve recurring concepts were however given some emphasis because they "seem to crop up on nearly every project" (p 63 - 76):

1. service grouping - centralised or decentralised
2. people grouping - individuals, large groups
3. activity grouping - integrated or compartmentalised
4. priority - order of importance or urgency
5. relationships - interrelation of spaces for efficiency
6. security control - property and personal protection
7. flexibility - expansibility, convertability, versatility
8. sequential flow - progression of people or things
9. separated flow - kinds of traffic, degree of separation
10. mixed flow - to promote social encounters
11. orientation - to prevent the feeling of being lost
12. energy conservation - reduce heated areas and heat flow to a minimum

In summary CRS's programming method included the following features (summarised from original p 84 - 85):

it is separate from design

it is based on a combination of data gathering interviews and work sessions for decision making

it is finding out what the whole problem is it establishes limits and scope of possibilities

it applies to any building type or size

it emphasises cooperation between client and designers

it is a rational and explicit process in which decisions and information are displayed for close scrutiny

it distinguishes between wants and needs

it is heuristic (serving to guide and discover)

it is NOT algorithmic (not based on rules and procedures)

Despite the last statement above a set of 132 programming procedures were included in the primer, but with the suggestion that they could be modified by experience, or to fit in with the needs of particular projects (see appendix B[6] for example).

The preceding detailed review of CRS's approach to 'briefing' examplifies a method of design in which problems are seen as distinct from their solutions. This approach reflects both Archer's and Alexander's earlier attempts to develop systematic methods of design analysis, both of which have now been largely rejected by the design professions, and by their authors (Jones 1980).

The opposite approach, ie that of continual, comprehensive and integrated interaction between needs, problems, possibilities and solutions, is favoured by some designers such as Heath (1970) who saw the design and briefing process as essentially algorithmic in nature:

> "The design process which will reach a satisfactory conclusion with the greatest economy of effort is the one that eliminates the greatest number of possibilities with each decision. A skilled design team will trace this maze of decisions to a satisfactory solution more quickly than an unskilled one. They will do this because experience has taught them to ask the right questions in the right order so as to limit the field as rapidly and completely as possible..... both their questions and the order in which they are asked can be codified in the form of an algorithm. To this extent the design problem is algorithmic"
> (Heath 1970 p 67).

Heath's argument was that the briefing process could be approached logically, ie that there was a preferred order of asking questions, of considering evidence, of making decisions, which was better than others. The order which was 'right' in any particular situation was that which "eliminates the need for feedback loops", ie that avoids having "to return to an earlier stage of the problem by the discovery that two different lines of argument have produced contradictory constraints".

At a multi-professional seminar on Health Service Building Planning at the University of NSW Heath (1973) spoke on 'Compiling the Brief' and expressed the view that:

> "the briefing process can be defined as the process of discussion and explanation by which the critical decisions of the problem and its main elements are located and ranked, and the record of this definition and ranking is the 'brief'" (from Synopsis of paper).

Heath was really arguing about the design process as a whole rather than the briefing process, and a paper he gave at a seminar on Building for Health in 1976 in Sydney made it clear that he thought there was "no distinction between briefing and design".

Methods of obtaining briefing information range from copying someone else's ideas to ignoring all precedents and working entirely by intuition. Neither method is likely to be wholly successful and any project is likely to employ a variety of means of acquiring data.

Collecting too much information wastes time in recording and analysis, especially if it reveals no new problems or solutions. Collecting too little information means that decisions are likely to be unduly subjective or pragmatic. Much information gathered in planning new facilities is not used, yet lack of information of the right kind at the right time causes many errors (McQueen 1971).

4.5 HOSPITAL BRIEFING METHODS

In the field of hospital design there has been much individual work on developing briefing techniques. Some of this has been reported at conferences or led to the production of guidance on department and room design. Other work has focused on improving methods of planning and processing hospital building projects (Great Britain MoH 1961 - 1967, DHSS 1967 - 78, Green et al 1971).

One design guide specifically on briefing for hospitals was however published by the South African National Building Research Insitute (Woolley 1970) under the title 'The architectural brief and planning information'. It was a fairly general discussion on design methods applying to government hospitals in South Africa, but it emphasised the close interrelationship between briefing and design methods. Six main techniques for briefing were recommended which could "aid in the compilation of more efficient design briefs" (p iii).

Two existing methods of briefing were first described:

1. a written brief given to the architect by the client authority

2. the basic design undertaken by the client authority on the basis of interdepartmental briefs prior to the architect being appointed

Several areas of difficulty arose from these methods:

1. a tendency for the brief to describe a preconceived solution rather than the problem to be solved

2. lack of opportunity for discussion between client and designer

3. lack of coordination between the design consultants (especially the services engineers) which resulted in delays and excess costs

4. lack of continuity in public authority staff which meant that essential information was often lost when a key person was replaced.

Woolley then described some of the methods by which architects generated the form of designs, including checklists, diagrams and policy statements. Two types of diagrams were differentiated - constructive and non-constructive (or 'form') diagrams. The former attempted to explain desirable relationships or to express operational policies. The latter described the possible forms of a design solution. A number of complications in the design process were then discussed using relationships of spaces in operating suites as an example. Understanding the complex and sometimes conflicting requirements could be aided by a variety of techniques such as interaction matrices, flow diagrams and 'classification by levels'.

Finally six recommendations were made on improving briefing methods for hospital design:

1. setting up information centres to record, store and disseminate design data
2. multi-disciplinary project teams to include both users and designers
3. use of constructive diagrams
4. use of an hierarchical sequence in decision making - from the general to the particular
5. analysis of relationships between elements to derive 'independent clusters'
6. use of flow charts to explain sequences of planning and design tasks

In assessing the relevance and validity of Woolleys' approach it has to be recognised that he was attempting to reform a very rigid and hidebound attitude to hospital design in South Africa. There was little mention of analysis of functions or activities, the main emphasis was on spatial relationships and traffic, although examples were given of data sheets for activity spaces such as scrubbing up and gowning rooms.

Following the establishment of the post-graduate course for health facility planners at MARU in London in 1970, its Director, Raymond Moss proposed (in 1972) that a logical structure was needed to help solve some of the problems of procedure and comprehension which had arisen in the MARU course hitherto. A draft proposal for such a structure was circulated for comment to a number of interested people in November 1972. It contained "a checklist of questions which might be asked during stages A, B and C of the DHSS Capricode (procedures)". The intention was to analyse the process of asking the questions in a logical sequence, deciding where the information would originate, who would be involved and what decisions would need to be made. In other words a set of rules for conducting a planning and design project, but which would not constrain the kind of information being processed or the kind of decisions made.

The structure of the checklist was divided first into three sections corresponding to the three Capricode stages A, B and C.

A. Type of facility and functions to be provided
Siting and building shape.

B. Detailed functions of units/ departments
Interrelationship with other units/departments

C. Internal organisation of unit/department
Room types and layout
Equipment details

(See appendix B[7] for details)

The questionnaire was intended to apply to a hospital department or to a facility such as a geriatric unit or health centre. Unfortunately the checklist does not appear to have been developed much further, although a revised version was included in a report by Moss (1975) on Hospital Design and the National Health Service (part 2). What it needed in its proposed format was some kind of linking structure so that the interdependence of questions and information could be more easily appreciated. It would also have been useful to have had some guidance as to where relevant information would be likely to be obtained. The checklist did however provide a useful pointer to the way in which briefing topics could be arranged for analysis and decision making.

Some health and public works authorities in Australia have produced guidance recommendations on 'good practice' for preparation of planning briefs, development briefs, and functional briefs (eg NSW 1973-74, 1975, 1981). Most of the health authorities' briefing guides have however been aimed at user members of planning teams, while the public works authorities' guidelines were orientated more towards design teams.

The briefing guide by the NSW Health Commission (1975) proposed main headings for a hospital 'department' brief as follows:

1. PURPOSE
2. PEOPLE
3. ACTIVITIES
4. MOVEMENT
5. LOCATION
6. ACCOMMODATION
7. SERVICES
8. FUTURE TRENDS
9. EQUIPMENT

A 'department' briefing guideline from the NSW Public Works Department (1973-4) had similar headings but in a slightly different order:

1. PURPOSE
2. PEOPLE
3. TIME (sequence of events)
4. MOVEMENT
5. LOCATION
6. SIZE
7. EQUIPMENT
8. SERVICES
9. FUTURE TRENDS
10. OTHER REQUIREMENTS

These lists of headings supported the idea that information can be collected in a way which encourages systematic, analytical and innovative thinking. Topics were arranged in an order which aimed to help both enquirers and respondents to develop their ideas from broad general principles and policies towards more specific and detailed proposals and programs. Supplementary lists were also provided of 'kinds of things' to consider, such as 'departments' or 'services', 'parts of buildings', and 'types of materials'. The aim was to ensure that nothing important was forgotten or omitted, but this may make users request things because they are on the list without verifying whether they are really needed or not (see appendix B[8]).

The NSW Works Department's 'outline of project contents' concluded by bringing together all data needed, firstly to produce a 'space budget', and from this a 'cost budget'. Some questions were included concerning staffing implications, but little consideration at this stage was given to running costs, or to alternative ways of providing facilities and services at less cost. These were apparently assumed to be the responsibility of the 'client' authority. The Works Department's (and the designer's) task was to produce a building which met the clients' stated requirements for a building, not to question why it was needed, or if it was needed. In other words these enquiry methods started after the basic decisions on what to provide had been made. This made it easier to decide <u>how</u> to design and construct a building rather than to question its purpose and justification.

4.6 A BRIEFING METHOD FOR HEALTH CENTRES

With the development of a new type of building such as health centres, there is often a period of experimental design during which time certain ideas and patterns become hardened. If however the functions which the buildings are to serve are unclear, there may come a point when someone exceptional attempts to clear up the mess. In the case of health centres this someone happened to be both an architect and a medical practitioner with some experience in both fields. Dr Ruth Cammock originally approached the DHSS in London in 1968 with a proposal to study the working of a selection of recently built health centres which she felt were inappropriately designed for their functions. This awareness was occasioned by her work as an architect in the office of a local authority architects' department responsible for health centre planning and design. The research was eventually carried out at MARU with support from the DHSS and published as a study of three activities in health centres (Cammock 1973).

Concurrently with the comparative study of health centre designs in use, Cammock and Adams (1970) were investigating methods of briefing for health centre design. This was because inadequate briefing was considered to be a prime cause of the dissatisfaction evident in the evaluation studies. Some of the briefing and design methods which were proposed for health centres originated in the hospital design field in DHSS, others had been developed from the ADM studies by Moore et al in MPBW.

Cammock makes the point that to enable useful comparisons to be made between briefs:

> "a standard format is necessary, both to ensure that the same ground is covered - that no significant items are missed - and to aid the prompt identification of common factors. Such a format must be capable of modification as time goes by, but must at any one time be widely accepted..." (Cammock & Adams 1970 p 900)

The 16 steps of Cammock and Adams' briefing process are summarised below: (see appendix B[9] for details)

1. assemble user/designer planning team
2. formulate general operational policies
3. assess overall size and cost of facility
4. determine priorities for services and facilities
5. estimate floor areas and develop design policies
6. consider sharing and flexible use of space
7. throw away accommodation schedule as soon as budget approved
8. consider levels and interrelationships of policies
9. consider options and select preferences
10. predict likely demands and catchment population
11. consider relation to other facilities and services
12. analyse functions diagrammatically
13. explore spatial and equipment implications
14. relate activities to rooms
15. assess available design guidance critically and apply to project as appropriate
16. assemble all data and integrate into building design.

Cammock and Adams stressed that stated or written operational policies should form the basis of their briefing method for the following reasons:

1. They constitute the clients' instructions to the architect explaining <u>what</u> to provide and <u>why</u>.
2. The architect can refer to them to verify functional aspects he is unsure about.
3. The more carefully they are constructed the less likel.hood there is that the client will change his mind.
4. They provide measuring sticks against which proposed designs, or design options, can be compared.
5. They provide the criteria for assessment for the final design in use.
6. They allow comparisons to be made between the building for which they were prepared and other buildings serving the same or similar functions.

A draft checklist for policy statements followed of which the version below is a summary:

1. Title of functional unit
2. Pattern of activities:
   functional diagrams
   written statements
3. Frequency and deviations of activities
   Total number of patients, items etc.
4. Staffing - types, grades, hours of work
5. Spaces required:
   type, number, ref. to activity data
6. Relationship to other policies.

The policy statements would relate both to general and detail policies and there would need to be cross reference between them to avoid unnecessary repetition. Cammock makes the point that:

> "The recording of facts has long been accepted as a valuable discipline in the medical field, providing a scientific basis for progressive development, and it seems likely to prove even more valuable when more widely applied in the field of architecture" (p 900).

The emphasis throughout Cammock and Adams' paper is that decisions involving operational and design aspects need to be made jointly by client/user and architect. Unfortunately in many planning and design situations clients are acting on behalf of other unknown people, and their main concern is to get a building constructed at minimum cost before this year's financial allocation has dried up. Consequently the detailed and painstaking assembly of information, consideration of alternative policies and designs, evaluation of effects, and feedback of knowledge of results, is a very rare occurance indeed.

4.7 GUIDANCE ON HEALTH FACILITY PLANNING AND DESIGN

Much information used in briefing and design is obtained from guidance publications issued by government or professional organisations and advisory bodies. The guidance is generally based either on research into needs and problems or on feedback from evaluation of designs in use, with some guidelines covering both aspects.

The US Department of Health, Education and Welfare was one of the first Government Departments to produce design guidance in the form of standard plans (Modern Hospital 1947, USPHS 1952). These plans were copied widely during the early post-war years, and although they were revised periodically up till 1962, they had the effect of imposing a straight-jacket on hospital design with little provision for growth or change (Thompson & Goldin 1975 p 254). More importantly perhaps they prevented planners from working out solutions to their problems from first principles - if the government authorities were satisfied to provide funds for new buildings which conformed with the published standards, then this was good enough.

Research into planning and design of hospitals in the 1950s by the Yale Study Team in the USA, and by the Nuffield Investigation in England, began to produce some objective feedback data on how hospital designs, particularly wards, affected their use and efficiency. These data were published in various reports and journal articles which were read and applied by many hospital designers.

In 1961 the British Ministry of Health began its series of Hospital Building Notes and Bulletins which aimed to establish recommended standards of design, including floor areas and costs for NHS hospitals and other health buildings. The Scottish Home and Health Department followed suit in the same year with a series of Hospital Planning Notes and Hospital Design in Use reports. These publication series were also used as general guidance on hospital planning and design by people in situations well beyond their originators' intentions (Moss 1974).

A DHSS Hospital Building Note which adopted a new approach concerned pathology department design (Great Britain DHSS 1973). This was a revision of an earlier Note undertaken to investigate demands for an increase in financial and space allowances for hospital laboratories by the Association of Clinical Pathologists. The format of the Note differed from most previous Notes in the series by first describing in detail the functions and activities on which the various design options discussed were based. This material was derived partly from user requirement studies conducted in the Greenwich Hospital Project (Moss 1971), and partly from a series of evaluation studies in 1967 and 1968 of recently completed pathology laboratories in Britain. A series of 'work study' investigations were also carried out in one well managed pathology department, and detailed descriptions of typical work processes, supplemented by 'functional diagrams', were included in the Note.

Consideration was given by the drafting committee to the most useful order for presenting topics in the Pathology Department Note. The two main options were between a logical progression of headings based on a typical planning decision process, or a grouping of headings related to the specialised roles of members of a planning team. The former sequence was intended to encourage members of a planning team to work together in making decisions, whereas the latter approach acknowledged the different interests and needs for information of users and designers.

The second option was considered more suitable for the purposes of a guidance publication, each main section being directed at particular types of professional readers. While the sequence of topics in option '1' was more integrated and aimed to represent a typical sequence of decision making, it was nevertheless felt to be too restrictive on planning methods and too complex for easy comprehension.

In the USA the American Institute of Architects and the American Hospital Association have both published a variety of guides and books on both general and particular aspects of hospital planning and design (AIA 1977, AHA 1980). In Britain the King Edward's Hospital Fund, the Scottish Health Service Centre, and a number of other government, professional and private organisations, have produced many publications concerned with planning, design, commissioning, and operation of health facilities (see Bunch 1979). Similar organisations in Canada, Sweden, Denmark and Germany, for example, have produced guidance material which was mainly applicable to local needs and problems.

The World Health Organisation, and the International Hospital Federation, have not only been responsible for publishing a range of original reports and articles by leading experts in a variety of fields, but also select lists of publications on hospital planning and design of particular relevance to developing countries (Kleczkowski & Pibouleau 1977+, World Hospitals 1977).

Many documentary sources of health facility planning and design information used in Australia have been derived from the British Department of Health & Social Security (1961+) and from the US Department of Health, Education & Welfare (1951+). Only relatively recently have 'planning and design guidelines' been produced specifically for use in Australia; for example the NSW Health Commission and Government Architect's Branch Health Building Guidelines (1973+). Most of these guidelines have been based on experience gained from previous local projects, but with little evaluation of their effects in use.

The New Zealand Department of Health, Hospital Design and Evaluation Unit (1972+) has produced a series of reports on planning and design of health buildings such as health centres, ward units and geriatric facilities. These reports are based on evaluation of buildings in use and are more 'open-ended' than the NSW guidelines in that they do not describe solutions, rather they attempt to explain problems and possibilities revealed as a result of research.

Hosplan in NSW publishes a looseleaf series of 'feedback' notes on design defects detected in the course of evaluation studies in hospitals. These are presented, two to a page, in the form of an illustration of the problem together with a short description. The details are coded according to a special Hosplan classification scheme (see appendix G7). The feedback data sheets are however unsuitable for arranging in cumulative order, and the basis of the classification code is not explained. Nevertheless the concept of linking evaluation concepts to feedback information is a help, but it needs to be developed further if repetition of mistakes in design are to be avoided, and the real causes detected and corrected.

The content and form of these planning guidance publications have varied according to their topic, application and purpose, ie whether they were for general background reading or to define standards of design. The following comparison between formats of selected guidance publications on ward planning illustrates some of the approaches.

The order in which information has been presented in the various guidelines ranges from 'general before particular' and 'whole before parts' (deductive), to 'details of functions and activities' followed by 'design implications for parts' and then for 'the whole' (inductive).

The SHHD Planning Note No.1 (1963) was mainly inductive, ie it defined the functions first before considering the ward in the context of the hospital. The interaction between function and design was emphasised throughout the note (see appendix G^1).

The SHHD note also contained a Supplement which reviewed a number of design options and then described an experimental ward design in detail. The note contained six main sections: Introduction, Functions of the ward, Factors affecting design, Detailed functions and accommodation requirements, Design considerations, and Engineering services.

In 1963 the MoH issued Building Note No.17 on 'Deep Plan (Race Track) Ward Units'. This Note aimed to give guidance on the good and bad points of this type of ward layout in comparison with linear designs.

HBN 17 differed from other notes in the series by considering a particular problem, ie cost implications of compact planning. It was also intended to be read in conjunction with HBN 4 on ward units, first published in 1961, but which was reissued in a revised form in 1968. The 1968 version of HBN 4 gave considerably greater emphasis to functional aspects than its predecessor, and was set out under the following topics: scope, needs, patient care methods, communications, flexibility, noise, privacy, room provision, room data and activities, engineering services, terminology, and references (see appendix G^2 for full list of headings).

After the New Zealand Department of Health established its Hospital Design and Evaluation Unit (HDEU) with the help of the Scottish Hospital Centre in 1971, the first Report to be published by the unit was on 'Ward Planning' subtitled 'A study of functional requirements in acute general wards'.

The Foreword to the Report stated that:

a) the report made no attempt to produce standard solutions or plans as these tended to freeze thought and initiative

b) the conclusions were based on evaluations of a multi-disciplinary team in various types of ward

c) the emphasis throughout was on the relation of design to function and the necessity to make major policy decisions at an early stage

d) it aimed to make the user representatives and the designers more aware of their responsibilities in ward planning.

The New Zealand Report was set out under five main sections as follows: Introduction, Policies affecting planning, Room relationships, Room design, General considerations (eg fire safety and damage), Glossary, Methods of study, Bibliography and References (see appendix G[3] for details).

In Australia the NSW Health Commission and the Public Works Department Joint Guidelines Committee produced their first Guidelines in 1973. The Guideline sheets referring to general ward design have been progressively added to and revised up to 1978 and included both Planning Principles and Room Layouts (see appendix G[4]).

In 1977 the NSW Hospital Planning Advisory Centre issued a five volume Planning and Design Note No. 1 on Ward Units. The first volume on 'User Requirements' had the following main sections: Introduction, Scope, Functions of a ward, Accommodation requirements, Operational policies, General design considerations, Accommodation schedule, Bibliography, Operational policies and patient dependency categories (see appendix G[5]).

Another influential source of guidance on ward planning was published in 1979. The USPHS 'Minimum Requirements of Construction and Equipment for Hospital and Medical Facilities' included a mere two page section on Nursing units which stipulated categorically that the maximum capacity of patient rooms "shall be 4 patients" and that the minimum area exclusive of toilets, wardrobes, alcoves etc "shall be 100 square feet (9.29 square meters) per bed in single bed room and 80 square feet (7.43 square meters) in multi-bed rooms". Each room or workspace in the ward was briefly described in terms of access, equipment and/or critical dimensions. A general list of 31 standards and codes at the beginning of the guide indicated the restraints within which design options could be explored. Apart from this small section in the 107 page USPHS guide, no other guidance on general ward planning appears to have been published since the 1950s, either by Government Agencies in the USA or by the AHA. Such other guidance as exists is mainly in the form of textbooks by eminent architects or journal articles which describe a particular facility design or research study (eg Redstone 1978).

The World Health Organisation series on Approaches to Planning (1976+) included in Vol 3 a paper by Llewelyn Davies and Weeks (1979) on Inpatient Areas with particular application to developing countries. Llewelyn Davies' and Weeks' 16 page paper included four examples of ward layouts derived from experience of planning hospitals for different climatic and cultural situations, and five examples were given of ways of arranging beds in open bays. The text was simply worded and direct. The paper stressed the influence of staffing on running costs and emphasised the need to strike a balance between economics and flexibility, between medical requirements and status, and between privacy and the need for support. Wards of between 20 and 30 beds were recommended.

Apart from the USPHS standard ward plans referred to earlier, the DHSS and Regional Hospital Boards in Britain have issued standard plans for wards complete with detailed working drawings and specifications, but only a limited number were built before the Harness and Nucleus programs got under way in the early and middle 1970s. The Harness program generated a series of documents including an Outline Planning Policy on the 'Pattern of Adult Acute Patient Nursing Service' which, despite its title, aimed to set down planning objectives and policies for hospital ward design. This three page document (dated 1969) set the context for the 'Design Policy Data Sheets' which were set out following about 50 headings together with explanatory detail and suggested 'design implications' (see appendix G[6]).

The data were set out mainly for potential integration into the computer-aided planning system used in the Harness hospitals. It appears however that most of the actual designing was done by conventional methods utilizing the experience of people who had planned many wards before. The Nucleus hospital wards were a subsequent development which grew out of theoretical evaluation of the Harness ward designs as well as feedback from evaluation of other ward designs in use (see chapter 5).

This summarised review of guidance on hospital and ward planning has shown a wide range of approaches to the problem of how to provide information in a useful way for all members of the planning/design team. Some of the guidelines have specifically aimed to give general guidance on methods and options and to encourage an innovative approach. Others have provided model layouts or given specific minimum standards which have to be followed to obtain approval and funding.

4.8 BRIEFING AS A MEANS OF DEFINING PROBLEMS

The method of planning and design adopted on a particular project affects how briefing information is collected and analysed. Particip-ative methods of planning, for example, will involve much discussion of needs and options with users. There is however some controversy on whether briefing and design should be treated as separate phases of the overall planning process, or whether they are merely different aspects of problem solving.

Other factors affecting the type of information collected, and hence the methods of briefing used, are whether the problem to be solved is new, or whether its solution depends on discovering a previously used solution and then repeating it. The extent of provision for user participation in altering a design after completion also determines how far briefing can be extended into the operational phase of planning.

Because briefing on several similar projects may cover much the same ground it is sometimes possible to combine the briefing for more than one project, especially if they are being planned concurrently. Nevertheless there are some benefits for users in going through the process of discovering their problems and needs each time, and of searching for better answers. Merely reproducing an identical brief for each similar project is unlikely to lead to improvements in design. Requirements common to several projects must also be defined, and any local variations clearly differentiated.

Development of 'program building', as exemplified by the Harness and Nucleus hospital systems in Britain, involves preparation of standard briefs for a series of buildings, each of which may differ only marginally from others in the program. This offers opportunities for progressive improvements as findings from evaluation in use are fed back to briefing and design.

However detailed a brief may be, its main objectives are to establish terms of reference for a project, to provide a source of relevant information for the people concerned in its planning, to record all important decisions taken, and to establish criteria for evaluation.

While it is arguable whether there is a 'right' way to collect and process briefing information (or to design), nevertheless the use of standard briefing procedures and series of check list topics, appears to offer a means of developing better understanding and cooperation between planning team members, and hence improving the quality of design which results.

CHAPTER FIVE

HEALTH FACILITY DESIGN DEVELOPMENT - synopsis

This chapter traces recent developments in design of health facilities, particularly hospitals and hospital wards. The underlying theme is that design innovation is often pursued for its own sake regardless of availability of knowledge on how to design efficient health facilities. The converse approach, namely design standardisation, is considered in the light of 'systems and standards' programs in Britain and the USA.

The main requirements which health facilities aim to meet are first summarised, and several criteria proposed for evaluating options and effects. Different design characteristics of health facilities are then analysed and the effects of these characteristcs on efficiency in use are hypothesised.

The role of users in designing is examined, particularly how some designs allow for user participation, either during the design process or afterwards, while other designs exclude this possibility. Construction methods which provide for growth and change, and which allow for delayed decision making, are discussed in relation to their effect on resource allocation and control.

A selection of ward designs from Britain, USA, Canada and Australia illustrate how various design features have been combined in the search for the ideal ward. The effects of floor layout on patients' and staff satisfaction are considered, particularly regarding nursing supervision and patient privacy.

5.1 DETERMINING NEEDS AND CRITERIA FOR HOSPITAL DESIGN

Florence Nightingale's dictum that the "very first requirement of a hospital is that it should do no harm" is as good a starting point as any, although her theories on causes of infection and the need for abundant ventilation are not considered valid today (Thompson & Goldin 1975 p 159). Many of the principles of good hospital design were first defined by people such as Aiken in 1777 and Lavoisier in 1788. Their ideas were later endorsed by Miss Nightingale in her book 'Notes on Hospitals' (1859). Many hospitals have since used the pavilion plan based on the so-called Nightingale ward although it was actually conceived by Lavoisier. A typical Nightingale ward accommodated about 30 beds in two rows down each side of a large open nave-like room measuring about 30 ft (9m) in width, 120 ft (36.6m) in length, and with a height of 16 or 17 ft (5m) (see fig.5.1). The pavilions were usually linked by corridors and service rooms in the pattern which many subsequent hospital buildings followed. Hospital design requirements thus became established in terms of a building description or model rather than a definition of what the building should be capable of doing and the services which it should provide for.

In the late 1940s the Nuffield Studies on the Function and Design of Hospitals (1955) attempted to redefine the functional needs of hospitals. Ttese then formed the basis for development of some significant new ideas in design terms . Many hospitals built in Britain, North America, Europe and Australia during the inter-war years were planned using nursing units with single, two and four bed rooms in an attempt to provide hotel-like private accommodation for inpatients (at a price).

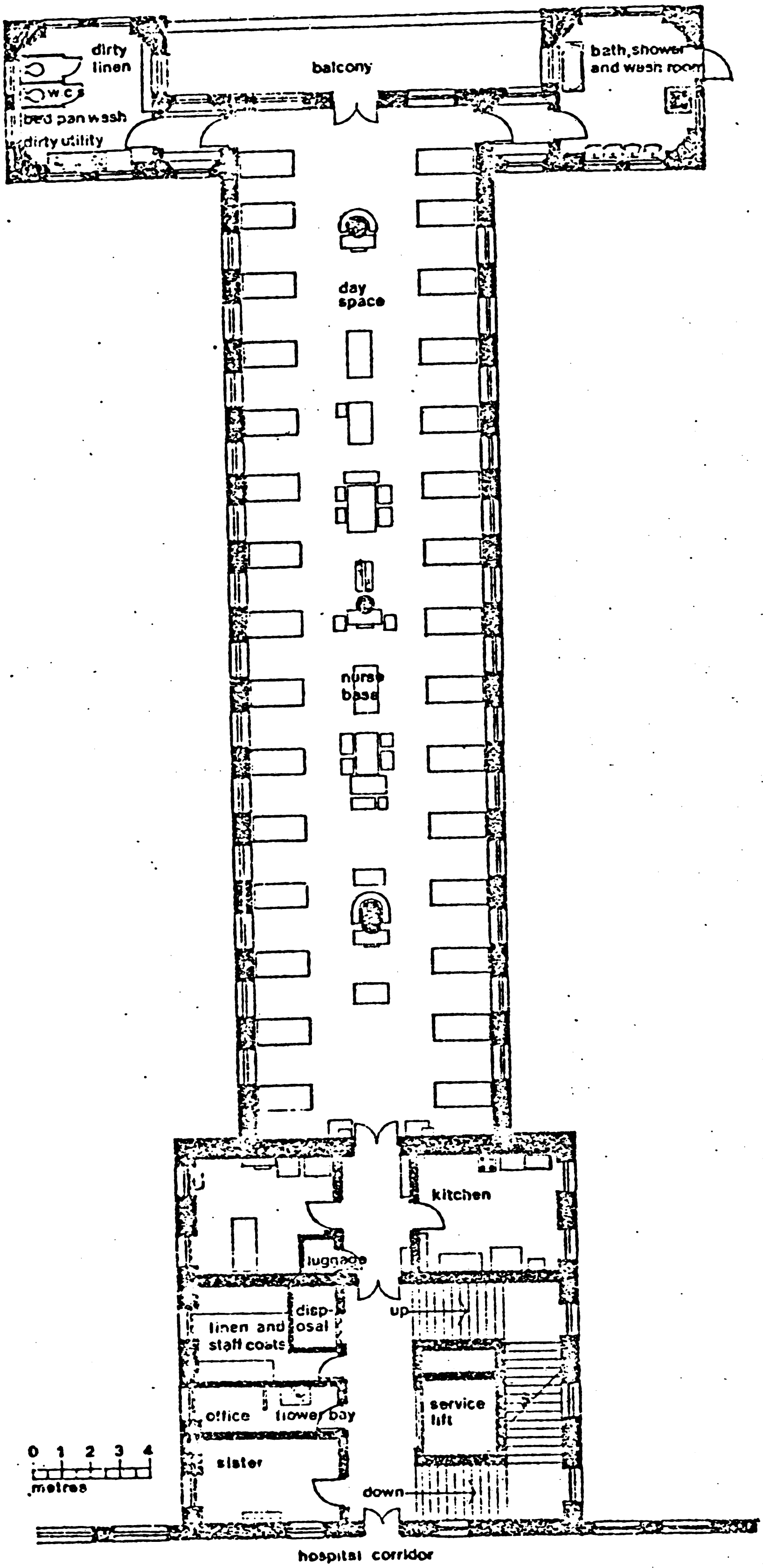


Fig.5.1 Nightingale ward, St. Thomas' Hospital, London, 1871. (Source: Noble & Dixon 1977)

Wards, outpatient departments, and operating theatres are each described in separate chapters of the Nuffield report, but chapter 6 especially mentioned the Royal Victoria Hospital, Belfast, built in 1903, in which the single storey Nightingale style wards were arranged abutting each other side by side, being lit by clerestorey windows and ventilated mechanically (see also Banham 1969 p 76). This allowed a very compact hospital layout, but there was no outside view from the bed areas, only from the ends of the wards which faced away from the access ends of the wards (fig. 5.2):

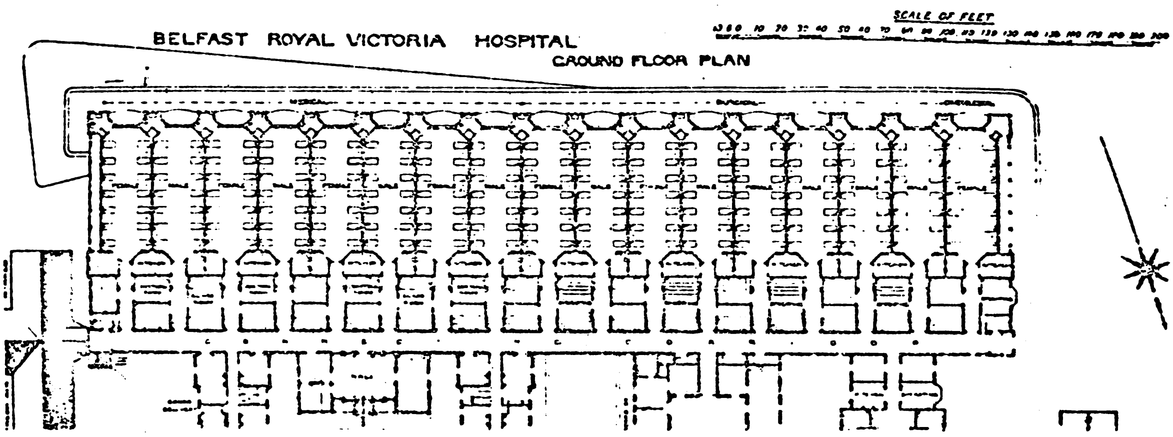


Fig.5.2 Side-by-side arrangement of wards at the Royal Victoria Hospital, Belfast, Henman & Cooper architects, 1899. (Source: Banham 1969)

The Nuffield report advocated the use of single storey wards mentioning that they allow plenty of light and view to penetrate the bed areas, and permit easy access to the outside. On small sites it would however usually be necessary to stack the wards on several levels, in which case the efficient utilisation of lifts, and the desire to provide unobstructed views, natural ventilation and daylighting, tend to cause ward blocks to be built high, "even on country sites where space is more or less unlimited"(p 145).

The importance of traffic was particularly stressed in relation to ward planning, firstly so that the location of lifts and stairs did not cause noise or obstruction in the bed areas of the ward, and secondly to avoid traffic going through one ward unit to get to another. Putting as many beds as possible on each floor level helps to reduce dependence on lifts and stairs, and also helps to keep the building low, thus reducing building and maintenance costs. It was mentioned in passing that grouping of lifts is better than distributing them about at different points in the building; "Thus for efficient lift service a single tall ward block is preferable to several blocks of medium height" (loc cit).

The arguments in favour of low compact ward blocks are that they achieve "economies by reducing the number of lift stations, service points and service rooms". They are cheaper to heat (and cool) as they provide more floor space in relation to external wall area, and they increase "the designer's freedom in the choice of building form" (loc cit).

Provision for flexibility and growth is needed in hospitals to allow for increases and decreases in demand, changes in policy, new techniques, and different people's ideas. Several means of making buildings adaptable were described in the Nuffield report, including demountable internal walls and partitions. These were said to be rather expensive and poor from a sound-proofing point of view. They are however cleaner and less noisy to demount and rearrange than cheaper brick or block walling.

Any changes in room layout or function will almost always involve alteration to engineering services such as water, electricity and drainage. Therefore if these services can be arranged in a regular grid of shafts or ducts they can be tapped into from nearly any point on the floor. This arrangement is however fairly wasteful as there has to be overprovision of service capacity to allow for additions at any point. The Nuffield report commented;

> "Generally the attempt to provide for a high measure of flexibility by changing the walls and services in a building can only by justified if there is reasonable certainty of substantial changes being made at frequent intervals" (p 146).

The aim of providing for growth and change could, the report suggested, be assisted if the hospital is zoned into four types of accommodation:

1. wards
2. outpatients and casualty
3. medical service departments
4. non-medical service departments

> "All (the above) are subject to growth and change and ideally all should be free to expand. This ideal can only be achieved in a hospital of one storey, on an unrestricted site.... For (larger hospitals) ... on restricted sites multi-storey design will be necessary for at least part of the hospital..."

The team thought that a hospital is rather like the development plan for a new town. It is:

> "essentially a growing organism, not a finite building, and the plan should start from considerations of zoning and traffic routes.... Too often... it is impossible to modify the arrangement of the hospital... because in the past no development plan was thought out for the future" (loc cit).

Nearly a quarter of a century after the Nuffield study team's report was published John Weeks* (1979) presented a paper for the Royal Society of Arts Alfred Bossom Lecture entitled "Designing and Living in a Hospital: an Enormous House'. The lecture was largely a commentary on the philosophy behind the design of many Llewelyn Davies and Weeks' hospitals,

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*A member of the Nuffield team.

particularly Northwick Park Hospital and Medical Research Centre in North London. Hospitals, especially large ones, were likened to villages in which each separate house is linked to the village street. Hospital departments were like houses in the village, their inhabitants identifying first with their department (or house), and secondly with their village (or hospital). Human identy was a main theme in Weeks' philosophy:

> "There is a basic human wish to identify with a physical place in the world. The need to retain the belief that we are all individuals, living somewhere, in an identifiable place, is so strong that even if people find that they are inhabitants of the same very large office building, the understanding of shared space is often a first point of contact" (p 417).

Weeks went on to condemn the anonymous architecture which results from commercial exploitation of office workers or political suppression of tenants of mass housing schemes:

> "The urge people have to express themselves and to signal their presence is powerful, and architecture which denies this is fundamentally anti-human" (p 473).

and

> "... a hospital should not be designed like an office building, but as a complex of separate parts, as a village is constructed of separately identifiable buildings" (loc cit).

Weeks' arguments sprang from two primary considerations: one, that the hospital is composed of individual departments which have different environmental, structural and spatial needs for growth and change; and two, that the needs of the people who work in the hospital are reflected in this village-like pattern of variety and interest. There are however other important considerations which affect the overall design of hospitals and one of these is (increasingly) energy conservation. As one of the speakers in the discussion following John Weeks' paper commented, Northwick Park Hospital "is not an energy-efficient building from any point of view" (p 477). This was however "compensated for by the fact that one can look out of windows everywhere" (loc cit). Thus two important requirements, one economic and one psychological, tend to conflict in the effect they have on hospital building shapes.

The ability easily to demolish hospital buildings and to re-erect them in some other place was also mentioned by a speaker in the discussion, although it clearly raises problems of durability, safety and (usually) cost. 'Temporary' buildings paradoxically seem to have a tendency to remain long after their intended lifespan has expired.

The requirements of hospital design as stated by both Florence Nightingale and the Nuffield team have produced many different types of hospital and ward design. These statements were nevertheless attempts to establish universal guidelines for design and criteria for comparison and evaluation of results. While factors, such as political, social, economic and technical trends, have also helped to determine the pattern of health facility design, a considerable degree of personal influence on the more innovative designs is evident.

The following sections trace some of the more interesting health facility design developments in Britain, North America and Australasia over the last thirty years or so. A strong 'family connection' between many of the design ideas will be apparent, although there is also a contrasting influence of 'variety for variety's sake' in some of the designs described.

5.2 AN OVERVIEW OF HOSPITAL DESIGN DEVELOPMENT 1948-1980

Following World War 2 the British Ministry of Education, and later the (then) Ministry of Health (following the demise of the Nuffield team), built up multi-professional design research and development groups. These R and D groups produced some novel buildings and design methods, due partly to exchange of people between public offices and private consultant firms. Study tours to Europe and the USA also provided valuable input of ideas. An important element was continuity of experience from project to project and development of systematic methods in planning and information processing. Subsequent advances in Britain and USA stemmed from grouping central government and regional building authorities (and also local authorities) into 'consortia' to develop building systems based on bulk purchase, and on collaboration with the building industry (Hacker 1967). One example was the system of ten hospitals built for the Mineworkers in the Appalachian mountains in the 1950s (Architectural Forum 1953) (see also figs 5.21 & 5.22).

An early development project of the MoH was Greenwich District Hospital, the planning of which was started in 1963 (Holroyd 1968, Green et al 1971). The objectives of this project were to explore ways of achieving a) extended building life without becoming functionally obsolete, b) spatial economy without sacrificing flexibility, c) acceptable environmental control on difficult urban sites, and d) means of fusing together hospital user needs and building design throughout the planning process. (The layout of Greenwich is shown in fig 5.3. A detailed description of this project is given in chapter 9.)

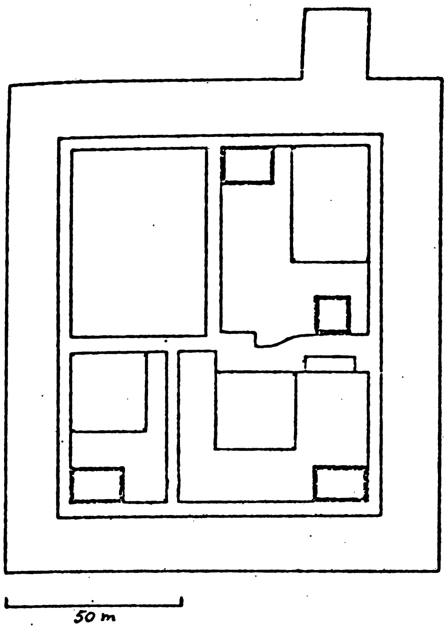


Fig.5.3 Greenwich District Hospital, London, DHSS architects

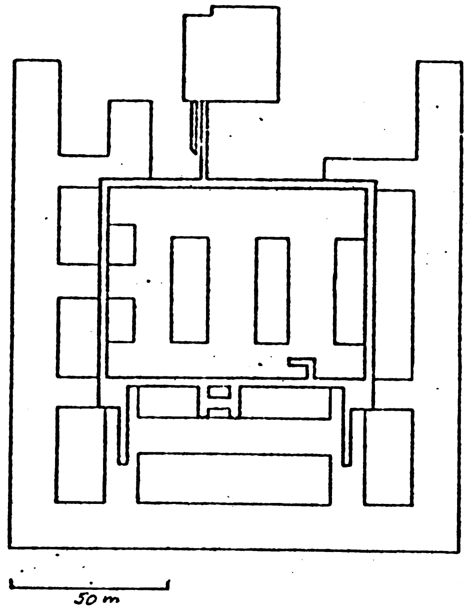


Fig.5.4 Best Buy Hospital, DHSS & Hospital Design Partnership, architects

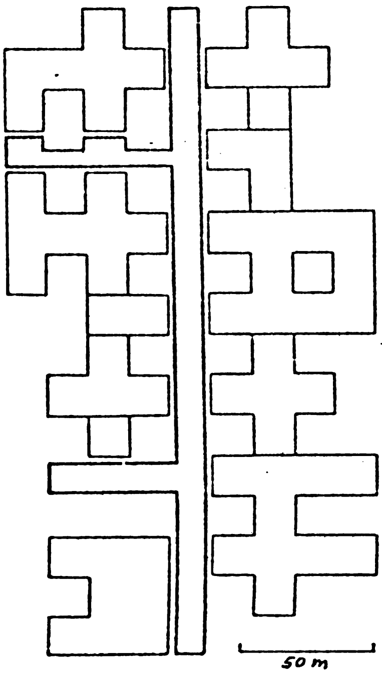


Fig.5.5 Harness Hospital DHSS & Hospital Design Partnership, architects

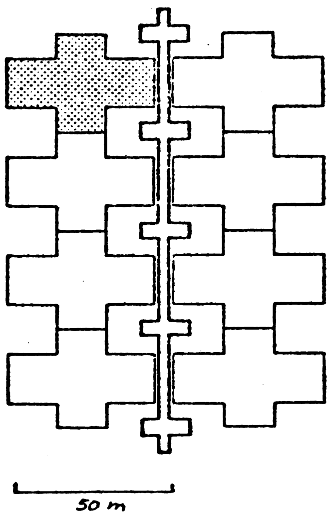


Fig. 5.6 Nucleus Hospital DHSS architects

(Source of illustrations: Cox & Groves, Design for Health Care)

Growing concern in the mid 1960s at a widening gap between increasing capital allocation to hospital building in Great Britain, and the ability of architects, engineers and contractors to produce buildings fast enough, resulted in the promotion by the British Department of Health and Social Security (DHSS) of an all-embracing computer based planning, design and cost control system called CUBITH (Coordinated Use of Building Industrialised Techniques for Hospitals) (Radford 1969, Boardman 1970). This system owed its origins to a number of ideas and systems from the USA including school and university construction systems (Hacker 1967, Weisbach 1969).

Although the main aim of CUBITH was to industrialise hospital building, it was also intended to use predictions of population and social trends as information system inputs, while the number and types of staff, hospital beds, windows, etc. needed for hospitals were to be the outputs. Other inputs were user activity data, local environmental details and structural requirements. The system was complex but open-ended. It involved the assembly of building components from a standard range, and although no complete hospital was ever built using the system, some departments were constructed using the standard components. Some problems of dimensional coordination were however discovered during construction.

At about the same time as the CUBITH developments, the DHSS Hospital Design Development Group in conjunction with Hospital Design Partnership was also investigating simpler methods of planning and designing hospitals, and of achieving cost savings by reduction in content, complexity and size of buildings - the so-called 'Best-Buy' project (see fig.5.4). Two identical hospitals using the Best Buy system were built for about three fifths the cost of a conventional hospital (Great Britain DHSS 1969b, James 1972).

Using the experience gained in these three projects (Greenwich, CUBITH and 'Best-Buy') the next stage was the 'Harness' project, named after the idea of an engineering services and traffic ring-main or 'Harness' onto which standard departments could be hitched (see fig 5.5). This project sought to produce a planning and construction design system which could be used on about 70% of hospital building projects in Great Britain, and on some overseas projects (Architect & Building News 1969, Davies 1974, Goodman 1975, Drake 1976).

The 'Harness' hospital system adopted standard increments for widths and lengths of rooms within a grid of 15m square modules which met most departments' needs (Great Britain DHSS 1972). The ease with which toy interlocking building bricks could provide an almost infinite variety of shapes suggested that such a system could work on a big scale.

Attempts to reconcile the different approaches behind the CUBITH and Harness systems proved impracticable as Harness was essentially a closed system . CUBITH was discontinued in the early 1970s. Harness was further developed as a computer-aided planning and design system, using some data from the Greenwich and 'Best Buy' projects, but with little feedback from results of design-in-use studies due to lack of time (Hospital & Health Services Review 1980). High construction costs of the Harness system and general economic restrictions resulted in only two prototype buildings being constructed before the system was abandoned in 1977.

Since 1970, planning on Harness hospitals had proceeded in parallel with the development of 'systems and standards' by DHSS and Regional Board teams. This resulted in compendiums of 'activity data' being produced for detail planning of all hospital rooms and spaces (Great Britain DHSS 1972).

The subsequent shift away from 'high-technology' hospital design is represented by the 'Nucleus' hospitals in Britain, one of the first of which was designed by Powell and Moya and Department of Health architects for a site in Maidstone, Kent (see fig 5.5). The Nucleus design combined many of the attributes of Best-Buy and Harness hospitals and showed substantial benefits in energy conservation. It has however been criticised for being unduly mean in its standards of space, and to be inflexible in meeting local requirements or preferences (BMA 1976). This was also a criticism made of the Best-Buy hospitals.

Parallel developments in the USA included 'systems built' hospitals for the US Veterans' Administration (VA) and the Department of Defense. These systems were both 'hardware' orientated although they aimed to provide for economical and efficient use of space and sophisticated environmental control (Agron et al 1972, Architectural Record 1972).

To reduce the time taken to plan, design and build large hospitals, to control costs, and to help delay their functional obsolescence, the authorities responsible for planning McMaster Medical Centre, Ontario, adopted what has become known as the 'fast track' method (Hiebert 1972, Zeidler 1976). This method of working depends on financial approval being given to outline design proposals before details of design and construction have been worked out. Budgets are determined for each

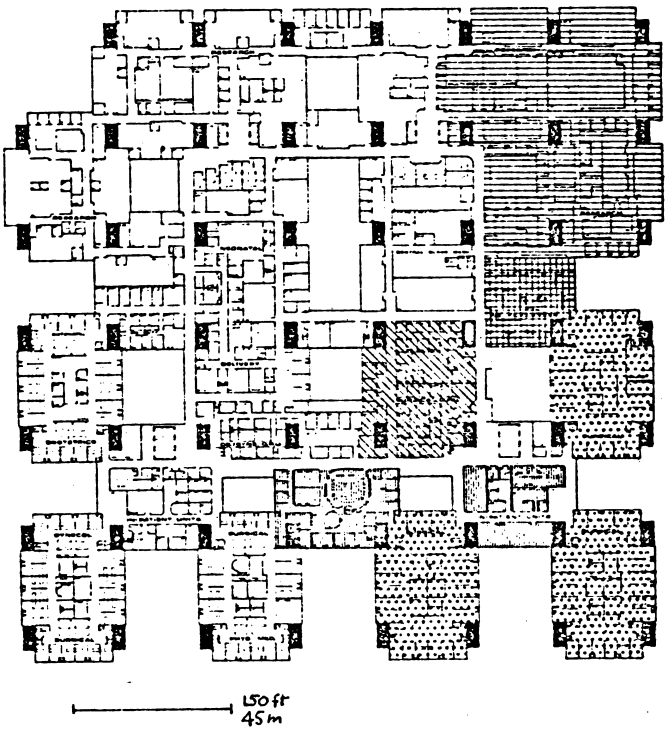


Fig.5.7 McMaster Medical Centre, Ontario
Craig, Zeidler & Strong, architects
(source Zeidler, Healing the Hospital)

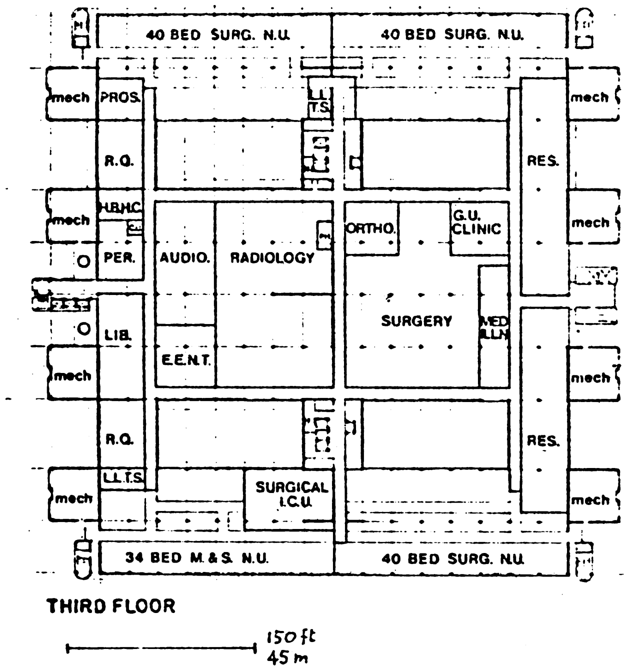


Fig.5.8 Loma Linda Veterans' Administration Hospital,
California, Stone, Marraccini & Patterson, architects
(source Agron, Architectural Record)

phase of building work which allow for some changes to content and design detail. The method requires flexibility both of attitudes and of buildings to be successful. Layouts of McMaster and the Loma Linda VA Hospital are shown at figs.5.7 and 5.8.

Although flexibility of layout and use can also be achieved in other ways, a potential by-product of 'fast-track' is that it allows users greater freedom and involvement in planning by postponing detail design of room layouts and fittings until after the main structure and services have been completed. Provided likely operational possibilities are foreseen in the basic design, users need not therefore be involved in early phases of planning (Weeks 1970).

Llewelyn Davies' and Weeks' firm, which had its origins in the Nuffield team in the early 1950s, has been responsible for many hospital designs in various parts of the world. Four stages of Llewelyn Davies' and Weeks' evolving philosophy of hospital planning are illustrated by a) Northwick Park Hospital, London (fig.5.9), which is a loosely knit tree-like layout with high and low buildings on a large open site with few restrictions, b) York District Hospital (fig.5.10) which, due to site limitations, is a more compact closely knit layout of mainly three and four storey buildings linked by a spine corridor, c) Flinders Medical Centre in Adelaide (fig.5.11) which is a mainly five storey grid-iron layout round large courtyards on an extensive sloping site (see chapter 9 for detailed description), and d) Westmead Teaching Hospital, Sydney, which is more open in layout than Flinders and represents the latest form of 'multi-strategy' planning (see fig.5.12).

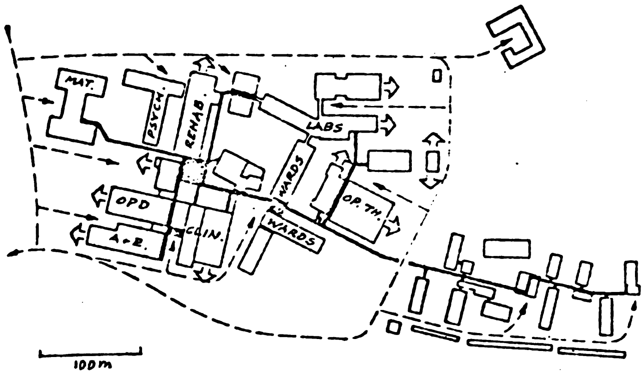


Fig.5.9 Northwick Park Medical Centre, London, Llewelyn Davies, Weeks architects. (source Cox & Groves)

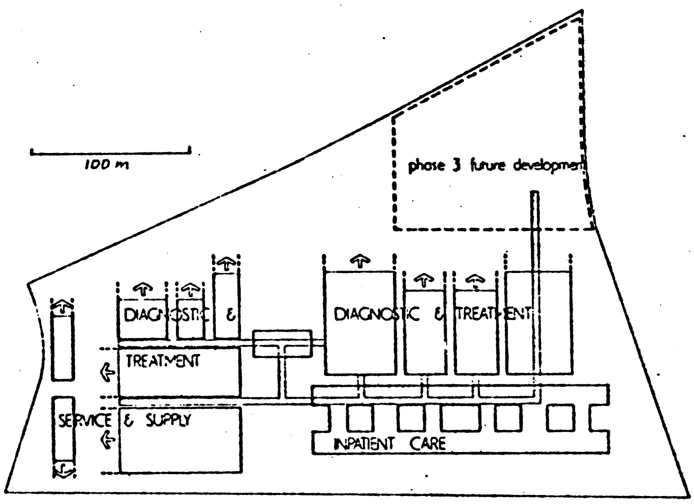


Fig.5.10 York District Hospital, Llewelyn Davies, Weeks architects. (source Architects' Journal)

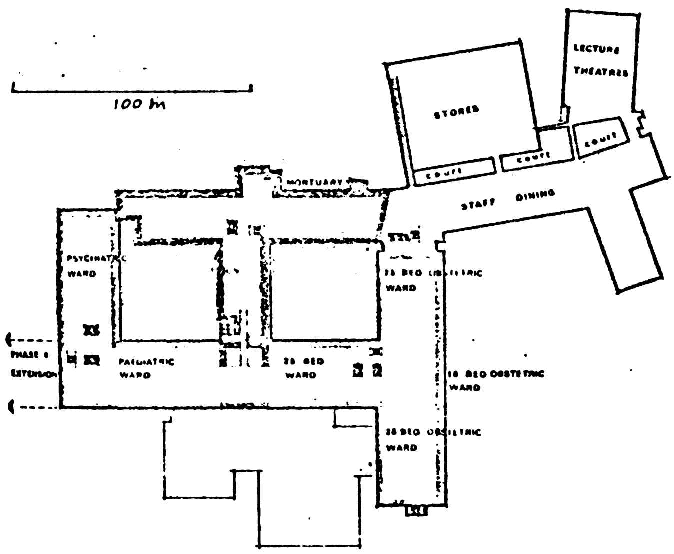


Fig.5.11 Flinders Medical Centre, Adelaide, Llewelyn Davies, Kinhill, planners (source Publicity Brochure)

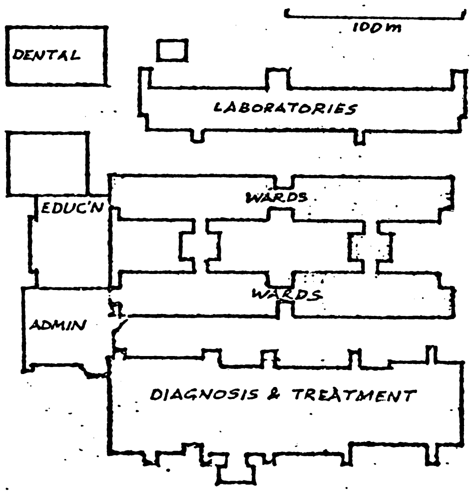


Fig.5.12 Westmead Medical Centre, Sydney, NSW Government Architect, Llewelyn Davies, Kinhill, planners (source NSW PWD)

An important feature of the Greenwich, 'Best-Buy' and 'Harness' line of development was the importance given to operational policies prior to, or in parallel with, developments of design proposals. The hardware orientated systems such as CUBITH and the VA systems have, on the other hand, been mainly concerned with equipment, building and engineering components, and their arrangement to suit user activities and environmental needs. The problem of trying to coordinate the functional and physical parts of the system into a compatible whole without inhibiting innovation and change seems however to have remained largely unsolved (Thunhurst 1973, Moss 1974-7).

The main lines of hospital design development since the early 1950s to the late 1970s have emphasised two points: 1) collaboration between health and educational building authorities has contributed to design developments on both sides of the Atlantic, and 2) competition and cooperation between public authorities and private firms led to many new ideas and improvements, both in planning methods and in building technology.

5.3 HOSPITAL DESIGN RESEARCH IN THE USA

The problem of designing modern hospitals without adequate information on which to base statements of requirements was (perhaps optimistically) expressed by Neergaard (1952) thus:

> "Hospitals require a special kind of research for planning and construction. An official central clearing house of information, available to all engaged in hospital design, could give guidance from past experience as to what has and has not worked, what new materials, methods and equipment will do a job better. Know-how and know-how-not are equally important. If each new hospital could avoid the many mistakes from which the old ones have suffered and adopt the features which have functioned with the least maintenance and replacement, the savings would run into millions." (quoted in Thompson & Goldin op cit p 253).

The effect of design on function may however be somewhat tenuous for, as a hospital architect J.S. Moore said, "... the architecture contributes very little to making a patient well, or to patient care" (quoted in Thompson & Goldin loc cit). Where then can designers search for sound guidance on which to base decisions? A factor strongly influencing hospital design, particularly in the USA, has been the search for efficiency' which has sought to maximise profit and minimise waste. This influence has had an effect, especially in those areas such as internal traffic movement and energy consumption, where costs in one form or another can be measured. In consequence much research effort has gone into developing methods of computer aided design (CAD) for designing hospital building shapes, ward layouts and mechanical handling systems which could show a reduction in time, energy, distance or monetary cost compared with other designs serving the same purposes.

One of the first such efficiency studies in wards was conducted by W. Gilman Thompson of Cornell University in 1913. Thompson sought to show that the then current trend towards private rooms in wards was causing increased workloads for nurses. Tests were carried out with nurses wearing pedometers to determine how far they walked in a typical day on the ward. The main effect of the studies however was to alter the arrangement of service rooms rather than reverse the trend towards greater sub-division of the nursing unit (Thompson & Goldin op cit p193).

In the late 1950s Pelletier and Thompson (1960) conducted an analysis of 30 hospital ward layouts designed in a variety of shapes, sizes and types of accommodation. They found "no correlation whatever among efficiency criteria" then being used to compare ward designs (Thompson & Goldin op cit p 294). The Yale Traffic Index (YTI) which Pelletier and Thompson devised measured the effects of ward design on walking distance of a team of nurses during the working day. The YTI:

> "helped the designer to know in advance how much he must pay in terms of the amenities for the ultimate in functional efficiency. We put the measuring tool into his hands, with the hope that sometimes he decides in favour of the amenities" (Thompson & Goldin op cit p 295).

Other studies conducted at Yale University by Thompson and his colleagues included comparisons between centralised and decentralised food services, a patient interview study ('what do patients like?'), nurse call systems, utilisation of a maternity unit, and the economics of privacy. The experiences gained in the Nuffield team's Investigations was acknowledged in the Yale Studies, and subsequent research in Britain by the DHSS benefited from similar investigations in the USA (Thompson & Goldin op cit p 231 et seq, Great Britain, Building Research Station 1963, Great Britain MoH 1963).

Thompson and Goldin (op cit p 254 - 260) describe four possible approaches to hospital research:

1. comparative studies, eg using opinions of users concerning alternative designs
2. conceptual studies, in which theoretical methods of possible systems are tested empirically
3. mathematical modelling, using data derived from existing systems to derive optimum designs
4. computer simulation models, by which many complex quantitative interactions can be represented and the likely consequences predicted.

Each of these approaches has applications in evaluation of hospital design. The main problem is in obtaining reliable data on which to base comparisons or predictions of new designs which may themselves cause changes to the data on which the evaluations are based. This 'catch-22' situation may only be solvable if the design 'model' becomes the design 'actual' so that the building or piece of equipment can change in response to feedback on how well it is functioning.

Another research project in the USA which had some influence on hospital building design was carried out at the Architectural Research Unit, University of Pennsylvania by Sheila Clibbon, an architect, and Marvin Sachs, a doctor (1969,1970, 1971, 1972, 1973). The aim of this research was to explore new ways of designing hospitals to respond to their continually changing needs by providing 'like-spaces' instead of 'Bailiwicks' for hospital departments. The separate grouping of spaces for 'patient fostering', 'clinical techniques' and 'industrial techniques' was proposed in a number of hypothetical design studies which were however never put into practice in actual construction. Clibbon ended a paper on 'Innovation in the Design of Health Care Facilities : Some Influences of Systems Building', delivered to the First International

Systems Building Conference in Boston in November 1971, with a warning regarding the rigidity of the way information on hospital design was organised and presented. She continued:

> "If we stick to existing administrative and physical organisational schemes, new designs are easily evaluated and compared with old ones, one like part with another like part, rather than one total system with a different total system.... Behind all this is our inability to collect and handle all the needed data and our willingness to let these limitations of systems approaches dictate what we will design and build in the future. We must be careful not to let the tail wag the horse."

But perhaps more than any other single person's influence on hospital planning has been that of Gordon Friesen (1961, 1975) whose 'newest concepts' of supply processing, storage and distribution revolutionised the design of hospitals in North America and elsewhere from the mid 1950s onwards. The design of wards in 'Friesen' hospitals was developed round the shared supply area which receives all supplies from the central supply department via a conveyor belt or by trolleys on an exchange basis and delivers them to 'nurservers' or clean supply cupboards outside each patients' bedroom. This system has subsequently been used in many new hospitals in many parts of the world (see fig. 5.13 below):

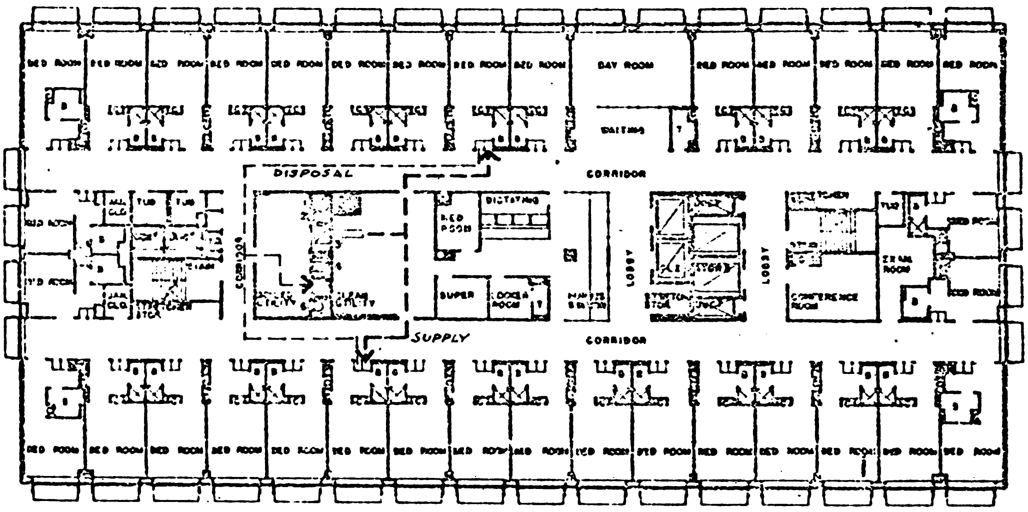


Fig.5.13 Friesen central supply system, Holy Cross Hospital, Silver Spring, Maryland; Gene Verge & Clatworthy, architects.

5.4 FACTORS SHAPING HOSPITAL DESIGN

In an article entitled 'Factors which determine hospital design' Lindheim (1966) listed a number of factors affecting the design of a typical hospital building, including technology, medical practice, organisational concepts, living standards, and the desired 'image' of the hospital. More specifically the architect would be concerned with the site, orientation, building codes, costs, materials, ability to expand, and relationships between departments. Decisions would be made on building shape, traffic routes, appearance and many other design details. But underlying all these considerations were three fundamental and interlocking factors:

1. the goals of the institution
2. the plan of operation
3. the plan of the physical facility

Lindheim condemned the widely held belief that changing the shape of hospitals or wards is the way to solve their problems or improve their efficiency. Nevertheless 'spatial patterns have a very strong hold on thinking and on attitudes" (p 1670). In a later study on organisation and design of radiology departments Lindheim (1971) showed how an analysis of the requirements of radiological diagnosis could lead to totally new concepts in how radiological facilities should be designed.

One of the most important factors influencing hospital building design is the organisational concept of hospitals as assemblies of separate departments or activity zones linked together by a communication network carrying people, goods, energy, information and waste materials (Great Britain MoH 1961). Some of these types of traffic emanate from one point and serve all kinds of departmental zones like an electrical ring main circuit. Other journeys go from point to point. The communication system therefore has to facilitate both kinds of journey as well as providing a means of escape in the event of fire. The pattern of corridors, stairs and lifts may either aim to provide for all types of traffic equally, or it may be designed to give preference to special types of traffic on account of frequency, urgency or cost.

Some traffic types, eg removal of waste, may need to be kept apart from areas which are considered clean. Vehicle delivery points and carparks, being noisy, should be sited away from areas needing quietness, such as wards and teaching facilities. Urgent traffic should not be encumbered by staff going to and from meals. Visitors and outpatients should be able to find their way easily to their intended destinations without getting lost or penetrating restricted zones such as wards or operating departments.

Zoning of hospitals (and health centres) into public, staff and shared areas, is one way of controlling access and maintaining security and confidentiality (Cammock 1975). Other reasons for grouping of specific departments or activities into zones are: sharing of engineering plant, accessibility to transport, and provision for occupants (especially in-patients) to benefit from interesting views of the outside world.

Considerations of economy, comfort, health and efficiency require that buildings do not impose thermal, visual, auditory or respiratory stress on their occupants (Goromosov 1968), and that an equable internal temperature range can be maintained even with extreme diurnal temperature variations, without the need for costly engineering plant or high running costs. Buildings with a high ratio of external wall and roof area to internal floor space tend to cause excessive heating or cooling loads in extreme weather conditions, depending on the climatic orientation of the building and site (Atkinson & Phillips 1964). Constructional features such as overhanging eaves and varandahs provide protection from sun, wind and rain (Jenkins & James 1978).

Building thickness affects how far natural lighting and ventilation can penetrate effectively into a building interior (Ne'eman et al 1966, Cockram et al 1971). But many other factors, such as the type of external wall and ground surfaces, and the degree of obstruction by internal partitions and curtains, will modify what may otherwise be an ideal building shape for comfortable internal conditions (Markus et al 1972).

Detail design of windows - their size, shape, degree of recession, spacing, sill height and means of screening from sun, wind, rain and insects - affects how buildings appear from the outside and what sort of view their occupants have from inside (Taylor 1979, Turner 1971, Nuffield 1955 ch.4). While views from the twentieth floor may be worth the discomfort penalty in bad weather, large areas of glass, even in relatively cool climates, cause excessive heat gain on the sunlit side, and may require external shading devices. These are not only costly to install and maintain, but also obstruct the view and attract unwanted birds (Jenkins & James op cit).

Due to the high cost of air-conditioning and window systems, some hospital designers have opted to follow a trend in the industrial field and provide almost entirely windowless buildings. These can be cheaper to build and run than factories or warehouses with side windows and roof lighting (Stone 1975, IES 1972), but their psychological and health effects have caused concern (Hillman 1973). Deep buildings require permanent artificial lighting in interior areas which has been suggested as a primary cause of visual fatigue and other stress symptoms (Medical

Journal of Australia 1970). Waste heat from artificial lighting installations also has to be dissipated in summer, although this can be utilised in cooler weather. In very well insulated buildings this heat source may even be used as the primary source of heating.

Internal traffic in the hospital as a whole has had an increasingly powerful influence on building shape and layout, particularly since the development of the electrically powered lift and other mechanical means of transportation (Strakosch 1979). Aware that increasing sophistication of medical technology and management methods were requiring equivalent sophistication in the design of hospital buildings, a number of researchers in the USA, Britain and Europe have developed methods for deducing optimum building shapes from predicted data on frequencies and importance of internal traffic journeys between departments in hospitals.

Among the first researchers to develop computer simulation of internal traffic in hospitals Souder et al (1964) based their traffic data on two newly built acute general hospitals of about 200 beds each. From these data comparisons were made between a number of hypothetical hospital layouts to determine an optimum layout which would minimise either overall journey times, overall journey cost, or time and cost of specific journeys. The choice was left to the researchers as to which criterion to use. The relative weight to assign to given types of journey was deduced from staff opinion surveys, and from estimates of staffing and energy costs for each type of journey.

A number of other studies have been carried out in the USA and in Britain, both of interdepartmental traffic in hospitals (eg Great Britain MOH 1966, Cinar 1968), and of intradepartmental traffic in, for example, operating theatres (Whitehead & Eldars 1964), wards (Delon &

Smalley 1969), outpatient departments (Thunhurst 1971), and accident and emergency departments (Beattie 1972).

The study by Hughes (Great Britain MOH 1966) was based on predictions of the optimum traffic that should occur in a well-run general hospital of about 600 beds. Weightings were assigned to particular types of trip to produce a proximity factor, but only 18 departments could be separately identified because this was the maximum number of locations which the computer then being used could handle! All wards were therefore considered as one 'department'.

Cinar's study was one of the first to represent the hospital interdepartmental traffic system satisfactorily in three dimensions. Most methods of computer simulation of traffic and layout depend either on using hypothetical traffic data to test alternative layouts, or they propose a layout and then improve it to reduce the time or energy consumed in travel for a particular set of trips. In Cinar's method the arrangement of lifts, corridors and stairs has to be predetermined; the allocation of departments to different floors is then worked out from traffic data. Some of the intradepartmental traffic models can arrange groups of standard space units to accord with policies about allocation of specific activities to spaces, for example whether the activity space unit must be adjacent to a corridor or have access to the outside for light, view or ventilation.

The 'chicken and egg' problem crops up here because any spatial arrangement of activities generates some traffic movements that cannot be predicted. Also any change in organisation or operational methods will cause changes in the traffic movement pattern. Hence any spatial allocation or layout design method based solely or largely on traffic movements will put constraints on the types of activities which can conveniently be accommodated. Nevertheless such methods help to ensure that layouts are designed which are reasonably economical in terms of traffic movement.

Tabor (1970) analysed a selection of floor layout types commonly used in office buildings, ie single loaded corridor, double loaded corridor, cruciform and hollow square. He then determined mean journey lengths between all rooms in such layouts, assuming an equal number of standard size rooms in each case. With a layout accommodating 32 standard rooms the actual journey distances are shortest in the double loaded corridor layout and longest in the single loaded layout. The cruciform and hollow square layouts are slightly less 'efficient' than the double corridor layout in minimising journey distances.

Somewhat similar studies have been conducted on hospital ward layouts of different sizes and types (Lippert 1971, Trites et al 1969, McLaughlin 1964 & 1969, Freeman 1967, Great Britain MoH 1963, Jacobs 1961, Thompson & Pelletier 1959). The findings of these studies cover a bizarre variety of ward shapes, but for optimum convenience and reduction of unnecessary walking by nurses the double corridor or race-track layout is hard to beat. Circular or radial layouts may however be preferred for intensive care units. The priorities placed on economy of staff traffic movement, together with convenience for patients, ease of nursing supervision, adaptability of floor space, simplicity of structure, view of the outside, and control of noise, for example, determine what shape is finally selected for a particular ward or department layout.

Gray (1975) described a computer aided method for optimising layouts. from a set of predetermined department profiles designed according to certain rules of assembly within the Harness hospital constructional system (Great Britain DHSS 1972). Nevertheless the range of choice left open to the designer will be constrained by the weighting or order of values placed on particular requirements, whether these are cost related and quantifiable, or are determined subjectively.

An earlier study by Souder (1963) proposed methods of estimating space needs and building costs for new hospitals on the basis of analysis of spatial allocations to different functions in a large sample of existing hospitals. As floor space is such an important factor in determining building costs there is a strong incentive to produce a quick rule-of-thumb table for use in the early phases of planning for estimating the amount of floor area required for each main department in a hospital.

Various means of analysing floor areas by departments have been devised (eg Great Britain MOH 1961, DHSS 1969 & 1974, Weeks & Best 1970, England 1971, NSW Health Commission & Government Architect 1975, and Davies & Howells 1976). Most of these methods depend on an analysis of previous hospital designs and serve only to generalise about the distribution of floor space to particular kinds of departments, and thus tend to perpetuate existing patterns of spatial distribution.

Few of the methods of analysing departments agree on the means of division or classification by function, and so direct comparison between space allocation in different hospitals is impossible unless the detailed floor layout drawings are carefully analysed according to a particular classification method. It is difficult, for example, to compare British hospitals planned according to DHSS Building Note guidance, American hospitals planned on US Public Health Service parameters, and NSW hospitals planned to follow the NSW Health Commission guidelines.

Considerable differences are however apparent in the standards of space allocation to particular departments serving the same purpose in different hospitals. The Best Buy hospitals in Britain, for example, provide approximately 185 sq.ft. ($17.2m^2$) per bed in general wards compared with about 285 sq.ft. ($26.5m^2$) which was recommended in the DHSS Building Note on wards (1968), while the Greenwich District Hospital (Green et al 1971) provided about 250 sq.ft. ($23.3m^2$) per bed in general wards. The number of beds in a nursing unit clearly affects the amount of floor space per bed within each unit - the larger the number of beds the less space is required per bed. Thus there is an incentive to increase the number of beds per nursing unit if the cost criterion is cost per bed. If however the criterion is cost per unit of floor area, a hospital with a higher floor area per bed will show lower unit cost of floor area but a higher overall cost per bed. Which criterion to use depends on the purposes of comparison.

The mean floor area per bed for complete hospitals may be as low as 500 sq.ft. ($46.5m^2$) for a small community hospital with simple supporting services. For a large teaching and research hospital the equivalent statistic is around 2000 sq.ft. ($185m^2$). Determining a basis for allocating space and money to hospital buildings or comparing value for money between different sizes and types of hospitals is thus far from simple.

5.5 INNOVATION AND VARIETY IN HEALTH FACILITY DESIGN

Health facilities, particularly hospitals, built over the last thirty years exhibit a bewildering variety of design characteristics, bearing in mind that they were all designed for broadly similar user requirements and environmental conditions (see Stone 1976). Even individual departments such as wards and operating suites exist in a wide range of layouts and types of construction which seem to have little to do with their particular local needs or constraints.

Exceptions to this general trend towards variety are those hospitals designed and built as part of a program of similar building projects originally conceived as total systems rather than as 'one off' projects (Architectural Forum 1953, Agron & Borthwick 1972, Great Britain DHSS & Hospital Design Partnership 1972, Architects Journal 1974, Billing 1977). Some of these 'systems' hospitals were 'semi-open' thus permitting a wide range of individuallity in design, eg the Mineworkers' and Harness hospitals; while others were virtually standard hospital or department designs, eg Best-Buy & Nucleus hospitals. Several systems of design and construction have been proposed which employ a standard framework within which virtually any department or building layout may be produced (eg Sheoris 1973, Zeidler 1976). The majority of hospital designs in developed countries are, however, unique for reasons which probably reflect their designers' need to innovate in a search for better solutions.

In chapter 2 various approaches to planning and design were described and compared. Some of these approaches allow greater opportunity for personal expression of ideas by planning team members and this may largely account for the individuality of the designs which they are responsible for (Moore & Smith 1975). The question remains however whether variety for its own sake is better than conformity or repetition.

Good designs, that is those which satisfy their users' requirements efficiently, are usually a result of continual development and improvement. But the requirements and conditions may become changed so that the old designs are no longer viable. In this event a new range of possible designs are generated until one or two become established by a process of natural selection (Whyte 1951, Vernon 1970, Whitfield 1975).

Alexander et al (1977) have catalogued a range of environmental designs or 'patterns' which are found to work well by experience, but unfortunately many of these are not known or not understood. The 'pattern language' proposed by Alexander and his colleagues was intended to be used in building and planning for a wide range of human activities. A companion book described the methods of applying the patterns in the creation of towns, buildings and rooms (Alexander 1979). In the past 'patterns of design' were well established, and variety was provided by the particular qualities of the individual craftsman or designer. Today commercial competitiveness causes new designs to be created unnecessarily before the older ones have had time to become established, modified and improved (Heskett 1980 p 72, Hospital and Health Services Review 1980).

From an economic viewpoint there is little doubt that producing identical hospital buildings or departments which meet their users' requirements reasonably well is more efficient than varying the designs to satisfy the whims of particular client organisations.

Copying another hospital design in inappropriate circumstances can however result in increased cost if many modifications have to be made to the original design to fit the new circumstances - the new Casaurina Hospital in Darwin is a case in point. It took nearly three years to adapt the design of Woden Valley Hospital in Canberra (on which the Casaurina Hospital design was based) to make it fit local requirements, and even then there was some criticism that the design was not really suitable for its requirements and location (Hyde 1973, Spain 1980).

In health centre design Beales (1978) has documented instances where the clients (mainly doctors) have unduly influenced the design of new health centres, resulting in inefficiency in operation and use of space. Many health centres in both Britain and Australia have been designed to meet the whims of particular people without a proper understanding of the functional requirements of their users (Cammock 1973 & 1975, Australia Department of Health 1978). Some standard designs have been produced for temporary health centres, eg in Canberra in the early 1970s, but they have subsequently been replaced by more permanent buildings of greater architectural impact, individuality and cost.

A comment from one doctor, in a recently completed new health centre in Canberra, was that he found the previous rather cramped temporary building much better for staff interaction and team-work than the newer more interesting and spacious but dispersed building. Beales (op cit) makes the point that the original idea for health centres in Britain was to promote the 'health care team' concept, but in many cases the design has inhibited or prevented this from happening (p 5). Apparently inflexibility in layout and construction was one cause of the problem, but also lack of awareness of the planners and designers in what was actually happening in health centres, or what <u>should</u> happen in them.

Alexander et al (1979) see most new health care facilities as:

> "enormously expensive....inconvenient because they are too centralised....tend to create sickness rather than cure it because doctors get paid when people are sick." (p 252).

'Community mental health centres' were developed in the USA in the late 1960s, but they tended to reinforce the patients' sick role rather than promote mental health in the community (Alexander ibid).

The only health centre planned to promote health activity instead of treat illness was the Pioneer Health Centre at Peckham in south east London which initially occupied a converted house when it opened in 1926. Later a permanent building was designed by the engineer Sir Owen Williams and this operated from 1935 until war broke out in September 1939. The building was designed round a swimming pool and contained a gymnasium, theatre, cafeteria and various recreation and craft rooms besides the relatively small amount of clinical accommodation. The three storey flat slab reinforced concrete structure was a simple rectangular glass box which allowed considerable flexibility in the arrangement of spaces by removable breeze block partitions (see Architectural Review May 1935). The layouts are shown below:

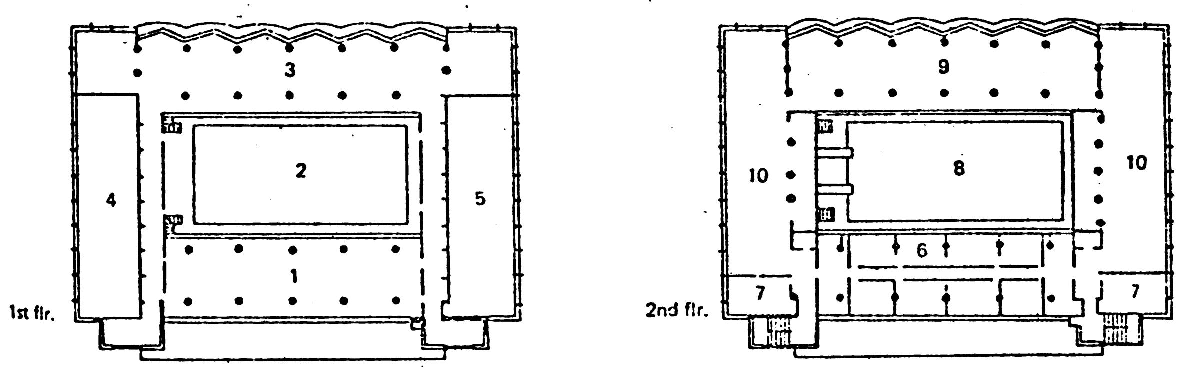


Fig.5.14 Peckham Pioneer Health Centre, floor layouts (Source: Cox & Groves)

0 — 18 m
0 — 60 ft

1 lounge & cafeteria
2 swimming pool
3 lounge
4 upper part gym
5 upper part lecture hall
6 medical rooms
7 dental
8 upper part pool
9 library & rest room
10 study & recreation

In a book on the Pioneer Health Centre experiment Pearse & Crocker (1943) describe the requirements for flexibility in the following terms:

> "the activities of its members cannot be pre-designed but must grow spontaneously. Hence the need that the construction of the building should be such as to give opportunity for maximum fluidity and change in its continuously unfolding 'organisation'" (p 301).

Many hundreds of health centres have been built in Britain, USA, Canada, Australia and New Zealand, but very few indeed have followed in the pattern established at Peckham. Why? Mainly, it appears, because of the strength of the medical profession in promoting a sickness service rather than a health service, and the reluctance of most general practitioners to be integrated into the local community health and welfare services.

Few health centres in NSW include general practitioner services, although most of those in ACT provide facilities for group practice doctors and dentists in addition to social workers and community nurses. None however offer the range of social and recreational facilities provided in the original Peckham centre which now accommodates conventional group general practice facilities and various health and welfare clinics.

The planning and design of most British, North American and Australian community health centres would appear to fail to meet even the basic requirements of promoting teamwork among the primary health care professionals who work in these centres (Beales op cit p 3-9). Inappropriate variety in health facility design may therefore be due to requirements not being investigated properly, or set down sufficiently clearly, thus providing no criteria for evaluation of design proposals and leaving too much scope for individual choice.

5.6 HOSPITAL CONSTRUCTIONAL DEVELOPMENTS 1960-1980

Most modern hospital construction has tended to follow the traditional approach of 'one-off' designs rather than adopt a systems approach to health building in which 'off-the-peg' structural systems are applied to a program of new building projects (Agron & Borthwick 1972, Ratcliffe 1979, Architectural Record 1979).

Choice of constructional methods and systems for hospitals will be determined largely by economic factors, but most recent multi-storey hospital buildings are medium or long span framed structures of reinforced concrete or steel, or a combination of the two. Structural grid dimensions vary, but many hospital designers have adopted a structural column spacing which coincides with typical room widths of 3.6m or 7.2m (11 to 12 ft. or 22 to 24 ft.) (Weeks et al 1976).

Some hospital systems, such as the Best-Buy hospitals in Britain (James 1972), have used a relatively short span frame and panel structure which limits the extent of internal spatial flexibility (Great Britain DHSS 1968). Other structural systems, such as those used on the Greenwich Hospital and the Harness system hospitals, have opted for longer spans up to 64 ft. (22.4m) which give considerable freedom in the planning of rooms and departments without interference from columns or structural walls (Holroyd 1968, Great Britain DHSS 1972).

Approximately fifty or so large hospitals built recently have adopted the 'interstitial space' or service sub-floor concept which was first used experimentally in a British Hospital at Greenwich, although the concept had previously been used in laboratory and industrial buildings in the USA and Britain (Devereux and Charlton 1962).

The advantage of a service sub-floor over the more conventional system of small scattered vertical service ducts is that installation of pipework and ductwork can be carried out at waist level instead of overhead in a false ceiling space or in cramped vertical shafts. This permits faster installation work and allows more building tradespeople to work concurrently in one building zone without interfering with one another. Subsequent alterations and inspections of services can be carried out relatively easily in the sub-floor space provided it is high enough to walk upright between beams, and there is sufficient light, ventilation and space to work comfortably and conveniently. (Building Systems Development & Stone Marraccini & Patterson 1972, Sheoris 1973).

A number of hospital building systems have been developed which employ large modular units containing between 450 to 650 m^2 (5000 to 7000 sq.ft.) of floor space uninterrupted by columns or service ducts (Sheoris op cit, Zeidler 1976). These systems tend to cost more than conventional structures, but the cost savings in installation work, and in later flexibility of rearrangement of services and partitions, is considered worth the extra premium of 3 to 8% on construction costs (Mathers & Haldenby 1979, United States General Accounting Office 1972).

The modular unit approach to health facility design has also been adopted on a smaller scale for mobile transportable hospitals and for health centres (Buchanan 1981). The relatively high cost of such systems prohibits their use in conventional situations, but they have been used successfully for military and emergency purposes. It is worth remembering that Brunel designed the military hospital at Renkioi as a transportable demountable building system in 1855, and that the pavilion wards of Lavoisier and Nightingale were essentially modular space units linked to and served by a corridor. The recent Harness and Nucleus hospitals in Britain have in many respects adopted the same principle.

Design of engineering services in hospitals has traditionally started after the basic layout and structural design concepts have been decided. But with the increasing cost and complexity of engineering services, and the higher proportion of capital and running costs being due to service installations, it is now regarded as axiomatic that engineering service consultants should have as much influence on basic design as the architectural and structural consultants. The development of the interstitial space (ISS) concept is a reflection of this approach, but the building contracting industry has been slow, especially in Britain and Australia, to take advantage of its benefits in speeding up construction (Eden 1962, Building Design Partnership 1978, 1979).

The 'energy crisis' has caused a major re-think of many aspects of engineering design, particularly as regards design for minimal energy consumption and the need to provide safe conditions in the event of prolonged power failures. This has caused engineering systems to be designed for minimal wastage by thermal loss or gain, and for maximum reliability and simplicity in use. It has also caused a return to natural lighting and ventilation wherever possible, rather than depending on high energy consuming artificial lighting and air-conditioning systems (Wallington 1980). Those hospitals designed before the energy crisis, and which adopted high energy consuming environmental control systems, now have little option but to continue to pay the price in heavy running costs, or close down the most expensive areas to maintain. Where such options have been built into the design, ie to enable natural or mechanical ventilation to be used, this clearly imposes more stringent requirements if other factors, such as infection control, are to be met.

The need for spatial flexibility, and the corresponding need for engineering service availability at virtually any point, have caused a major revolution in the way some hospitals have been designed and constructed over the last 20 years. They may however have led to economic problems such as high energy consumption and high staffing levels in many new hospitals. Inability to adapt to a changing environment may have caused the extinction of the dinosaurs. Large and complex hospitals may be doomed to the same fate.

5.7 AN ANALYSIS OF SOME CHARACTERISTICS OF HOSPITAL DESIGN

Hospital buildings have been classified into a variety of generic types (eg Green 1966, Agron et al 1972, Mikho et al 1974, Davies et al 1976). These generic types reflect three principal influences: 1) the desire to provide an adaptable and convenient interior, 2) the effects of the site and location of the building, and 3) the wish to create an 'architectural' statement. These three influences are more or less equivalent to Souder's (1964) 'utility, amenity and expression'.

Building shapes can also be classified according to a number of spatial or geometrical qualities: 1) relative height, number of floor levels, 2) degree of cohesiveness or spatial continuity, and 3) degree of compactness or extension. Buildings may therefore be described as high (over say 8 or 10 floors), medium height (4 to 7 floors) or low (1 to 3 floors); they may be highly cohesive and continuous (as in a large aircraft hanger) or dispersed and fragmented as the separate huts in a primitive village; and they may be very compact as in a solid cubic shape or extended as in a building with pavilions linked by long corridors. Other characteristics, such as type of structure, means of distribution of engineering services, number of entrances, internal arrangement of corridors, lifts and stairs, will affect how well the building may meet its various requirements.

The number of generic building shapes identified by the various authors listed above varies from five to eleven, although it is hard to see the difference between some of the eleven categories illustrated by Davies et al (op cit p 1-13). The six shapes identified by Green are shown in the diagram overleaf (fig. 5.15).

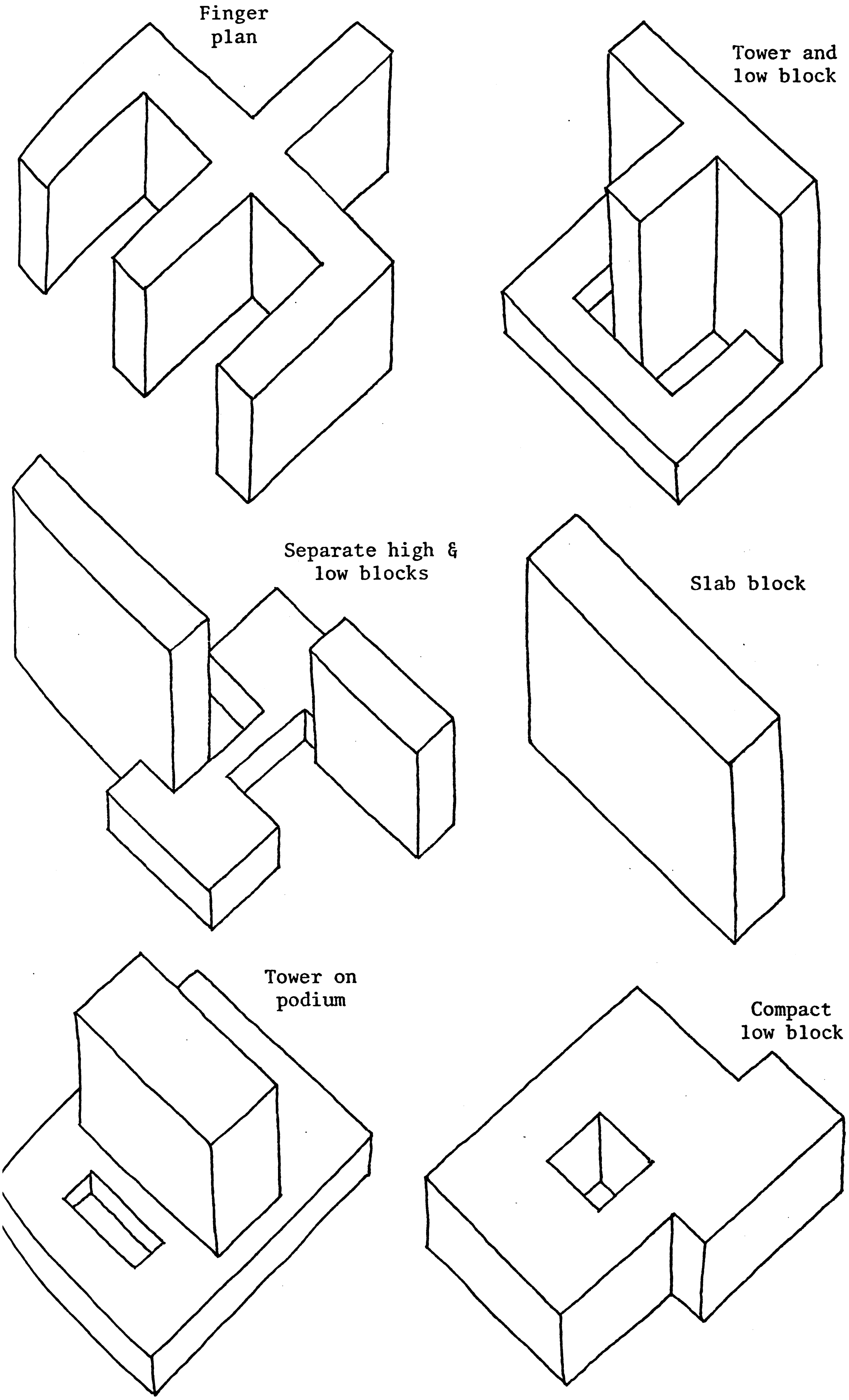


Fig.5.15 SIX BASIC TYPES OF HOSPITAL BUILDING SHAPE

The following comparison shows the different categories identified by Agron, Davies and Green:

AGRON	DAVIES	GREEN
high block	independent block	slab block
low block	'Harness' type	(as compact low)
tower on base	'T' block on base tower on podium	tower and low block tower on podium
(as low block)	cellular type	(as compact low)
pavilion	'Nightingale' type	(as finger plan)
(as low block)	'Greenwich' type horizontal linear horizontal square	compact low block
articulated	random blocks	separate high and low
(as pavilion)	finger plan	finger plan

A discussion paper circulated by the writer in 1963 identified eight measurable ways in which building shapes differed:

1. extent of ground covered
2. overall height
3. area of continuous space on one floor level
4. perimeter length of all floor levels
5. the area of space further than 6m (20 feet) from an outside wall
   (OR the number of internal rooms with no windows to the outside)
6. area of external wall and roof surfaces
7. disparity between floor areas on different levels
8. distance of furthest points on each floor from a central point measured along the shortest practicable route.

Seven other qualities were also identified which were dependent on detail design and local circumstances:

1. ease of adding on to a building
2. scope for changes in function and in spatial allocations to departments
3. scope for rearrangements of room layouts
4. degree of physical and social isolation between zones

5. ease of adapting the design to different site situations
6. adaptability of the transport system to meet changing needs and circumstances
7. exposure to climate and external noise

Nine further types of differences were identified as being due to, or affected by, the type of hospital organisation or the detailed building design:

1. building cost
2. engineering services cost
3. maintenance costs of buildings, services and grounds
4. running costs
5. number of staff needed to operate the building and services satisfactorily
6. length of traffic journeys of different types during a typical working day
7. number of lifts and hoists needed to maintain a satisfactory service
8. efficiency in the utilisation of space and equipment
9. number of inpatient beds which could be conveniently grouped as one administrative unit.

Lastly, six features were listed which could affect the buildings' performance:

1. means of transportation used for goods eg trolleys, hoists
2. means of transportation of people eg lifts, escalators
3. method of distribution of engineering services eg false ceiling, vertical ducts, sub-floor
4. suitability of construction system for rearrangement of room or department layout
5. suitability of the design for extension of the building and services
6. simplicity of operation and maintenance of building and engineering services.

All the thirty characteristics listed above were then used to derive eight principal criteria as a basis for evaluation:

1. suitability for building on different sites eg sloping, small, awkward shape, existing buildings
2. suitability for phased development on new or existing sites
3. potential for future expansion of unknown type or extent
4. adaptability in design and construction and use
5. simplicity in design, construction and use
6. economy in design, construction and use
7. ease of communications for people, goods and information within and without the building
8. suitability for accommodating the various functions and facilities of the hospital.

Each of the six layout types identified by Green was analysed in respect of these eight criteria from which it appeared that the low compact form of building offered more advantages than the other five types. This type of building was then explored for the Greenwich Hospital development project then under discussion, and for which the low compact form of building was finally selected (Holroyd 1968). The low building form was also used in various forms for the Best-Buy hospitals (James 1972) and for the subsequent Harness and Nucleus System hospitals. A number of other hospitals have been constructed which reflect the apparent advantages of a low compact form, eg Loma Linda Veterans' Hospital in Southern Calfornia (Agron et al 1972), and the McMaster Medical Centre in Hamilton near Toronto (Zeidler 1975, 1976). Several other versions of low compact hospital have also been built, eg the Queen's Medical Centre Nottingham (Building Design Partnership 1978), and Flinders Medical Centre, Adelaide (Llewelyn Davies, Kinhill & Weeks 1975).

Two contrasting trends are evident from the foregoing sections:-
1) the search for new design ideas which offered hope for solving problems previously encountered in design and use of health facilities, and 2) the steady evolution and development of an idea in a number of designs over a considerable period of time, each design learning from the mistakes and successes of its progenitors.

The next section describes how hospital ward designs have evolved since 1948. It shows how design requirements of hospitals and wards have interacted, not always successfully, to produce some of the present unresolved conflicts in hospital design.

5.8 DEVELOPMENTS IN WARD DESIGN SINCE 1948

Design of post-World War II hospital wards in Europe, North America and Australia was influenced by a number of factors among which were development of mechanical handling systems for supplies, use of air conditioning, and higher standards of comfort, convenience and privacy for patients. Economy was however still an important consideration, and the Nuffield Investigation team (1955) carried out floor space and walking distance analyses of a number of ward designs from Britain, USA, France and Sweden. They found some differences in the allocation of floor space to various functions, and also in the amount of space per bed in the ward:

Table 5.1 Comparative floor areas of wards

ward	type	country	no. of beds	space/bed ft^2	space/bed m^2	% space bedrooms
A	Nightingale	UK	26, 2s = 28	200	18.6	61.2
B	modified N'gale	UK	2x8, 8s = 24	207	19.3	55.7
C	corridor ward	UK	2x8, 1s = 17	256	23.8	45.6
D	corridor ward	USA	2x4, 4x2, 8s = 24	249	23.2	46.8
E	corridor ward	France	4x4 4x2, 2s = 28	229	21.3	47.0
F	corridor ward	Sweden	3x6, 2x3, 1x2, 4s = 30	211	19.6	56.0

The Nuffield wards

The Nuffield team's investigations into ward planning culminated in two experimental buildings, one at Larkfield Hospital at Greenock in Scotland, the other at Musgrave Park Hospital in Belfast, Northern Ireland. The 32 bed Larkfield ward consisted of 6 four-bed bays and eight single rooms in two units of 16 beds, each supervised by a nurses' station. At Musgrave Park each ward sub-unit consisted of 20 beds in 2 six-bed bays, one four-bed bay and four single rooms. Floor space per bed at Larkfield was 218 ft^2 (20.3 m^2) and at Musgrave Park 194 ft^2 (18 m^2) (see figs.5.16 & 5.17).

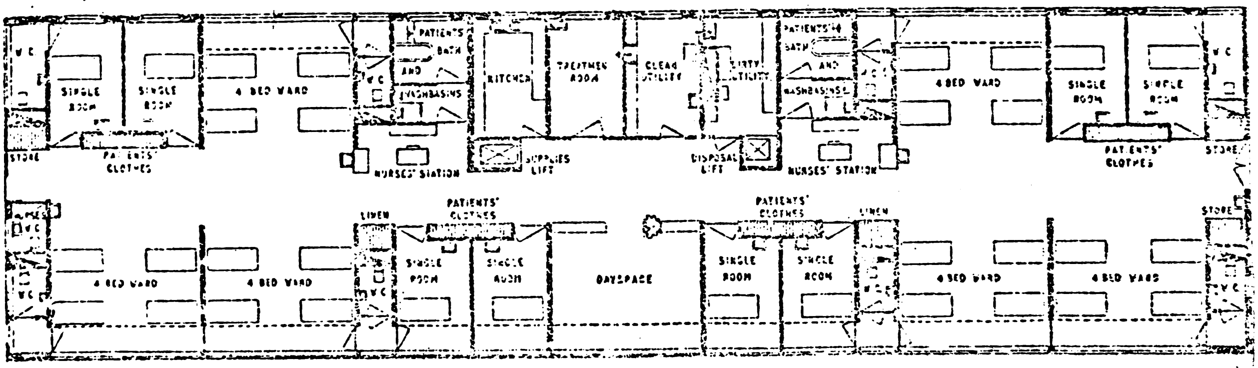


Fig.5.16 Larkfield Hospital, Greenock, ward layout
Architect, R. Llewelyn Davies

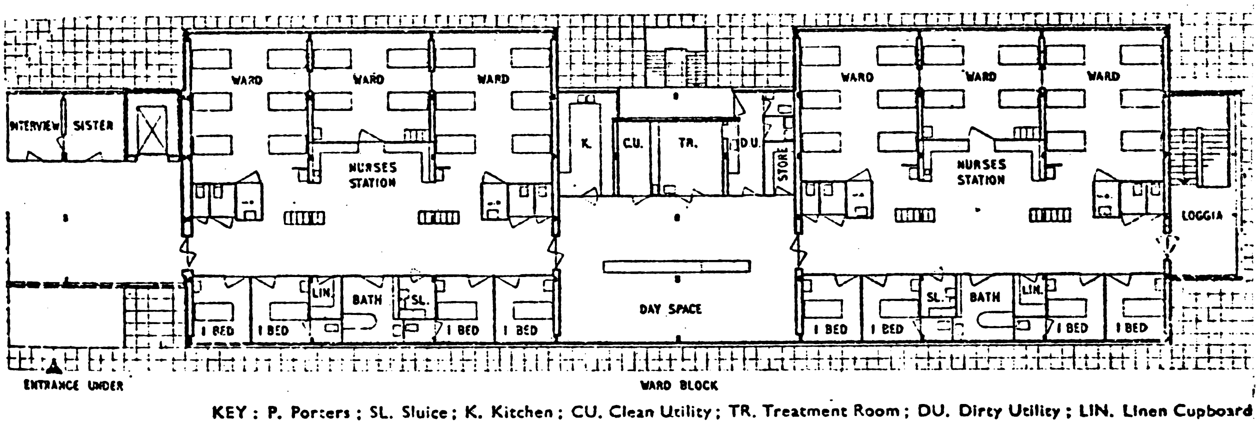


Fig.5.17 Experimental ward block at Musgrave Park Hospital, Belfast
Architect, R. Llewelyn Davies

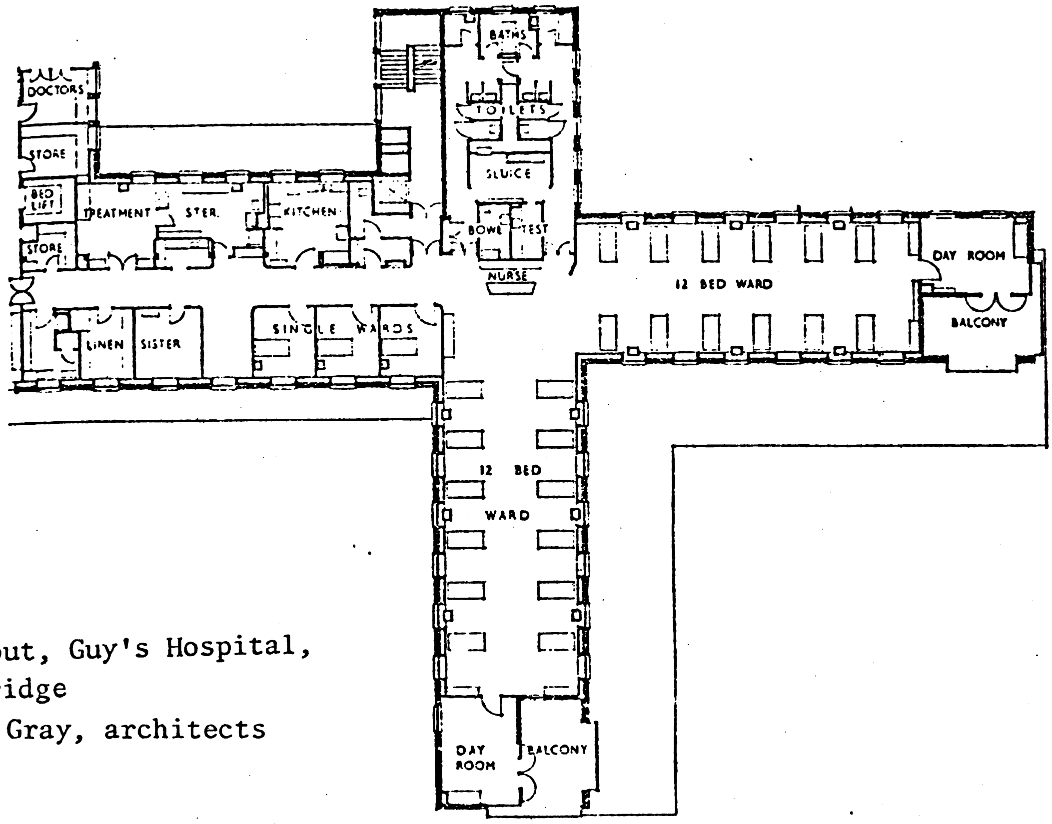


Fig.5.18

Ward layout, Guy's Hospital, London Bridge
Watkins, Gray, architects

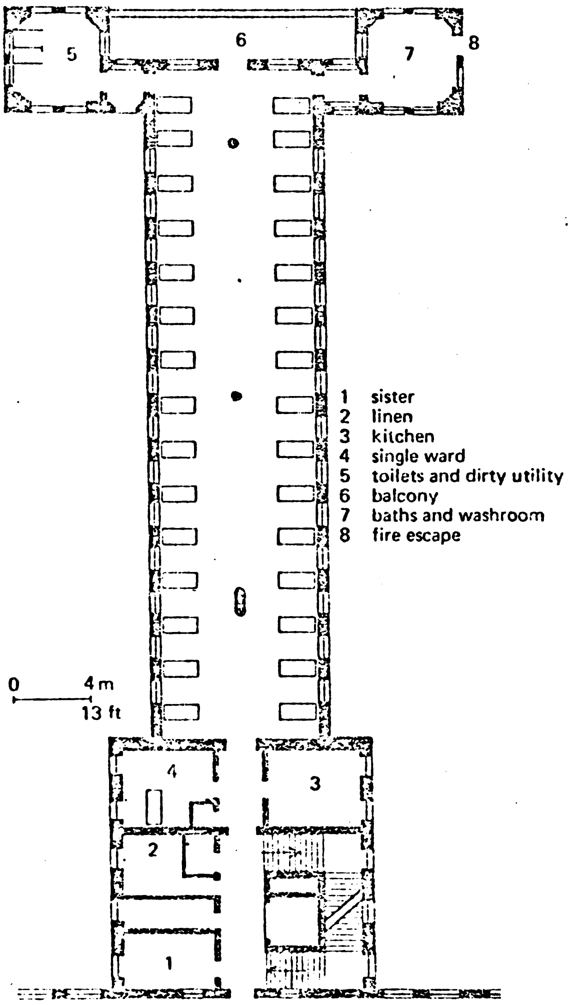


Fig.5.19

Nightingale wards, St.Thomas' Hospital, Lambeth

In both Nuffield ward designs there was some privacy for patients, but also good direct observation of most beds by nurses as they went about their tasks in the centre of the unit. Toilets in the Larkfield wards were accessible directly from the bed bays, being between each pair of bays. At Musgrave Park access to toilets was less direct though providing for more adaptability of space, less noise near patients' bed areas, and more economical grouping of plumbing services. In both wards patients had use of a buzzer to summon nurses if needed.

In London one of the first teaching hospitals to begin reconstruction after 1948 was Guy's Hospital where a new ten storey surgical ward block was completed in 1960. This design was a modified Nightingale ward in an 'L' shape with 14 beds in each arm. The design incorporated overlapping bed spaces with a shared 'no-man's land' between the beds. (see fig.5.18)

At St. Thomas' Hospital, London, an existing Nightingale ward (see fig. 5.19) was converted in 1959 to a partitioned layout with four-bed and two-bed bays each side of a central aisle (not unlike the Nuffield Larkfield ward. This experimental layout was used as the basis for the new T-shaped east wing wards built in 1965, each of which contained 28 beds in 6 four-bed bays and four single rooms. These wards had glazed partitions between the four-bed bays thus allowing nurses in one bay to observe patients in adjoining bays. This arrangement, however, diminished visual privacy for patients unless curtains were drawn across the glazed partitions when necessary. Three of the four single rooms were directly behind the nurses station at the cross of the T where they were near the centre of activities (see fig.5.20).

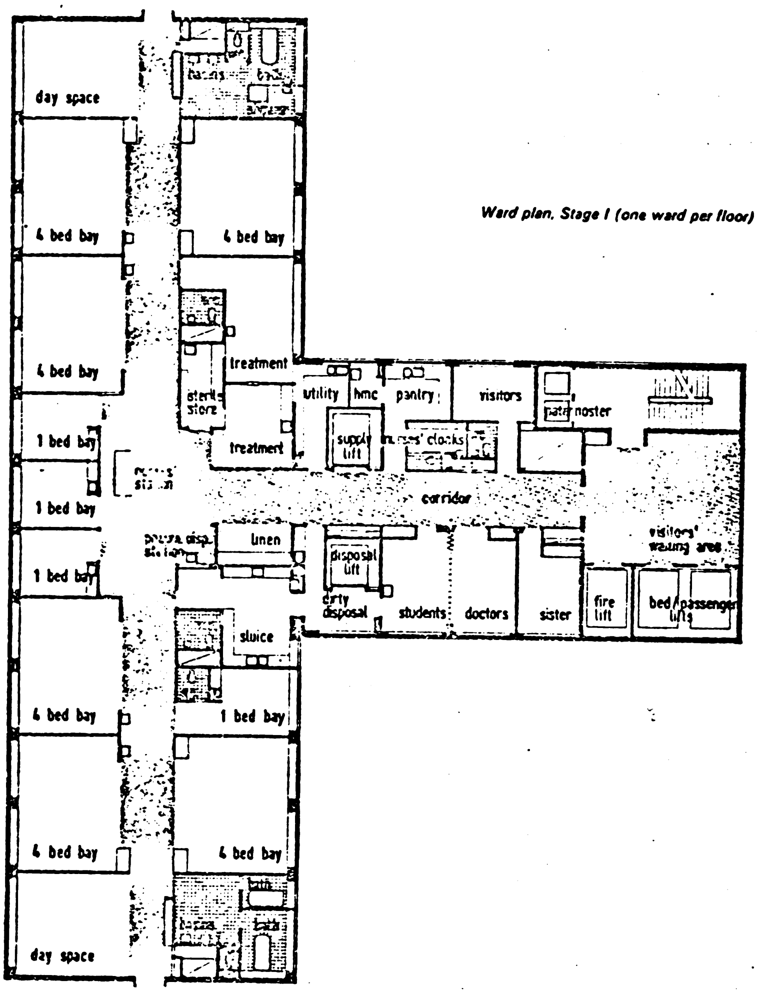


Fig.5.20 East wing wards, St. Thomas' Hospital, Lambeth
W. Fowler Howitt, architect

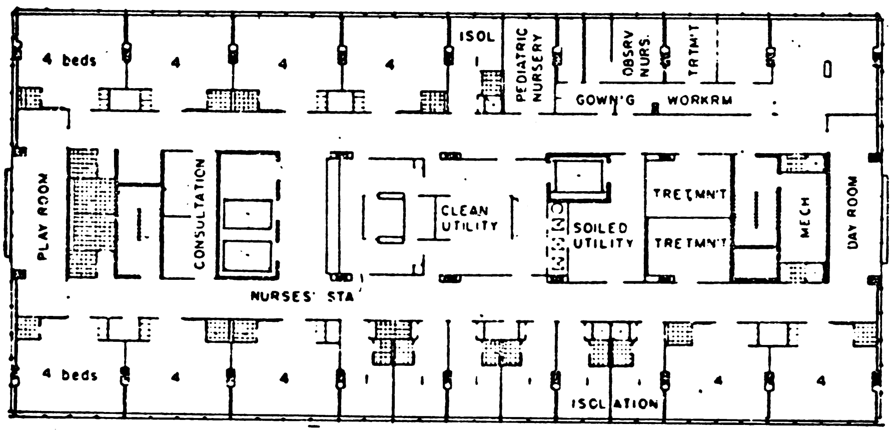


Fig.5.21 Harlan Hospital, Kentucky
Sherlock, Smith & Adams, architects

Mineworkers' and Friesen wards

Meanwhile in the USA a chain of ten hospitals ranging in size from 50 to 200 beds was built in the early 1950s in the Appalachian mountains for the United Mineworkers' Welfare Association. The hospital administrator, Gordon Friesen, advised on aspects of ward design and ward supplies handling, including the concept of 'nurservers' or supply cupboards outside each patient's room. These were kept topped up from supply trolleys replenished daily from the central supply department on a lower floor. The ward floors were often in the form of a double-corridor layout with the central zone between the two corridors housing the service rooms, all patients' bedrooms having an outside view and daylight. This form of layout, known as the 'racetrack' ward, provided a compact floor layout which took advantage of air-conditioning as well as reducing walking distance of nurses to a minimum. Patients' bedrooms contained mainly four, two or one beds. The wards at Harlan and Whitesburg are shown in figs.5.21 and 5.22.

The square deep-plan used in the 54-bed ward floors of the Whitesburg Hospital, Kentucky was subsequently taken a step further in the 176-bed ward floors of the 25 storey Bellevue teaching hospital in New York which contained four ward units of 44 beds, 30 beds being in six-bed rooms, 12 in three-bed rooms and two in single rooms. The layout is shown in fig.5.23.

The later north wing at St.Thomas' Hospital, which contained four L-shaped 28-bed Nuffield type ward units round the edge of a deep-plan floor (the centre area being occupied by teaching and ancillary rooms), was smaller but similar to the Bellevue layout.

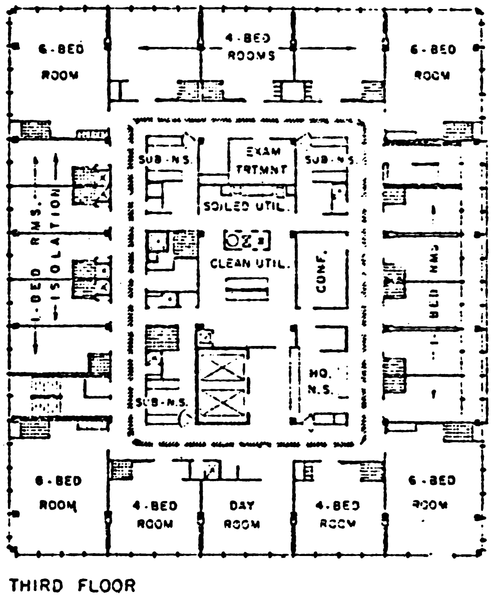


Fig.5.22 Ward floor layout, Whitesburg Hospital, Kentucky
Sherlock, Smith & Adams, architects

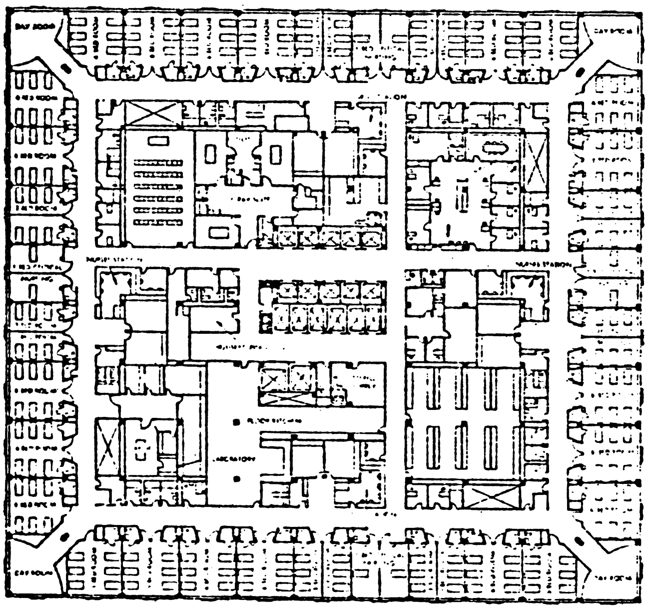


Fig.5.23 Floor layout Bellevue Hospital, New York,
Pomerance & Breines, architects

A number of new hospitals were designed and built in Britain during the 1960s, notable among which were the War Memorial Hospital at High Wycombe and the new hospital at Swindon, Wiltshire by Powell and Moya. The Oxford Regional Hospital Board was the client, and Llewelyn-Davies and Weeks from the Nuffield team were consultant planners for both hospitals. Many of the principles explored in the experimental wards at Larkfield and Musgrave Park were further developed at High Wycombe and Swindon.

In 1970 the Oxford Regional Hospital Board published a comparative evaluation study of the High Wycombe and Swindon wards. The two wards were similar in many respects, each unit consisting of 20 beds in a similar arrangement of four and six-bed bays grouped closely round a nurses' station. The main difference was that Swindon was a single corridor ward with 80 beds per floor, while High Wycombe had a double corridor layout with 40 beds per floor (see figs.5.24 and 5.25).

In comparing the views of staff and patients in the two ward blocks, it was found that the more compact 'U' shaped layout of multi-bed bays and single rooms round the nurses' station at High Wycombe provided better supervision and closer contact between nurses and patients than the more stretched-out layout used in Swindon. The cost of the High Wycombe ward was however greater due to more complex engineering services, especially ventilation in the centre core area.

Another ward design by Powell and Moya, Wexham Park Hospital, Slough, was also based on the Nuffield concept, but in this case an 'L' shaped layout was used with 16 beds in each arm. The single floor 300 bed hospital allowed all bed rooms a view out on to garden courtyards (see fig.5.26).

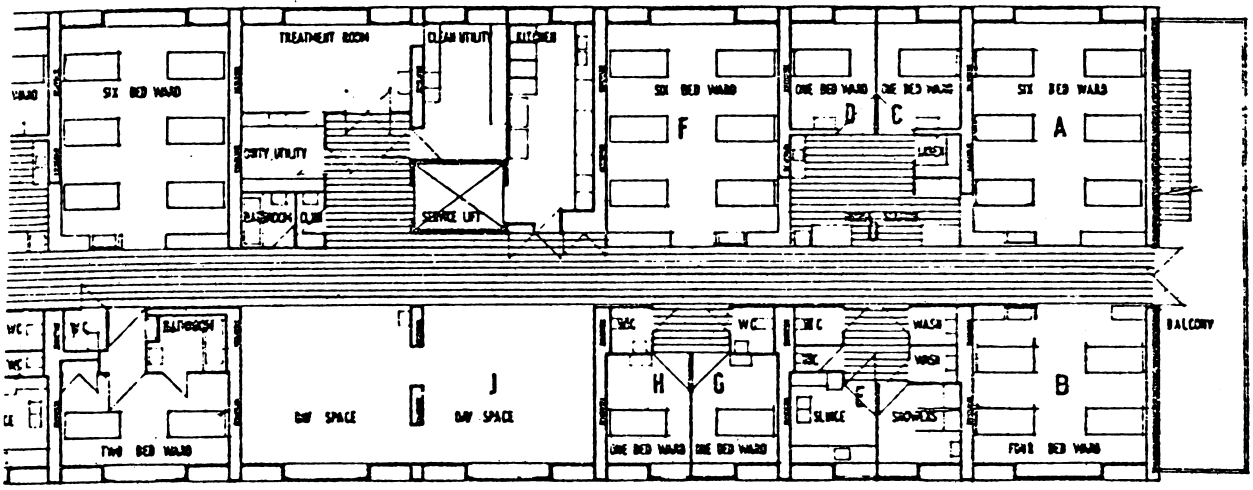


Fig.5.24
Swindon ward, Powell & Moya, architects
Llewelyn Davies, Weeks, planners

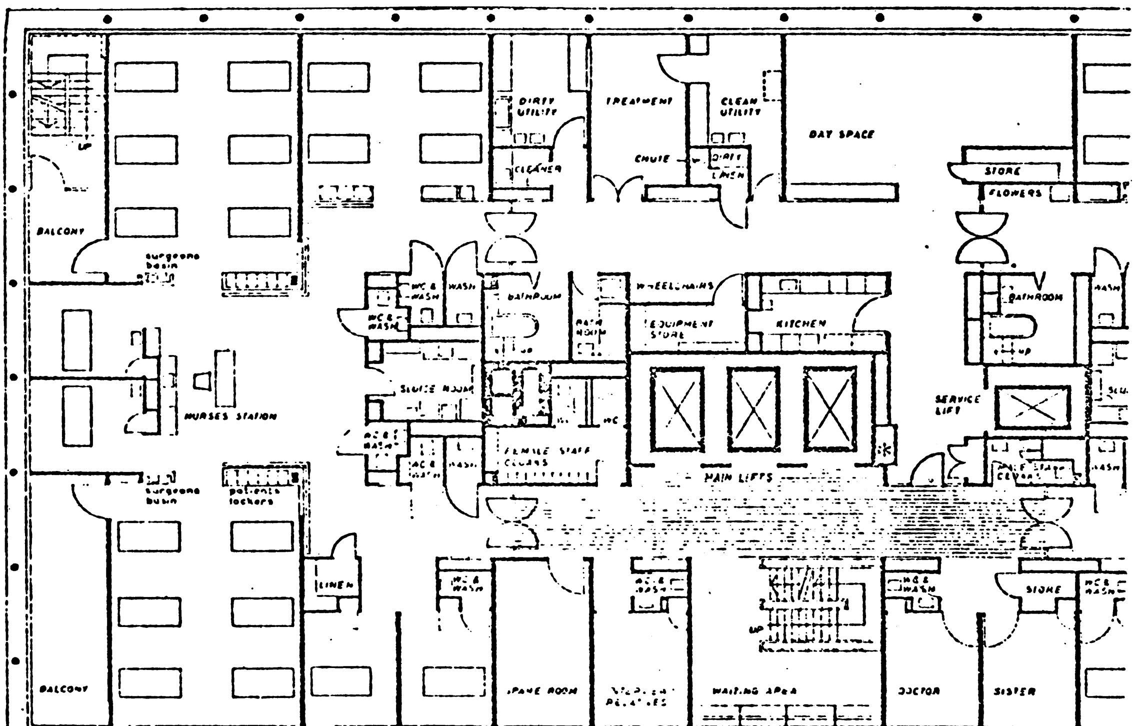


Fig.5.25
High Wycombe ward, Powell & Moya, architects
Llewelyn Davies, Weeks, planners

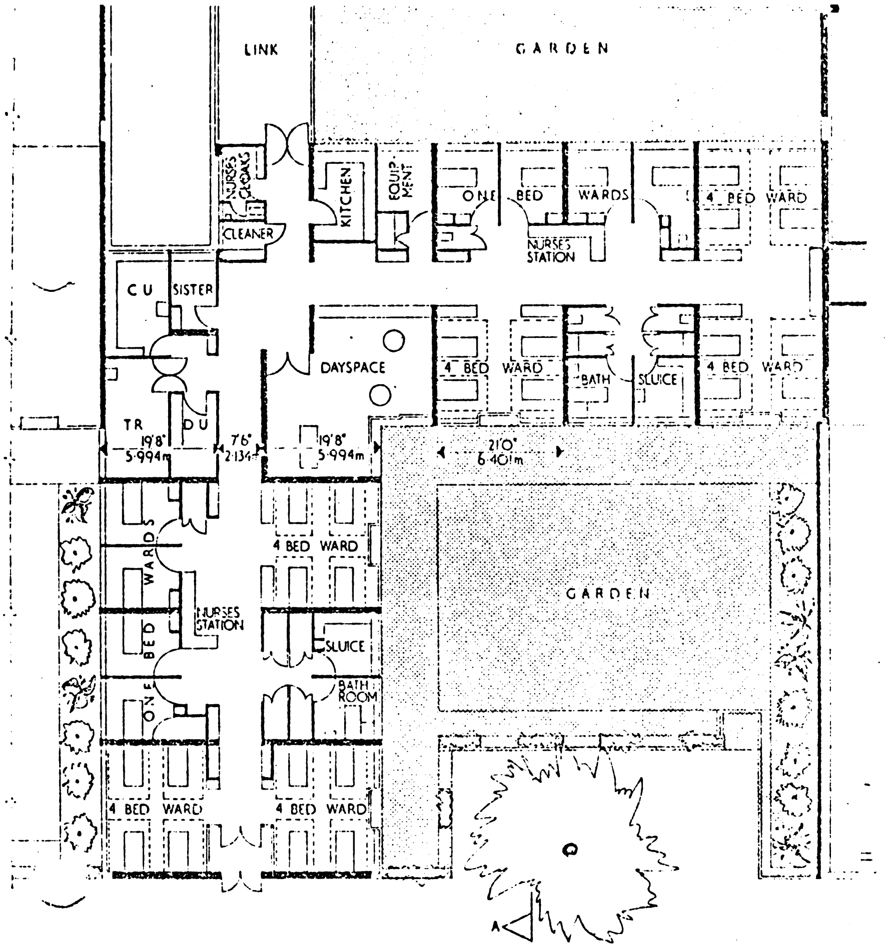


Fig.5.26 Wexham Park Ward, Slough
Powell & Moya, architects

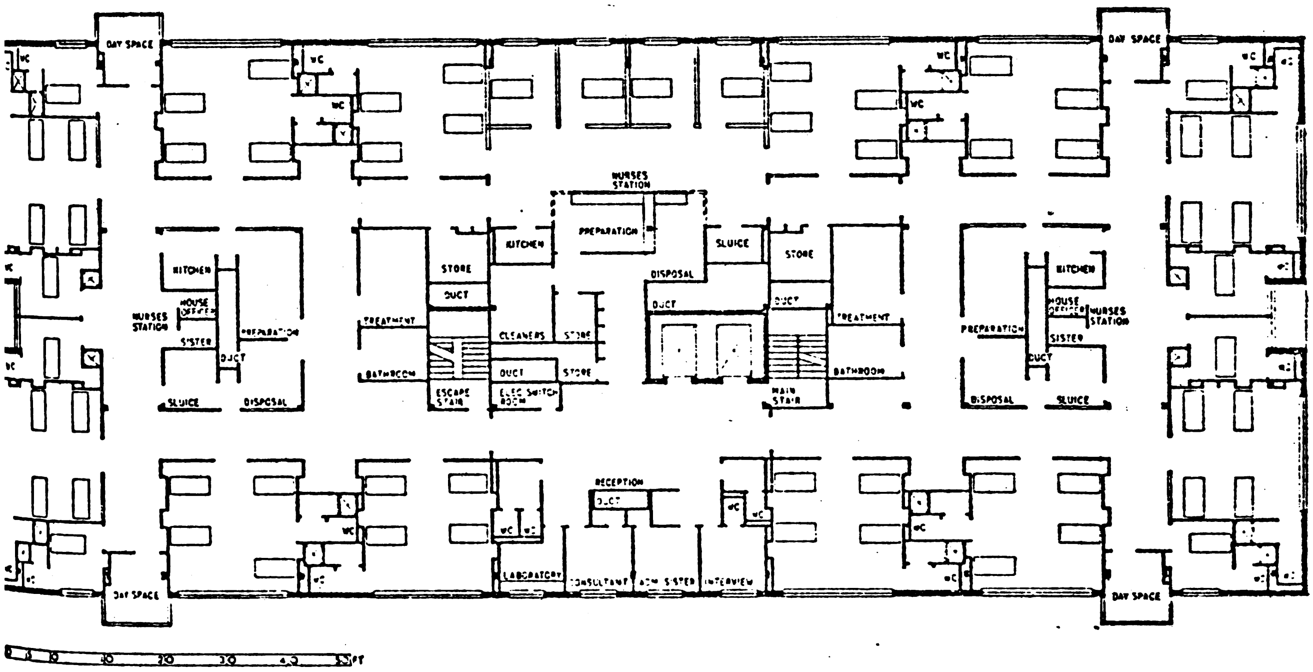


Fig.5.27 Falkirk Ward
Keppie, Henderson, architects, with SHHD & Western RHB, Scotland.

DHSS and SHHD Development Groups

When the British Ministry of Health set up its Architects' Research and Development Group in the late 1950s, one of its first tasks was to produce guidance on ward design. This was published as Hospital Building Note No. 4 in 1961. It was followed in 1963 by another Building Note, No. 17, on the pros and cons of deep-planned (race-track) wards. This Building Note was the result of an evaluation of various forms of deep planned wards compared with the single corridor layouts similar to the Nuffield wards at Larkfield and Musgrave Park. Building Note No. 4 was subsequently rewritten in 1968 and embodied feedback from experience of using some of the new types of ward.

An advantage of race-track layouts was the ability to fit a ward block containing, say, 60 beds on each floor, onto a smaller site than would be needed for the same number of beds in a single corridor layout. The price paid for this advantage was a higher proportion of internal rooms needing mechanical ventilation and permanent artificial lighting. Construction costs were about the same for single and double corridor layouts, although engineering costs were higher in the deeper layouts on account of the extra ventilation plant needed. Additional lighting was also needed by day to help balance the illumination levels in internal rooms with those in the naturally lit bedrooms.

In Scotland similar types of ward had been developed to those in England. Experimental wards were designed by the Scottish Health Department, one at Falkirk in double corridor form and another at Kirkaldy in single corridor form (Great Britain, Scottish Home & Health Department 1965 & 1969). The Falkirk ward is shown at fig.5.27.

In 1963 when the Ministry of Health (now DHSS) started to plan a large new hospital at Greenwich in South-East London (Green, Moss & Jackson 1971) one of the aims was to explore the benefits of compact planning and adaptability of floor space. The small urban site, already congested with existing old hospital buildings, meant that the new building had to be constructed in three or four phases over a period of five to six years.

Wards at Greenwich were arranged around the entire periphery of the two upper floors of the four-storey air-conditioned building, each floor consisting of eight 33-bed ward units with 30 beds arranged in five or six-bed rooms and three in single rooms.(see fig.5.28).

Considerable attention was given in the Greenwich ward design to resolving conflicts between adequate nursing supervision and reasonable privacy for patients. For reasons of economy of space, and to simplify plumbing services, most toilets were located across the corridor from the multi-bed rooms. This allowed good observation of bedrooms from the corridor through the glazed corridor partition. Doors were provided between the corridor and bedrooms to reduce activity noise, particularly at night, and corridor lighting was dimmed at night to avoid disturbing sleeping patients.

A ward design similar to Greenwich was used in the Best-Buy Hospitals planned jointly by Hospital Design Partnership and the DHSS architects division and developed concurrently with the Greenwich design. These wards had 36 beds in four six-bed bays, one eight-bed bay and four single rooms under the control of one nurses' station. A small day space was provided in each multi-bed room (see fig.5.29).

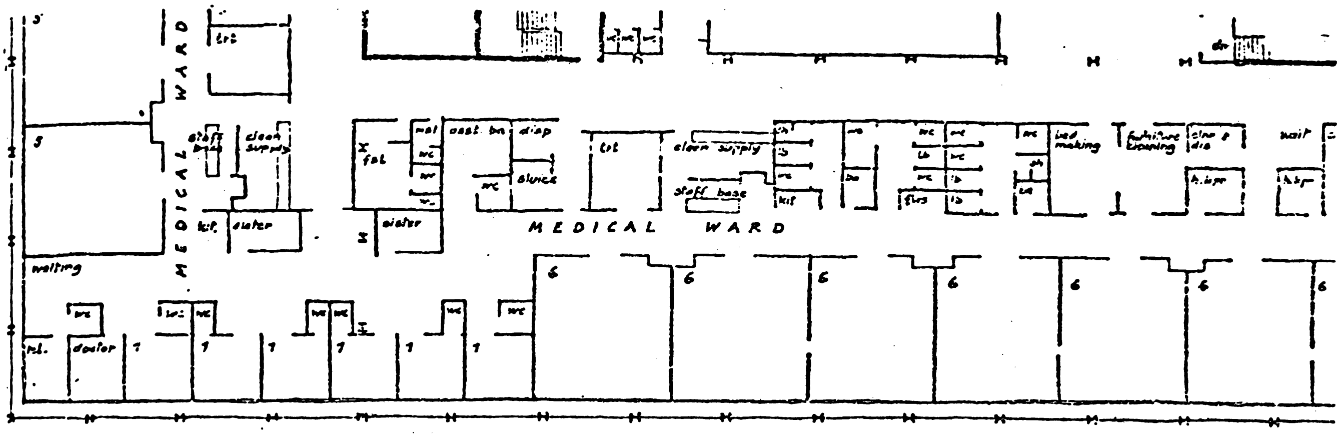


Fig.5.28 Greenwich ward
DHSS, architects

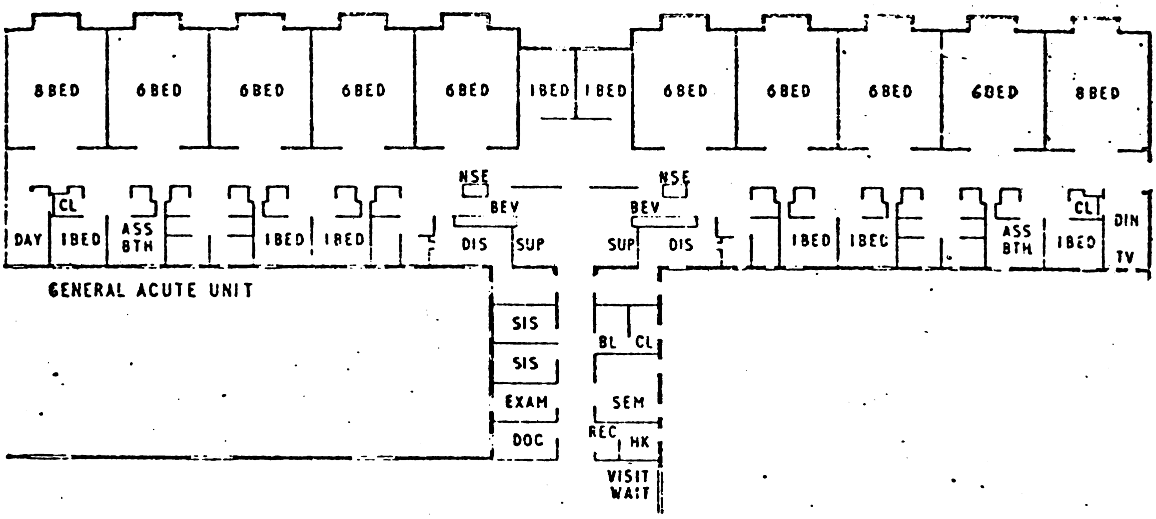


Fig.5.29 Best-Buy ward,
DHSS & Hospital Design Partnership, architects

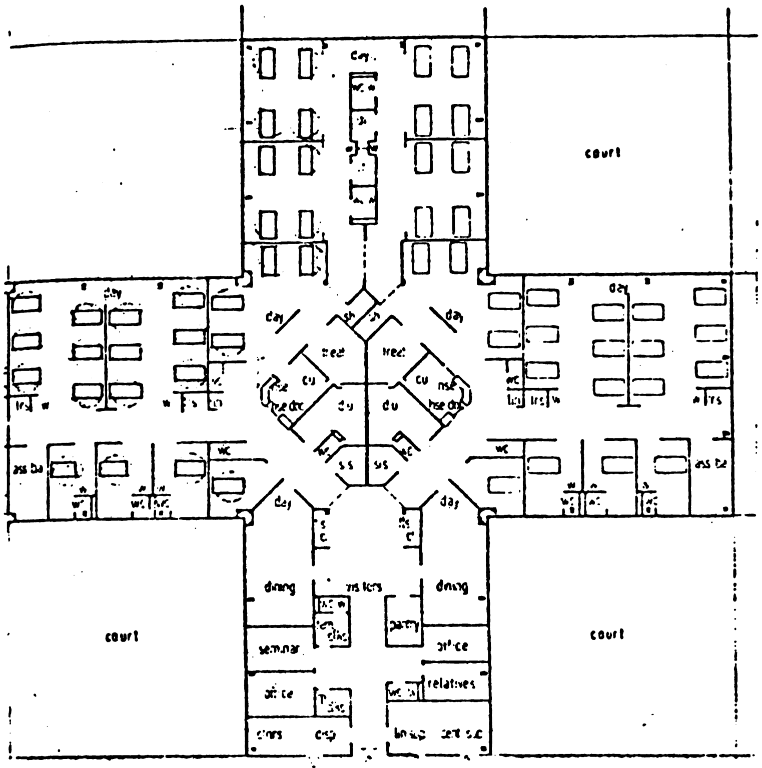


Fig.5.30

Harness wards
DHSS & Hospital Design
Partnership, architects

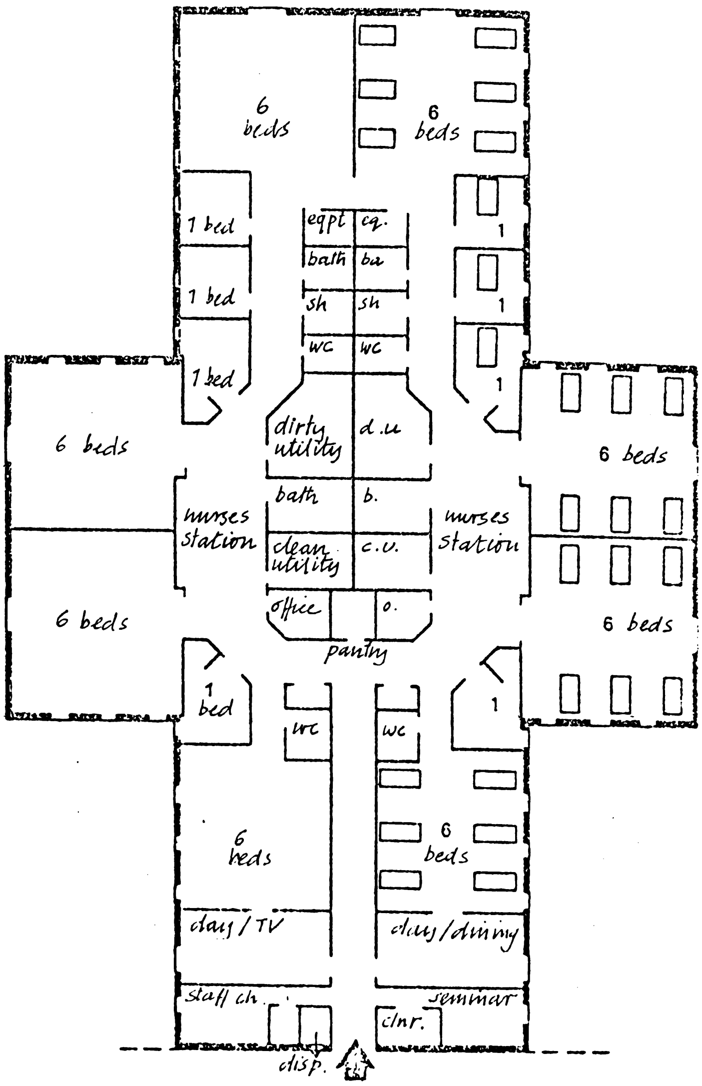


Fig.5.31

Nucleus wards,
DHSS architects

More recent developments in ward planning in Britain have been based on the Harness and Nucleus hospital designs (see figs.5.30 and 5.31). The Harness ward was cruciform in shape and used a combination of six, five and four-bed rooms in addition to some single rooms. The layout was flexible though complex. Both single and double corridor arrangements of rooms were used in different sections of the ward. The Nucleus ward is simpler in concept and shows the beginning of a return to a more open ward with good direct supervision of a substantial proportion of patients.

Following publication of the findings of the St. Thomas' Hospital ward evaluation in 1977 a number of ward designs were proposed which sought to provide some of the advantages which the more open ward clearly provided. One of these ward designs by Llewelyn Davies and Weeks is shown below at fig.5.32.

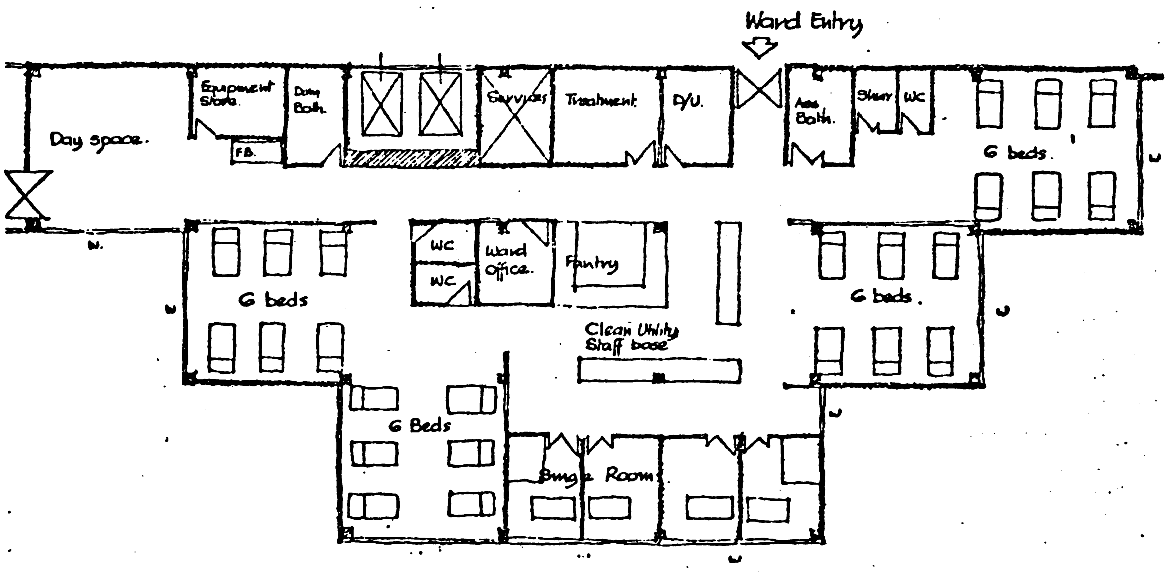


Fig.5.32 Twenty eight bed ward
Llewelyn Davies, Weeks, architects

North American trends

In North America during the 1960s and 70s many hospitals employed the well-established double corridor layout, most beds being in single or two-bed rooms, often identical in size and layout but capable of conversion from single to double occupancy as needed. A number of wards were built in bizarre shapes supposedly in the interests of good observation, economy of walking, privacy, convenience or just for fun (Jacobs 1961, McLaughlin 1964, Trites 1969) (see fig.5.33).

The studies carried out by Thompson and others at Yale University in the 1950s had attempted to determine factors contributing to optimum convenience and economy in ward layout (Thompson & Goldin 1975). This analysis included some circular ward layouts regarded by some planners as ideal both for observation and for economy of movement. Circular buildings are, however, more complex to construct and are relatively difficult to adapt to other purposes. Their main advantage is in intensive care wards where continual observation is more important than patient privacy.

Although private and semi-private (two-bed) rooms had predominated in much hospital building in North America during the post-war years, there were several exceptions, including the Mineworkers' and Veterans' Administration hospitals which were more often planned with a high proportion of four-bed rooms. Several hospitals planned in Canada adopted the same principle, in particular the McMaster teaching hospital near Toronto by Craig, Zeidler and Strong (Zeidler 1976) (see fig.5.34).

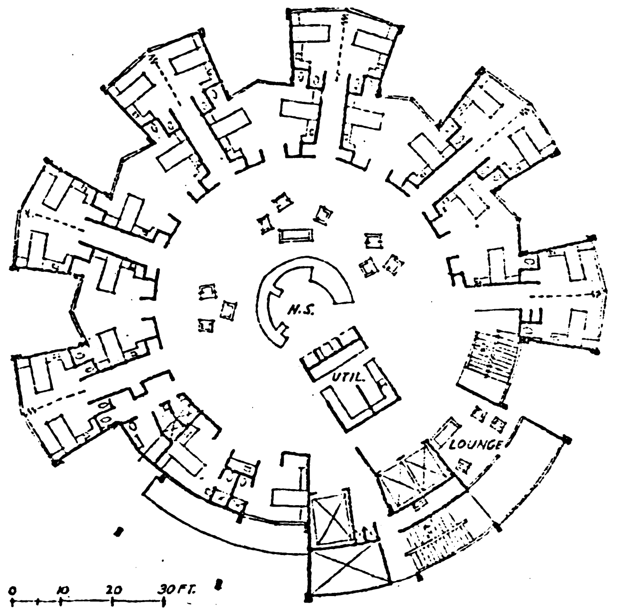


Fig.5.33 Project for ward at Cambridge, Mass.
Markus & Nocka, architects

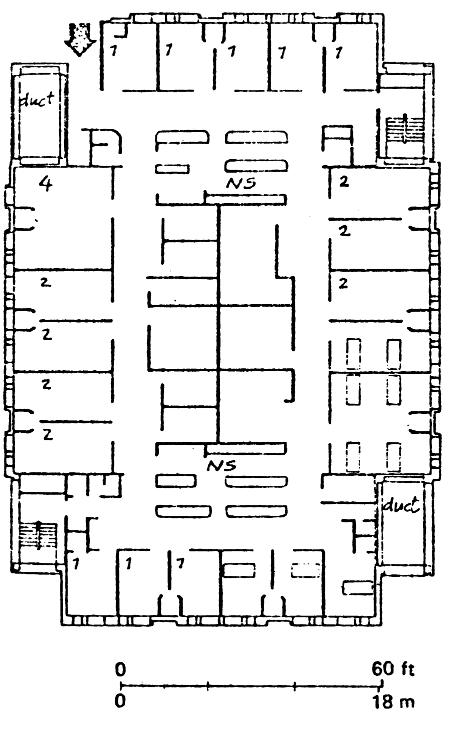


Fig.5.34 McMaster Medical Centre ward,
Craig, Zeidler & Strong, architects

Some Australian examples

Australia has tended to follow a mixture of both North American and British ward planning ideas, possibly causing a greater variety of ward designs, commensurate with the number of hospitals, than almost anywhere else in the world.

Early post World War II Australian hospitals, such as Royal Melbourne Hospital, embodied their own versions of the Nuffield ward layout. Sutherland and Bankstown Hospitals in Sydney were possibly influenced by the double 'Y' layout used at Grace-Newhaven Hospital in Connecticut. Others, like the Royal Adelaide Hospital and the Queen Elizabeth Hospital, Woodville, South Australia, adopted six-bed rooms, with work bays and nurses' stations adjacent to the bedrooms.

Some of the most recent Australian hospitals (such as Woden Valley Hospital in Canberra, Flinders Medical Centre in Adelaide, Westmead Centre in Sydney, and additions to the Alfred Hospital, Melbourne, and Royal North Shore, Sydney) have adopted double corridor layouts for the wards with one, two and four-bed rooms and ensuite toilets. There is thus little direct observation of beds from a central nurses' station in the corridor, and in most cases a two-way call system has been installed. The size of standard wards varies from about 18 to 28 beds, while higher dependency beds are grouped in small units of 8 to 16 beds to serve two or three standard ward units. The ward layout at Westmead is shown in fig 5.35.

One of the most recent hospital developments, at Royal Prince Alfred Hospital in Sydney, has ensuite toilets located on outside walls, thus avoiding the visual and spatial barrier between bedrooms and corridor (see fig.5.36).

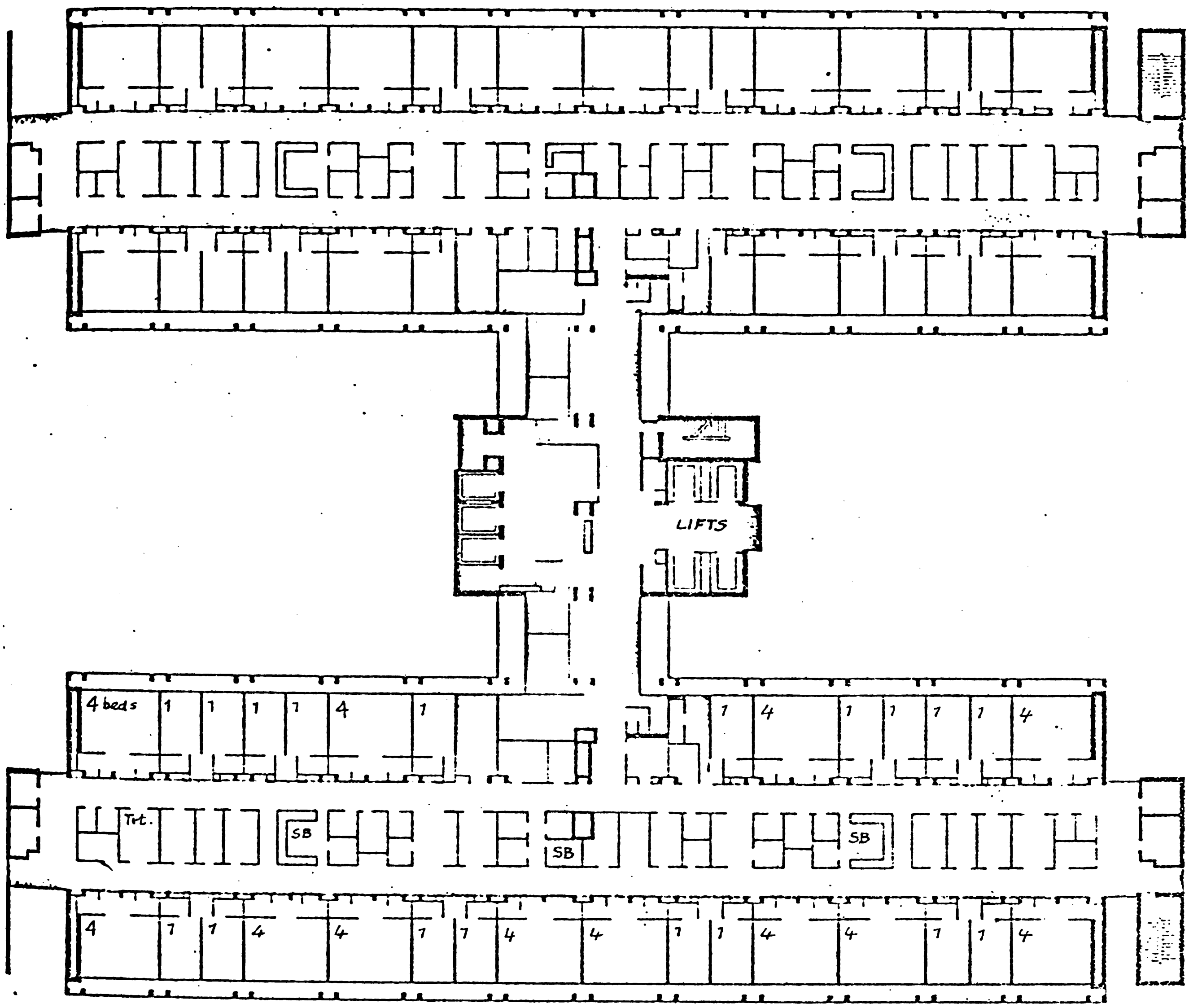


Fig.5.35 Ward floor layout at Westmead Centre, Sydney
NSW Government architect,
Llewelyn Davies, Kinhill, planners.

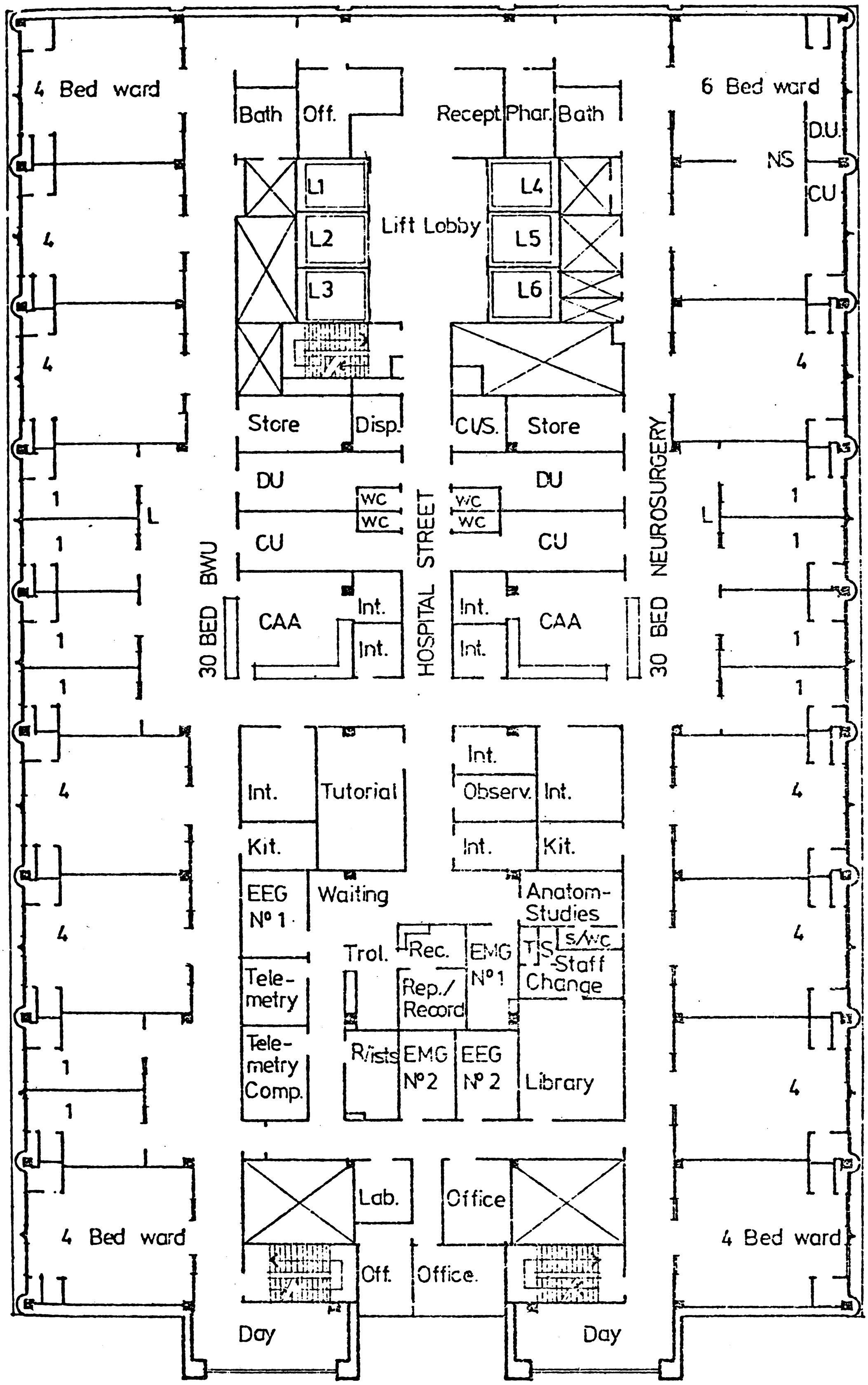


Fig.5.36 Royal Prince Alfred Hospital, Sydney
Phase 1 A ward
NSW Government Architect &
McConnel.., Smith & Johnson, architects

Conclusions

This survey of developments in ward design has shown an increasing trend towards spatial subdivision of ward units which has not apparently caused any significant improvement in nursing efficiency (see next chapter). The problem of controlling hospital acquired infection has however led to a need to restrict the free movement of air and of people round ward units (Smith et al 1980), but not to the extent of adopting all single or two-bed rooms for general acute wards. Noise is another factor which is often worse, particularly at night, in more open wards compared with wards with separate rooms (Ogilvie 1980).

Wards containing a mix of male and female adult patients have been advocated both for reasons of economy and sociability (Hospital & Health Services Review 1981). The degree to which sexes can conveniently be mixed in ward units is however affected by the size and arrangement of bedrooms, location of toilets, and provision for private consultations and examinations. More open wards with eight or nine patients are less likely to be practicable for mixed sex wards than where room size is restricted to four or five beds.

The need to subdivide ward units for fire protection reasons also limits the size of bedroom units which can safely be provided in one continuous space without intervening fire/smoke doors.

As discussed in chapters 6 and 10, many nurses dislike types of ward designed to meet the assumed privacy needs (or wants) of patients. Development of team nursing and primary nursing methods may be aided by subdivision of bed spaces into units of four to eight beds, but further research is needed on the extent to which ward design significantly aids or hinders the adoption of a particular method of nursing care.

The next chapter on evaluation of design includes (in section 6.9) a description of several evaluation studies of hospital wards, among which are some of the wards described above. Chapter 10 describes further evaluation studies by the writer with particular emphasis on different perceptions of users concerning supervision, privacy and convenience.

An opinion survey of hospital staff concerning policies and trends in nursing methods (described in section 10.6) attempts to identify the design features which staff think contribute most to efficiency in use. The results suggest however that users may not perhaps be the best judges of the extent to which particular design features are beneficial.

CHAPTER SIX

EVALUATION OF DESIGN - synopsis

Evaluation is considered first as a means of learning about effects of planning and design. Applications of evaluation in selecting design options and measuring operational effects are explored in detail.

Developments in building performance research and building appraisals are then traced from the early 1960s to 1981, both in Britain and the USA. Various methods of evaluating buildings in use are compared.

Lighting and visual perception are used to illustrate the problem of relating design characteristics to user responses. Examples of hospital design-in-use studies are described, and several opinion surveys of hospital patients are compared for their feedback value.

A selection of ward design-in-use studies are reviewed in depth, particularly regarding their role in providing information for briefing and decision making.

The final section attempts to integrate the various evaluation methods described into the planning/design process.

6.1 EVALUATION AS A LEARNING PROCESS

The subject of design evaluation is far greater than can be adequately covered in a thesis, let alone one chapter of a thesis. This chapter will therefore only attempt to explore some of the evaluation approaches and methods applicable to buildings, especially hospitals and wards. The intention is to show what has been done, and what could be done, to improve the quality and effectiveness of planning and design through feedback of information from evaluation studies.

Evaluation is primarily a learning activity on which decision making is or should be based. Some planning decisions are however made without proper consideration of the consequences, either because of lack of time, or lack of evidence, or both. But even if these resources are utilised , they may not be used correctly in reaching a decision. Evaluation is also <u>mis</u>used for a variety of reasons - political expediency, commercial advantage or professional prestige. Findings of evaluation studies therefore need to be treated with caution, and their context verified, if the results are to be correctly applicable to other situations.

Because learning is more often achieved by making mistakes than by successes, any system of collective learning is affected by a tendency to cover up errors of judgement. Edwards Deming (1975) commented:

> "Examples that show results that went in the wrong direction are hard to find: they get buried, not published. No one is around to take the negative credit for a failure." (p 54)

The same author also defined four requirements of an effective system of evaluation:

1. suitable means of measuring success or failure
2. satisfactory designs of tests or surveys
3. complete presentation of results of tests, etc. ie describe environmental conditions and test methods used
4. people authorised to act on the findings

The effects of the political context of evaluation were considered by Weiss (1975), both from the viewpoint of constraints on the objectivity of evaluation, but also, more optimistically, with the prospect that evaluation could play a significant role in political decision making and debate. Political constraints were not an excuse for abandoning evaluation research, rather they acted as a challenge.

Deciding how the results of evaluation studies should influence future research and planning is not a matter to be left to evaluators. There should be a dialogue between planners and evaluators - between development people and research people - if evaluation findings are to be used and integrated into the planning process. There is a need to define adequately the problem to be solved, otherwise evaluation research is likely to lack direction with the result that there are "erratic reforms in procedure" (Wilson 1968 p26).

There is also a need to consider how feedback is to be effected in making proper use of evaluation studies. Lewin (1968), for example, described three kinds of feedback methods:

1. return of data collected about the program to program staff in the form of information about how they are doing, about the program's impact, and about the effects of the variables involved
2. reporting of findings and implications to agency administrators
3. communication of agency responses about new programs.

(quoted by Twain (1975) p36).

Evaluation therefore had to be fitted into the planning process in such a way that rational decisions were made, and with the knowledge that the results were likely to be as intended. Edwards, Guttentag & Snapper (1975) demonstrated the link between decision making and evaluation in the form of a diagram (adapted from original p 149):

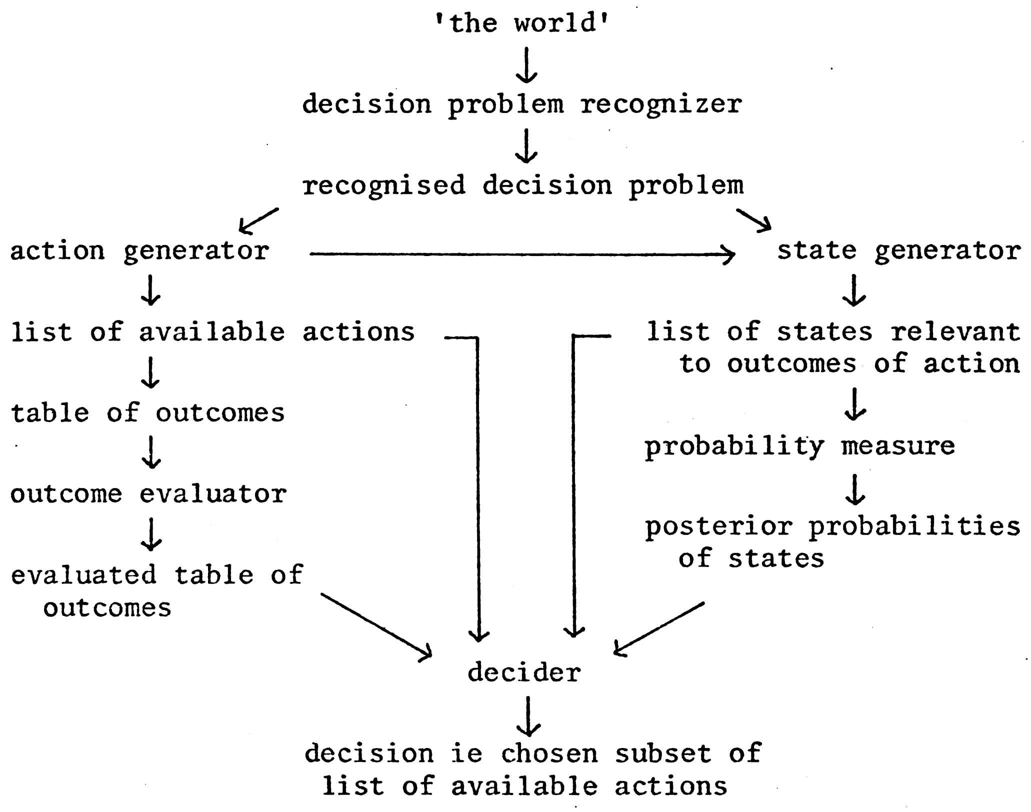


Fig 6.1 Linking evaluation to decision making

As hospitals are an important part of health care systems, it is relevant to review some of the evaluation literature in the health and welfare field. Suchman (1967), for example, saw evaluation of public service and social action programs in the USA as making a major contribution to "defining objectives and developing new control programs for the future". Experimental social welfare programs involving evaluative research served five main functions:

1. measuring the impact of new activities on specific social problems

2. showing the effect of one program on other programs and activities

3. testing public acceptance of programs

4. serving as a framework for further research

5. helping to develop future programs.

Evaluation was also seen as part of the administrative process of:

research
↓
planning
↓
demonstration
↓
operation
↓
evaluation

But evaluation as the means of measuring effectiveness might occur at each stage of the above process. One could, for example, evaluate the research findings, the feasibility of a program, and its operational effects, as well as the results of evaluation itself (Suchman op cit pp134-135).

More recently the problems of evaluation of health and welfare services and policies in Australia were the subject of enquiry by the Australian Senate Standing Committee on Social Welfare (1979) which described the health and welfare system as like:

> "..a giant jelly; it can be moved out of shape only with the maintenance of constant pressure; if the pressure is removed, the jelly resumes its usual and comfortable form." (op cit p1).

The system was seen as "out of control - part of a larger crisis in Administration...". But this was partly due to a lack of evaluation because:

> "...Without evaluation we cannot know whether a particular project is achieving anything at all or whether, for example, its effects are the reverse of the stated objectives." (op cit p 5).

6.2 EVALUATION IN PLANNING AND DESIGN

Evaluation is an integral part of any systematic planning process, even if it has not been recognised as such. As Perraton (1974) pointed out:

> "The idea of evaluation as an explicit and formal activity has emerged recently, with much discussion about the nature of the planning process" (Perraton & Baxter p 117).

The function of evaluation in relation to decision making in planning depends on which approach to planning is being adopted (see chapter 2). But as all planning is essentially goal-directed, Perraton suggested that it must include selecting the means which best promotes the most valued ends. Five steps leading to selection of a plan were defined:

1. identify and rank goals
2. develop alternatives
3. predict consequences
4. evaluate consequences
5. choose plan

A distinction was also made between four levels in the ends-means hierarchy:

1. underlying values
2. goals (final ends)
3. objectives (intermediate ends and means)
4. standards or performance criteria

Perraton then considered how the process of evaluation should be integrated with the plan making process. Because the implications of objectives and priorities were often difficult to foresee, it was necessary to evaluate during the development of alternative policies and plans, rather than at the end of the process. A distinction was therefore made between pre-evaluation of hypothetical alternatives, and post-evaluation of the consequences of decisions which could be measured in terms of human behaviour and satisfactions, and which also provided the information needed to make pre-evaluation more realistic.

In summing up her description of the planning process Perraton listed five requirements for evaluation:

1. evaluation measures had to relate directly to the objectives
2. criteria had to reflect the full range of objectives and impacts
3. assumptions and values had to be made explicit
4. comparisons and choices had to be clearly defined
5. each alternative had to be separately identified and explored, and its implications made evident.

Planning evaluation could either be made a continuing and interactive part of the planning process, or it could be simply used to determine the costs and benefits of the final outcomes. Either way there was the problem of how much information to gather and present, and whether to attempt to define values in terms of a common measure such as money. The use of evaluation to explore impacts and resolve conflicts in planning seemed "more appropriate to the design process in planning", although this raised problems of how to present alternatives in such a way that the public could understand how they were likely to be affected.

The problem of how the planner 'thinks' in developing solutions to 'fit' problems was discussed by Cheesman (1974) who used Alexander's (1964) concept of design as 'being concerned with fitting forms to contexts'. Most people tended to think and design linearly; they also had difficulty in coordinating the three main phases of planning:-

1. criteria specification
2. synthesis
3. evaluation

By 'linear' thinking Cheesman meant a tendency to think in clear-cut hierarchies (or trees) rather than more complex interactive relationships (described as semi-lattices):

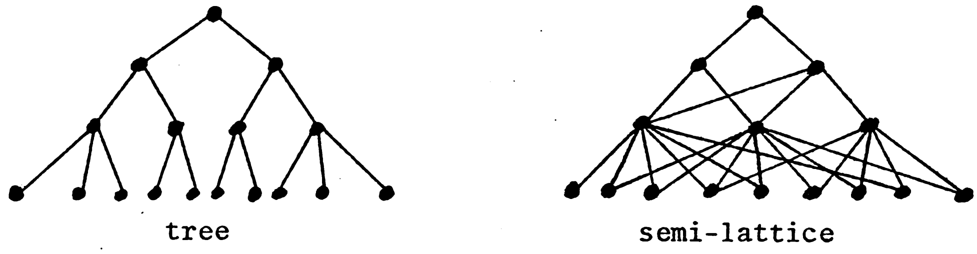


Fig 6.2 Two forms of organisational relationships used in thinking.

The significance of this distinction in modes of thinking lay in the way design criteria were established and how solutions were synthesised and evaluated.

Cheesman then went on to show how the process of synthesis was concerned with finding a form to fit a context, evaluation being the means of knowing whether a suitable fit had been achieved. Changing the method of design synthesis would result in a different solution, but this solution could be checked against the performance specification, and a preferred method of planning selected. Cheesman concluded that "true evaluation must be considered as an integral part of the planning design process" (p 163).

Cheesman applied this principle to the planning of a hospital in which criteria were listed and specified for all the materials, components, spaces, services and equipment items needed. These criteria were based on the activities and comfort requirements of a diverse range of users, many of which interacted and conflicted in a bewildering variety of ways.

One approach was to design according to the constraints, eliminating any conflicts, and thus avoiding the need to make any decisions because nothing was incompatible - except that the solution did not meet the requirements! The other approach was to investigate all the desirable requirements of each type of user, and only consider the constraints where conflicts became evident.

The synthesis phase in planning had to be split up into a succession of levels and groups of problems, even if sophisticated computer-aided methods were used. This meant that complex non-linear relationships between elements had to be reorganised into 'clusters' so that the problems could be comprehended and subjected to analysis. (Unfortunately the act of reorganising problems and requirements into clusters presupposes that their relationships are known, whereas these are really part of the solution.)

Because potential solutions to a problem need to be explored before the problem can be satisfactorily defined, evaluation becomes almost indistinguishable from decision making. In effect, evaluation acts as a counter-balance to innovation, each proposal being tested before it becomes embodied in the 'plan'. This iterative process can be represented in the form of parallel sequences of planning phases and evaluation phases. Each evaluation activity provides information for subsequent planning activities, and each planning activity generates the need for evaluation. The following seven phases of building planning, for example, generate six corresponding phases of evaluation: (see fig 6.3)

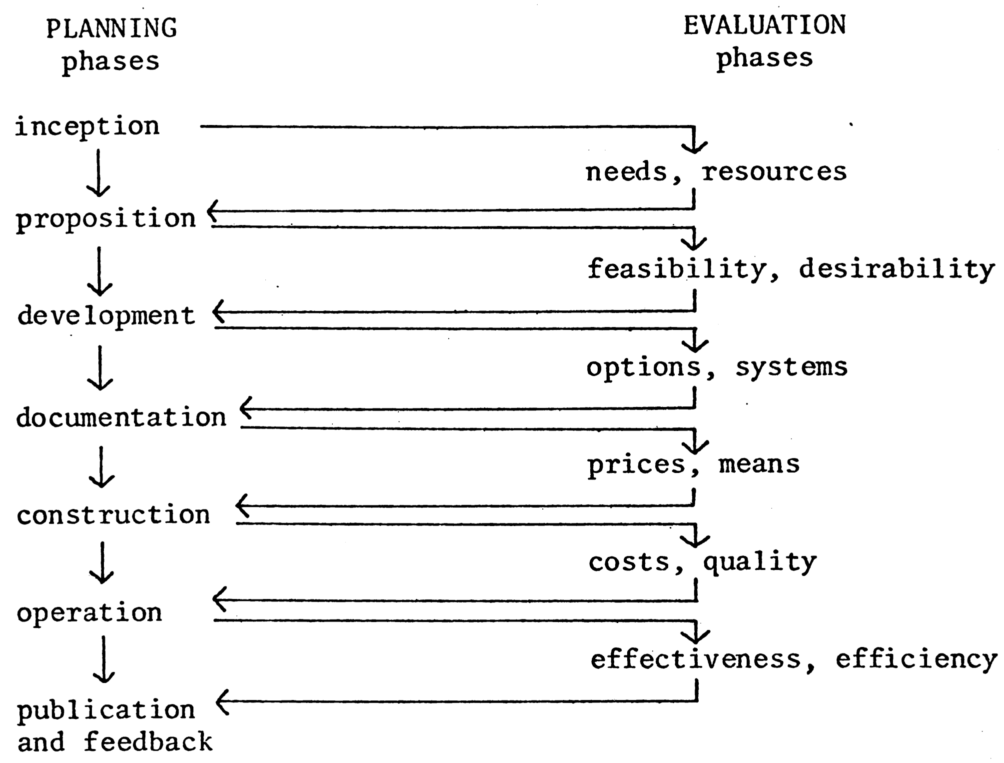


Fig 6.3 Phases of planning and evaluation

The planning process as a whole (or specific parts of it) can also be the subject of evaluation. Seven types of evaluation therefore can be described in terms of their fields of application:

	TYPE	FIELDS OF APPLICATION
1.	PLANNING	Planning and design process, procedures, methods organisation, personnel
2.	NEEDS	Project justification, resources available, physical limitations, political constraints
3.	FEASIBILITY	Feasibility of meeting requirements with resources and restraints imposed
4.	OPTIONS	Selection of preferences for economy, durability, desirability, social benefit etc.
5.	TENDERS	Award of contracts on basis of prices, time, methods proposed, credibility etc.
6.	RESULTS	Assessment of results in terms of costs, safety, quality, appearance etc.
7.	EFFECTS	Determination of effects on users, society, environment, energy balance etc.

While each of these seven fields of application is relevant to planning and design of health facilities, only 4 and 7 above will be considered in any detail, with the main emphasis on the latter. As selection of preferences for design (see 4 above) is based, in theory at least, on assumptions about effects of design in use (7 above), the links between these two types of evaluation will now be considered.

In the simplest form of planning process 'evaluation' can be represented as one of three elements in the recurring cycle:

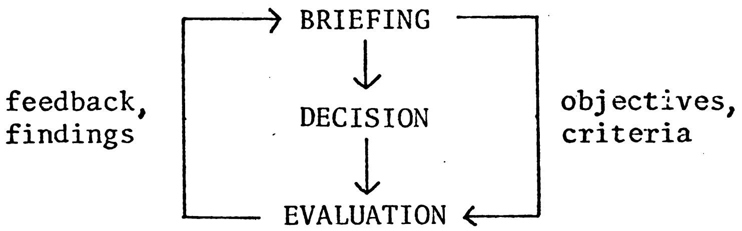


Fig 6.4 Three elements of the planning cycle

In a more developed model of planning the evaluation of options and the evaluation of effects are connected by two forms of information link - 'feed forward' and 'feedback':

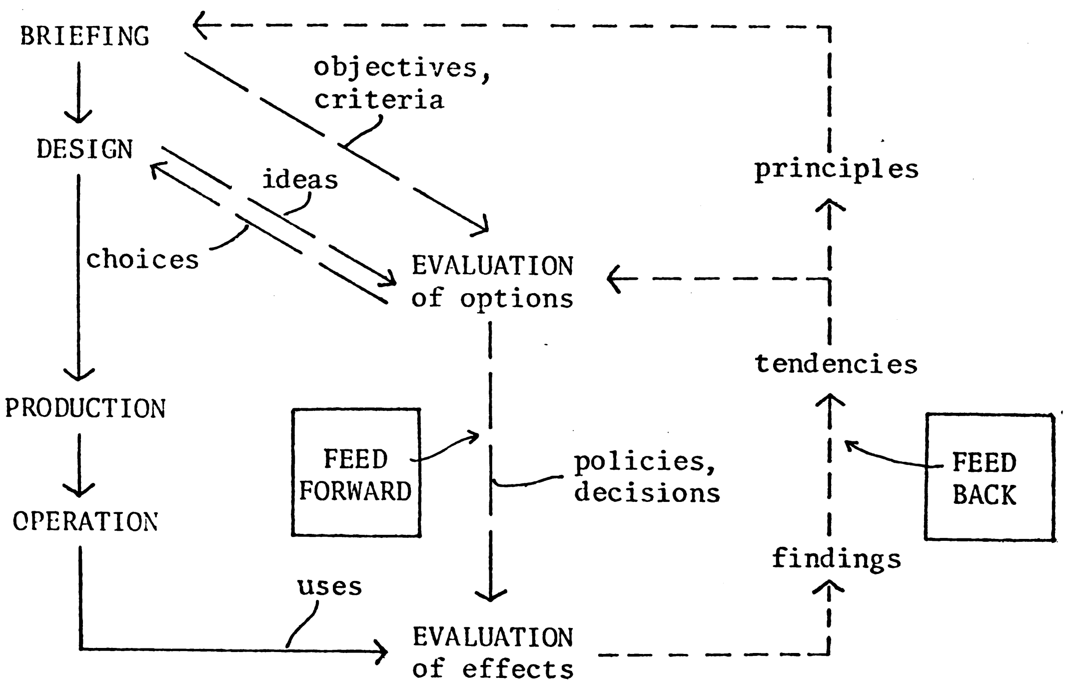


Fig 6.5 Links between evaluation of options and effects

Evaluation of design options depends on defining the objectives and criteria against which each option can be compared. Policy decisions arrived at in evaluating the options are then used as the basis for evaluating effects. Findings from evaluation of effects can be used to describe 'tendencies' which help to establish design principles on which briefing information is based (Alexander et al 1970).

6.3 PURPOSES OF DESIGN-IN-USE EVALUATION

Evaluation studies of design in use have been conducted for a variety of purposes:

1. to educate members of planning teams in the effects of design on function
2. to form the basis of design guidance
3. to verify if the original intentions of a plan had been realised in practice, and if not, why not
4. to compare different designs in respect of their ability to meet specific requirements
5. to identify problems in a particular design and to make improvements
6. to test a design idea in use
7. to justify (or condemn) a decision to adopt a particular design policy
8. to test a method of design evaluation
9. to establish evidence for a theory on the relationship between design and human behaviour
10. to test the capability of a student of planning, design or administration
11. to identify the order of merit in a design competition

Because of this variety of purposes in design evaluation a wide range of methods and approaches has grown up in this field. Consequently there has been some confusion as to the role of design evaluation in the planning and design process. The specialised nature of some of the types of evaluation research involved has also led to a variety of specialist professions entering the field. Some of these specialists have tended to push their own techniques without addressing the real problems which evaluation could help in solving.

Environmental psychologists such as Canter (1974) and Lee (1976), for example, have been primarily interested in the effects of environmental stimuli on individual people or types of people. Their methods of investigation have therefore tended to focus on behavioural reactions to stimuli such as light, colour and shape. Sociologists such as Gutman (1972) and Conway et al (1975) have been more interested in interactions between people and buildings in general, and also in how planners and designers went about their work. Statistically orientated researchers such as Sears & Auld (1976) and Rawlinson (1978) have concentrated on developing sophisticated methods of analysing the quantitative effects of particular characteristics of environments. Architects and engineers such as Manning (1965), Markus (1974) and Hopkinson (1969) have been mainly concerned to develop better ways of designing buildings and engineering systems in relation to users' needs and functions; while economists such as Stone (1975) have explored ways of measuring the cost effects of design decisions and of obtaining value for resources expended.

This diversity of approaches has had its benefits in that various facets of effectiveness of design in use have been explored, but a unifying framework is needed to enable the results of these methods to be integrated into the design and decision making process.

One such attempt at a unifying framework was proposed by Law (1981) and was based on a study by Turner et al (1977) of the National Cancer Institute Emergency Virus Isolation Facility in Washington. Turner proposed four 'bases' for evaluating buildings:

1. The purpose for which the building was originally designed, or the changed purpose which it subsequently served.

2. The process of planning, designing and constructing the building.

3. The performance of the building in physical terms, and its interaction with the people who used it.

4. The operation and maintenance of the building, including its costs in use.

These four bases could, Law suggested, help to overcome the failure of many evaluation studies to define their objectives as a result of which their findings were often disappointing. It was also arguable who should pay for evaluation studies, who should get the results, and what should be done about them.

While purpose is the beginning of the problem solving process, design performance determines whether the purposes have been achieved and to what degree. People ultimately decide whether the performance meets their purposes, and this information is fed back through the problem solving process to modify purposes and processes in succeeding projects:

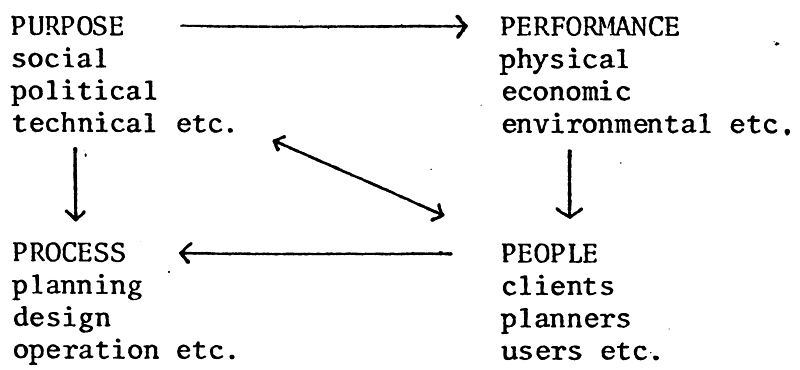


Fig 6.6 Problem solving process (after Turner 1977)

The problem of evaluating the qualitative effects of planning decisions was discussed by Ackoff (1976) in relation to operational research and the quality of life. The ingredient so often missing in planning and design was that of aesthetics - of beauty, of fun, of satisfaction. While science and technology answered the need for knowledge and truth, while politics and economics provided for corporate efficiency, and while ethics and morality satisfied the desire for virtue, it was aesthetics which met man's basic need for pleasure in living. Planning and design were often deficient in meeting the aesthetic needs of man because they fail to allow participation in the process of decision making - they provide products, but not the means to enjoy them nor involvement in their production. If quality of the results of planning and design is to be included in evaluation, then one measure of this should be the extent to which users are able to determine and modify the shape of their environment (Ackoff op cit).

Adaptability of design therefore was not just a means of correcting faults, postponing decisions or providing for change, it was a means of allowing a designed system to learn from its users' knowledge, experience and ideas. Ackoff summed up his approach to evaluation in planning thus:

> "...all phases of planning...should be participative. It is only in a society in which most individuals take responsibility for their quality of life, rather than passively receive it, that continuous improvement of it can be realised....the key to improved quality of life is not planning for or measurement of others, but enabling them to plan and measure for themselves" (op cit p 303).

The lack of a clearly specified purpose in many evaluation studies, and in the designs which were being evaluated, was identified by Cammock (1973) as a major problem in a design in use study of health centres conducted for the DHSS in London by MARU. This study sought to compare 11 recently built health centres with respect to 'reception, waiting and patient call'. The study was unique in being carried out by an architect who was also a medical practitioner, and who was thus able to see both sides of the problem - the users'/clients' side and the planners'/designers' side. The study was initiated because Cammock was aware of a problem - that health centres were being designed by people who did not understand the requirements of health centres, for people who did not understand the needs of the users. As a result of the evaluation study it became very clear that the objective of 'confidentiality' was recognised neither by clients nor by designers, yet it was fundamental to the purpose of the activities for which health centres were provided.

Cammock's health centre evaluation findings were subsequently channelled into design guides and into a description of a briefing method for health centres, thus serving to complete the feedback loop. The value of the study was however largely due to awareness of the problem, both from the users' and the designers' viewpoint. One significant finding of the study was that there was no consensus on design requirements among users which could be used as the basis for a comparative evaluation. The evaluation team therefore had to develop their own evaluation criteria as a means of comparing the different designs studied.

As the purposes for which most buildings are designed cannot be stated precisely, and in any case may change during planning or subsequently, one of the commonest purposes of design is that of providing for adaptability in use. This means that purposes only need be defined sufficiently precisely for proposals to be evaluated against a range of possible requirements. A suitable design can then be selected which adequately meets the most likely sets of requirements, even if it does not meet any one of them ideally. Cammock put it another way:

> "Definition of objectives is the starting point of management, but the essential corollary is that all sub-systems' objectives shall be compatible with each other, so that improved performance in one sub-system is not achieved at the expense of another" (op cit p 5).

Analysis of the operational systems involved is therefore a prerequisite both of design and of evaluation. Incompatible objectives should be identified <u>before</u> they lead to design failures, rather than left to be discovered when the design is evaluated in use (Luckman 1969). Good design for a particular set of circumstances will therefore lie somewhere between answering all requirements perfectly, and answering none of them at all. The most satisfactory design in use will be that which meets the majority of users' needs over the longest period in use, even if it bears little relationship to the purposes or objectives for which the design was originally conceived. Herein lies the evaluation dilemma which is only resolved if the principles of adaptability, and of user participation in planning, design and use, are automatically included in the evaluation criteria.

6.4 BUILDING PERFORMANCE EVALUATION STUDIES

Interest in building performance evaluation developed in Britain in the early 1960s when the Building Research Station (BRS) initiated a series of discussion meetings on 'Appraisal of Buildings'. These involved both public and private architects concerned in housing development, school building and hospital design. At the first meeting in 1962, a 'Draft checklist of data relevant to user satisfaction' was proposed. This list was arranged in two sections:

A) Description of building
B) Experience of occupants

(see full list at appendix E[1]).

While users' opinions of design features were included in the BRS list it was not until psychologists attempted to quantify the way people perceived and reacted to their environment that architectural psychology as a field of study in itself began to emerge.

One of the first university research units to focus primarily on building performance was set up at the University of Liverpool Department of Building Science by the Pilkington Glass Company in 1959 under the direction of Peter Manning, an architect, and with a team including a psychologist (Brian Wells). This unit concentrated mainly on evaluation of office, school, factory and hospital buildings, and much of their work derived from the detailed study of environment and user responses in a large office block in Manchester (Pilkington Research Unit 1965). The PRU was particularly concerned "to develop a system of appraisals of building performance which was related to a systematic design process".

Following the demise of the Pilkington Unit in 1967 Manning (1968) summarised the main conclusions resulting from the unit's research.

They were:

a) appraisals of buildings in use can provide information on performance of buildings and their effects on the users

b) results of building performance appraisals can be used to determine design requirements of new buildings

c) techniques used to appraise buildings in use can also be used to evaluate alternative design proposals

d) systematic staging of the design processes is essential to use of appraisal techniques by providing useful 'feed-in' points for information resulting from appraisal studies

e) the experience of making appraisals is educative to designers.

Manning had also contributed to a symposium at York University Institute of Advanced Architecture Studies (IAAS) in 1965 by describing the methods used by the PRU, and by organising a subjective appraisal of an office building in which symposium members participated using check lists developed by the PRU.

Another contributor to the symposium was Tom Markus, then of the Welsh School of Architecture, who contributed a paper on the need to measure measurement techniques in building appraisals, emphasising that some techniques were much better than others in producing results which could be used in design.

At the same symposium Garnham Wright proposed a method for assessing building performance based on a series of six headings which were common to both briefing and evaluation, thus helping to ensure consistency between input and output. The six headings were:

1.	content	-	owners, users purposes, functions, uses
2.	conditions	-	physical environmental for uses/users
3.	space	-	amount arrangement internal/external
4.	fabric and mechanism	-	materials structure services
5.	cost	-	effects of space quantity of technical quality
6.	locale	-	the fit between design and situation

Garnham Wright proposed a simple yes/no type questionnaire for evaluation based on these headings, although the questions could be elaborated for more detailed studies. The six basic questions were:

1. are users able to carry out their tasks efficiently?
2. are physical conditions suited to users requirements?
3. is space adequate and suitably arranged?
4. is the building safe?
5. has good value for money been provided?
6. does the building and its use suit its situation?

No further guidance was given on how to apply this questionnaire method, or what further questions to ask if the first answer was 'no'.

During the latter half of the 1960s BRS continued to promote developments in building design evaluation, and in October 1966 a meeting was held on 'Feedback and Evaluation in Development' attended by 35 senior staff from government and private offices. The main purpose of the meeting was to suggest ways in which BRS could best assist in providing design guidance as a result of assessing building performance. Four main phases of evaluation were identified as a basis for discussion:

1. design
2. production
3. evaluation in use
4. feedback.

The topics discussed included subjects for investigation, responsibility for carrying out research studies, methods of investigation, and financial responsibility. The need for feedback from evaluation studies to design teams was emphasised, particularly regarding the means of assessing feasibility of design innovations, and production of tested guidelines on design standards.

One of the outcomes of the BRS initiative was the establishment of the Building Performance Research Unit (BPRU) at the University of Strathclyde in January 1967 under the directorship of Tom Markus. The unit was financed jointly by the Ministry of Public Buildings and Works, the Architects' Journal, the RIBA, and about 20 private architectural and engineering firms. The members of the unit included two architects, two scientists, and a psychologist (David Canter) who had also worked with the PRU.

A variety of evaluation techniques developed by BPRU have been described by Maver (1971), Markus et al (1972), and Markus (1976). These mostly concern the way building costs can be related to their performance or to user opinions. Markus et al (1972), for example, described a series of evaluation studies of school designs using five categories for analysis:

objectives
activities and behaviour
environment
hardware
resources

Appraisal of a building design consisted of three basic steps:

representation ⟶ measurement ⟶ evaluation

Representation included any kind of verbal, visual, mathematical or physical model of the design to be appraised. Measurement consisted of objective statements on aspects such as cost, environmental conditions and space utilisation, as well as subjective measures of human response. Means of evaluation could comprise cost benefit analysis, aesthetic judgement, comparison with norms and standards, or conformity with requirements and constraints (Markus et al, op cit).

Design appraisals could provide five kinds of knowledge: 1) Predictive knowledge concerned with relationships between variables such as buildings, environment, users, costs and performance, this knowledge being amplified by studying buildings in use to test hypotheses stated in the design phase; 2) simulated knowledge using models, although these might not accurately represent real life situations; 3) knowledge of variations in use of buildings, ie types of changes made and how often; 4) knowledge about processes of designing, especially those involving several participants; and 5) knowledge about production methods, although commercial secrecy often made this difficult to obtain.

The BPRU found that no adequate classification system existed by which design problems and design methods could be quickly and well matched. "Only continuous, explicit apprasials could lead to such a taxonomy" (op cit p 27).

The aim of design 'optimisation' was to arrive at a single best solution, although if there were several types of criteria, this was more difficult to achieve. Money was therefore often used as a comparative measure.

Studies by BPRU of teacher satisfaction with school buildings showed that opportunities to modify rooms and equipment arrangements, and newness of buildings, resulted in greater satisfaction levels. Another study explored relationships between importance ratings of design features and the frequency with which teachers listed them as requirements for specific activities. Although there was general agreement on features considered necessary, there was disagreement on their priority. (Significantly no school pupils were included in any of the user surveys.)

Several school building shapes were compared by BPRU for efficiency with regard to energy conservation, adaptability and conveneince of circulation. Compact buildings were found to be generally more efficient than sprawling layouts. A series of detailed investigations were conducted at one particular school in Scotland and included:

building and engineering systems
construction and operating costs
space utilisation
shape and environmental comfort
user (teacher) satisfaction
traffic circulation
changes in use of space

The BPRU team members took a rather pessimistic view of the extent to which evaluation could lead to design improvements, mainly due to the complexity of relationships between the many participants, and the multiplicity of factors with which they had to contend. Changes in society were needed to effect improvements in design, but the architect could initiate these changes by making the consequences of design failures evident to society. Continuous objective evaluation of the products of design was the most powerful weapon for effecting improvements.

A more recent study of building appraisals by the School for Advanced Urban Studies (SAUS) at the University of Bristol (Bishop 1978) considered that the information gap between evaluation of design in use and evaluation of design options was due to differences in approach between decision making in design and the need for feedback from earlier projects. Bishop's study had four aims:

1. more cost effective design
2. reduce mismatches between design intentions and results
3. link theory and practice in evaluation
4. develop evaluation methods for use by clients and architects.

For <u>theoretical</u> evaluations there were six possible approaches:

1. subjective - report on an individual's impressions of a building
2. descriptive - report by a team of experts on specific aspects
3. social/psychological - user ratings or behaviour observation
4. sociological - identifying problems by interview
5. environmental - assessment of human comfort, behaviour and performance
6. technical - physical effects and defects.

The effectiveness of feedback from theoretical evaluation was conditioned by whether the building was one-off (a closed system) or part of a program of developement (an open system).

The views of six proponents on types of categories to use for organising theoretical evaluation were compared by Bishop, but little agreement was found. The following list of categories indicates the degree of coincidence found between authors:

Table 6.1 Categories for organising evaluations (after Bishop 1978)

category	no.of authors mentioning (out of 6)
environment	4
activity	3
culture	3
building/site	2
costs	2
paths/routes	2
resources	2
system	2
behaviour	1
climate	1
context/setting	1
domain/area	1
expression	1
grouping	1
human	1
modifier	1
objectives	1
technical	1

Practical evaluation was mainly undertaken by design offices responsible for design, thus ensuring direct feedback to subsequent projects. The York University Centre for Continuing Education in the Building Professions had, however, organised several practical building appraisal studies which had four aims:

1. to suggest design improvements
2. to improve design methods
3. to learn about design and evaluation
4. to provide feedback to other projects (Bishop op cit p 19).

The design offices' evaluation methods covered a different range of purposes:

1. to examine specific projects
2. to study the design process
3. to report on defects and problems
4. to see how well the clients' needs had been met

One American firm of architects used four 'dimensions' in their evaluation method:

form
function
time
economy

Each project was evaluated on each dimension using a ten-point scale and a 'quality quotient' derived for the project (Peña 1977). The process of design was evaluated in terms of 'management, design and technology'.

Bishop (op cit) described an evaluation of a housing estate in Bristol in which eleven different evaluation techniques were used:

1. semantic differential scaling of specified aspects
2. interviews regarding good and bad design points
3. detailed questionnaires on specific aspects
4. listing of 'most important' design aspects
5. listing of likes and dislines
6. recording furniture layouts in rooms
7. recording design modifications by users
8. discussion of results of 1 to 6 above
9. seminar on the project
10. publication of article describing and commenting on the design
11. obtaining views of police on security aspects

The above approaches provided a variety of perspectives on the value of the project. Residents, for example, differed in their impressions from those of the design team and the experts. Children's views were often in marked contrast to their parents.

No evaluation method was ideal. Subjective evaluations tended to be biased and too personal. Expert teams involved a lot of time and expense. Social/psychological surveys produced little for the effort involved. Sociological studies were too general. Environmental studies were fragmented and revealed a wide range of responses from users. There was little help in 'the literature' on how to carry out any of the theoretical approaches to evaluation (Bishop op cit p 46).

The practical approach was however fairly well covered in published guidance, although it tended to be weak in objectivity and was biased in the designers' favour. Users' views and behaviour were poorly represented in practical methods of evaluation, and the original project objectives were often lost, obscure or had changed in the interim.

Bishop had found that architects perceived evaluation studies of their buildings as a professional threat. 'Individualism and fear' had prevented development of a universal approach to evaluation which could help in coordinating results of evaluation studies for general application. A balance had to be achieved between superficial studies which produced nothing of value, and in-depth studies which only confused practitioners with too much detail. Objectives of evaluation studies had to be related to methods used and results needed to be presented clearly and simply if they were to be applied in practice.

Survey respondents needed to be selected to include all types of user, designers also had valuable experience to offer even if it was biased. Few designers read technical journals in which evaluation findings were published, hence the results of evaluation studies did not get applied in design. Practitioners could become more involved in evaluation studies, but they needed to be trained in appropriate techniques.

Bishop (op cit) suggested that a variety of evaluation techniques were necessary depending on the type of problem being studied. But the biggest problem was to get designers to be more self-critical and less defensive, and to recognise the causes of their mistakes, otherwise design would deteriorate.

6.5 METHODS OF EVALUATING DESIGN IN USE

Two different but interactive approaches are apparent in any kind of evaluation - quantitative and qualitative. Quantitative entities such as money, floor area, energy consumption, duration of time, and workload capacity are commonly used in design evaluation to measure and compare the efficiency of different forms of design serving the same purposes. Qualitative entities such as comfort, convenience and stimulation, which can only be measured in relative terms, are nevertheless just as important in assessing the value of a design in human terms.

The purpose of design evaluation is to provide an empirical basis for producing designs which meet their declared objectives - as well as possible, and with the least waste of resources. To this end evaluation seeks consistent relationships between design features and their physical, economic and human effects. These relationships can then be used in developing a theoretical basis of design which uses knowledge of likely effects as the input to decision making.

The problem is that there are wide divergencies between how people react to their environment under different circumstances. It is therefore untrue to say that because a majority of people say they are 'comfortable' at a static air temperature of 22°C and relative humidity of 65% that all will be comfortable in these conditions. People vary in their perception of comfort for a variety of reasons, for example the type of clothing worn, or the type of activity being performed. It also depends on the state of health of the individual and on the temperature of surrounding surfaces (McCormick 1970). One can however establish by experiment the proportion of a given population which will express satisfaction with thermal comfort in given circumstances.

The physical environment is made up of a number of complex and interacting phenomena. Aspects such as thermal comfort cannot therefore be evaluated independently of ventilation, of lighting and colour, or of the visual character of a physical setting. To describe completely a particular environment is not only a complex task, but also rather meaningless in terms of predicting its effect on people. It is however possible to identify the most significant aspects and to measure their effects on people by changing one characteristic at a time and observing changes in behaviour or attitudes. This method of evaluation unfortunately has to be performed in a 'laboratory' setting which cannot accurately represent typical behaviour in a real environment. Social factors may also affect the environment being evaluated. The act of measuring, for example, can cause changes in people's behaviour which are often difficult to detect.

The methods used in evaluating a design will be largely influenced by the purposes for which the evaluation is being conducted. Thompson (1975), for example, identified three basic elements in evaluation research:

1. developing criteria
2. developing measurement methods
3. analyzing factors affecting measurements

Only in a few instances in Thompson's studies of hospitals in use was it possible to direct any one of these three elements to research for actual application by hospital administrators. Instead Thompson developed methods which hospital staff members could use to determine their own needs (see section 6.7).

Because many of the problems of design evaluation are to do with how people act or feel when they are using buildings, psychologists have attempted to categorise the methods which can be used in behavioural research. Lee (1976) for example listed nearly 60 measurement methods which could be applied in studies of building users' behaviour, feelings, perceptions, and attitudes. Of 29 listed methods, 13 involved direct recording at the time of behaviour, 11 were indirectly recorded from subjects, and five involved verbal reports by the subject of post or current behaviour. The last mentioned for example included:

interviews
questionnaires
behaviour self-reporting
sociometric analysis of reported behaviour
open-ended survey questions

To evaluate respondents' attitudes Lee listed ten verbal means of recording:

instrumented - open-ended questionnaire
interviews
sentence completion
story completion

structured - custom built scales eg Likert
forced choice
paired comparisons
ranking by preferences
information tests
sociometry eg diagrams showing friendship choices

A broad distinction can therefore be made between methods of evaluation which describe real or hypothetical effects of design in use in terms of objective values, and those which employ users' subjective assessments. Objective values include running costs per unit of performance such as patient day, floor area per place or bed, energy consumed per unit of time in relation to climatic conditions and intensity of use, and intensity of traffic movements in relation to operational capacity or workload. Some measures of behaviour, such as incidence of damage and changes in use of space, although affected by users' reactions to their environment, can nevertheless be expressed and compared quantitatively. Identifying the causes of unusual trends is more a matter of judgement.

Users' attitudes to design features can however only be compared proportionately, there is no fully objective means of measuring their value. Users' opinions regarding degrees of importance of specified requirements, or most-liked and disliked features, can therefore only be presented as 'tendencies' in a given population of respondents in specific circumstances. Anecdotal comments in response to questions such as "what do you like about this room?" can represent typical respondents' viewpoints, and although these are expressed verbally the relative frequency of certain types of comments can be compared for selected respondent categories eg age group, sex or occupation.

Analysis of the literature on design evaluation shows the following aspects* to be among those most frequently described as significant:

accessibility - convenience by car, on foot, by disabled
adaptability - versatility, ease and degree of variability
air - smell, freshness, draughtiness
appearance - stimulation, homeliness, tidiness
colour - brightness, space and temperature effect, image
comfort - thermal, tactile, pressure
convenience - distance, arrangement, effort expended
lighting - glare discomfort/disability, colour, fatigue character
maintenance - cleanliness, reliability, ease of access
noise - annoyance, character, intensiveness
privacy - auditory, visual, spatial
route finding - simplicity, 'message', orientation
security - vulnerability, safety, protection
sociability - atmosphere, friendliness, interactions
space - size, layout, suitability for purpose
view - interest, attractiveness, symbolism

*(derived from Ronco 1971, Sears & Auld 1976, Noble & Dixon 1977, Canter 1978. See also appendix E[5].)

Suitability of designs with respect to the kind of qualitative/ subjective aspects listed above can be evaluated by a variety of means, the most common being by semantic differentiation, or by Likert scales involving degrees of agreement or disagreement with statements about the design. Simple questions with 'yes/no' answers are however easiest to analyse but they tend to oversimplify results and can therefore be misleading. The relative significance of aspects can be assessed by statistically analysing results of scaling responses or by simply asking respondents to place features in defined categories or in order of importance. Open-ended questions on likes and dislikes can also help in assessing the general level of satisfaction with a design, and in identifying common problems.

Generally speaking the more detailed and complex methods of design evaluation involve more time and expense in preparation, in survey work, and in analysis of results. They have not been found to produce results commensurate with resources expended (Bishop 1978). While simpler methods are often less precise, less informative, and less reliable, they may be more effective in providing useful feedback for minimal expenditure. Open-ended interviewing is the most adaptable method of obtaining information on user response and can reveal important and helpful information in the hands of an experienced and able interviewer. A combination of survey methods is often the most rewarding approach. It enables responses on similar topics to be correlated and provides more interest for respondent and interviewer alike.

The number of value scale intervals, and the number of items to be value rated, are problems which have been debated by psychologists such as Oppenheim (1966), but the important question is the degree to which survey questions accurately reflect users' powers of discrimination and how their questions can provide useful feedback for designers. Faced with 80 or more questions on attitudes to environment, and seven scale intervals to choose from in each question, many respondents' powers of discrimination are likely to waver and therefore to become progressively less reliable.

For those surveys which have adopted 'yes/no' type answers, or a three-step scale using words such as 'unacceptable', 'just tolerable', and 'acceptable', there is the risk of uncertainty about the range within which evaluations are given. Relative values are more clearly established in Likert and semantic differential scales when five or seven intervals are used. But these methods take up considerably more space on the questionnaire and are more prone to errors when summing totals for comparison of item values.

6.6 EVALUATION OF LIGHTING DESIGN

An evaluation study of one particular aspect of environmental design, such as lighting, may reveal useful data which can then be used in providing guidance on design techniques for answering specific user requirements. Many evaluation studies have been carried out on models and in real buildings on the effects of lighting on visual acuity, on visual comfort, on work performance, and on the aesthetic effect of the visual environment (eg Hopkinson 1963, 1969; Hopkinson, Petherbridge & Longmore 1966; Hopkinson & Collins 1970). The contentious Hawthorne studies of Roethlisberger & Dickson (1939) focused interest on the relationship between lighting and work, as well as the importance of the full range of environmental influences on behaviour.

Lighting is also important in building design because of the effects of window design and artificial lighting on the thermal behaviour of buildings, and on the thermal comfort of their occupants. In offices, schools, factories and hospitals the trend towards deeper buildings, and energy efficient buildings, has brought about the need to reassess the effects of different forms of daylighting and artificial lighting on layout of rooms, and on means of preventing problems such as glare from sunlight. The slowness of the eye to adapt to quick transitions between well-lit areas to areas of relative gloom has also generated a need to examine the interrelationship between users' activity patterns and their visual performance (Ne'eman, Isaacs & Collins 1966).

One in-depth evaluation study which explored how lighting conditions were perceived by building users was undertaken by Blasdel (1973) in university libraries using a panel of architectural students as observers. This method had also been used by Hopkinson in evaluation studies of daylight glare in a variety of building types including hospitals (Hopkinson & Collins 1970).

Blasdel aimed to explore the relationship between quantitative measures of lighting conditions with human sensory responses. The problem in evaluating different environments was to transform subjective data into 'attributes' relating to observed qualities in the environment. Designers lacked structured and comprehensive information, their information needs were very diverse, their problems could not be identified in advance, and the effects of a design could not usually be evaluated by the designer. There was little feedback except concerning mistakes and omissions. What was needed was a structured means of obtaining occupant evaluations.

Blasdel's study of lighting in ten university libraries was undertaken using a questionnaire covering nine specific aspects and one overall aspect for evaluation. In addition, respondents were asked to nominate one worst and one best characteristic in each setting. The nine specific aspects were:

type of fixture - aesthetic quality
arrangement of fixtures - appropriateness
colour scheme - compatability
colour of light - effect on surfaces
glare from lights - direct
glare from surfaces - reflected
gross light distribution - contrasts, light and shade
modelling - strength of shadow on textured surfaces
quality of light - for intended purpose

From factor analysis of the results of the survey Blasdel was able to identify 13 attributes of lighting "with clear physical implications". These were tabulated in relation to 'glare' and 'general lighting' characteristics and were grouped into sub-sets based on the original questions:

Table 6.2 Attributes of lighting (after Blasdel 1972)

GLARE		
from lights	general	view of room
	fixture	view of lights
from surfaces	reflections	off desk tops
	reflections	off windows at night
GENERAL LIGHTING		
mixed	overall illumination	
	room luminance	
	light colour - spectral content	
colour scheme	'colourfulness'	
	'organic quality'	
distribution	evenness of light	
fixture arrangement and type	'gestalt quality	
	shape and noise (?)	
modelling	texture and shading	

Blasdel commented that the analysis indicated that "human responses were shown to be orderly and subject to interpretation over a remarkably wide range of topics". This does not altogether accord with Hopkinson (1963) who found wide variations in judgements on glare between the members of a small panel of observers. This variation was attributed by Hopkinson to both physiological and psychological factors, although individual observers maintained a fairly constant level of judgement over quite long periods (p 234). This finding makes questionable the validity of Blasdel's use of architectural students as observers, bearing in mind their untypical level of awareness of lighting and design. Hopkinson was aware of this danger and compared the responses of a team of six experienced observers with a group of 50 randomly selected observers and found that "the general population is less sensitive to glare than the experienced team" (op cit p 235).

Ideally in any evaluation studies involving subjective judgements, the respondents should represent a typical user population rather than a selected group of trained observers or specially qualified people. An alternative is to compare the overall and specific responses of a randomly selected panel with a trained panel, and to make adjustments in their levels of discrimination. The advantages of a trained panel of observers is their degree of consistency in evaluating a number of physical settings. For Blasdel's purpose this method allowed him to identify the components in the visual environment which were considered significant in achieving a good quality of lighting.

Blasdel concluded the report of his study by commenting on the development of design guide criteria:

> "Compared to medicine and law, for example, design lacks the written stock of knowledge which supports decision making. This is due both to a lack of a technical vocabulary for expressing the effects of design, and to the lack of a criterion by which designs may be evaluated.... The 'post-mortum' (sic) is a rare event in design and the design professions have not developed thorough systematic evaluation of problems." (op cit p88)

Blasdel's research on lighting had however tended to identify problems rather than specifying what was appropriate in a particular environmental setting. The idea of 'feedback' in design was often presented as a means of telling the designer how successful his design had been in the eyes of its users. A more appropriate way for the design professions to progress was "for all to learn through the endeavours of each" by developing "a common stock of knowledge sufficient to feed forward into future work" (p 92). To achieve this goal:

> "a descriptive language is required to structure the development and evaluation of designs, and where possible the quantitative features of the physical environment should be related to this language."

In an attempt to provide access to 'a common stock of knowledge' on hospital lighting design the writer initiated a study in 1974 on analysing the literature on lighting design by means of descriptive 'keywords'. These keywords were selected as a result of analysing both the literature and the concepts used by designers in trying to match design solutions to functional needs. The development of this descriptive language is described in chapter 8, and although the experimental bibliography which resulted from the study only partially succeeded in its purpose, it demonstrated the possibilities for linking the results of evaluative research in the field of lighting design with the input to design decision making (see slso appendix D[6]).

6.7 HOSPITAL DESIGN EVALUATION STUDIES

With an expanding hospital building program in Britain and North America after World War 2, the need became apparent to provide more efficient buildings in terms of money, staffing and energy. As a result many designers and building authorities turned their attention towards the need for feedback from studies of hospital design in use. Most of the early studies in the 1950s, such as the Nuffield Investigations and the Yale Studies at Newhaven Hospital, were directed primarily at specific problems such as ward design, lighting, call systems, and catering services. The US Public Health Service and the British Ministry of Health also sponsored a number of studies directed at providing information on planning and design methods, including the integration of engineering services in hospital buildings and the development of optimum building shape and department layout.

As many of the design ideas being developed at this time were largely untried in practice, it became necessary to test the ideas in live projects as soon as possible and to publish the results for general application. As the United States had a lead on Britain and Europe due to a better economic situation, many of the innovatory design concepts which originated in the USA were subsequently copied or adapted for use in Britain, often without sufficient testing or knowledge of the reasons for their development.

Hospital design developments in other countries which had been relatively untouched by World War 2, such as Sweden and Switzerland, were also studied with a view to saving time and money on research and development. In consequence design ideas were picked up from several disparate sources and applied without verifying their suitability in different social, climatic and economic situations from those in which they had originated. When designs embodying these imported design ideas were put into use some of them were found to be unsuitable for technical, social or economic reasons. Two-way talk nurse call systems, for example, which had been developed in the United States in hospitals with a high proportion of single and two-bed enclosed rooms, were not found to be justified in more open wards customary in British hospitals where observation was better. Compact hospital and ward layouts, which had been developed in the North American climate to reduce the costs of air-conditioning, and to minimise unnecessary traffic movement, were found to cause psychological problems among British hospital staff and patients who were used to fresh air and a view of the outside world. But there was no way of obtaining this knowledge without building hospitals embodying these concepts and finding out how they worked economically, socially and technically in each distinctive new setting.

Another factor generating a need to find out how different hospital designs performed in practice was an increasing proliferation of different designs for hospitals, wards, departments and items of equipment which were serving basically identical functions. If an empirical design approach resulted in such a variety of different designs, perhaps it was worth spending resources on eliminating unsuitable designs from the repertoire and concentrating on improving those designs which appeared to perform better than the others. For this to be done a consistent basis of comparison was needed which not only ensured that all designs were measured by an equivalent standard, but which also compensated for inevitable differences in design contexts such as climate, construction methods, and operational policies.

With a time span of up to ten years between initiating a hospital building project and its completion and use, it was clearly impracticable to wait this long for feedback from design in use studies in order to try another idea. Consequently a number of theoretical evaluation measures were developed based on practical knowledge of how hospitals worked. Results of surveys of traffic in existing facilities, for example, were used to develop models of typical traffic movements which could be used to test different design proposals. A 'standard nursing day' was evolved to test ward layouts for economy of nursing staff movements. But for many design criteria, such as adaptability and safety, theoretical models were impractical if not misleading.

With the completion of a number of new hospital buildings in Britain and North America in the late 1950s and early 1960s, it became possible to evaluate them in use rather than hypothetically. As a result every opportunity was taken to study the effects of new design ideas in operation, both to verify whether they were meeting the requirements on which they had been based, and to record how they were being used and what their users thought about them.

One of the first such evaluations of a new hospital building in use in Britain was published by the Nuffield Foundation in 1962. It described the experimental building extension to Musgrave Park Hospital in Belfast designed by the NPHT Investigation Team in the early 1950s (see chapter 5). The evaluation was conducted by a team assisted by a technical committee and a work study committee, and was regarded as a follow-up 'case history' to the NPHT 1955 Report rather than a formal assessment. Its purpose was to help other planning and commissioning teams, and to encourage similar studies to be undertaken on other hospitals.

The Musgrave Park case history concentrated primarily on describing the physical features "which could be improved on in future planning", such as the width of single rooms and multi-bed bays in wards which had been found too cramped with a 20'0" (6.1 m) structural module and wall thickness of up to 1'0" (30 cm). It was also recommended that bed centres should be at the traditional 8'0" (2.4 m) to give sufficient room to attend patients when the cubicle curtains were closed. Other aspects mentioned in the case history concerned patient observation, noise disturbance, bacteriological tests on bed-pan washers, lighting and heating. Little information was given in the Nuffield case history on survey methods used or the precise composition of the survey team.

A series of hospital evaluation studies in the USA by Thompson et al in the late 1950s and undertaken at the Yale-New Haven Hospital were equivalent in many ways to the Nuffield Studies in Britain. Thompson's studies, which were financed by a US Public Health Service Grant, included a comparison of 18 different shapes of ward layout and led to the development of the 'Yale traffic index'. Thompson also investigated patient satisfaction with ward facilities, attitudes to privacy, call systems, progressive patient care, catering systems, and utilisation of delivery suites.

One method developed by Thompson et al was the comparative model by which two or more different designs or systems which served the same purpose could be evaluated in terms of their effects on users' attitudes, on costs, and on other measurable performance indicies. There were however practical difficulties in applying this method in the hospital context.

Another approach was that used in operations research where practice and theory were related through analysis of costs and performance. This could be undertaken conceptually, ie by the theoretical testing of ideas; or by mathematical modelling, ie by statistical analysis of activities and usage of facilities; or by computer simulation, ie predicting the effects of changes in inputs to the situation being studied. Each of these methods had its limitations, partly because of the practical difficulties of studying real systems in use without altering the way they behaved, and partly because the theoretical approaches could not adequately represent the real-life situations being investigated.

The methods used by Thompson were applied to a variety of design and management problems, but the more useful findings appeared to be those based on behavioural studies in real situations. A study of the use of patient-nurse call systems in wards, for example, found that they were used more for staff inter-communication than for patients to call a nurse. This clearly had implications for ward designs based on the idea that visual supervision was not important because patients' needs could be made apparent by the press of a button and a few words into a microphone. Some recent hospitals which have been equipped with sophisticated patient-nurse call systems have found to their surprise, and their cost, that this is still true today.

Another contemporary study undertaken by Jacobs, an architect, for the American Institute of Architects and the American Hospital Association in the late 1950s, concerned the design of operating theatres with the objective of reducing infection risks. This led to some innovative ideas for containing the patient in a plastic bag which were to be developed further by Cowan in South Africa in the 1970s.

The next detailed evaluation of a new hospital building in Britain was published by King Edward's Hospital Fund in 1963 and was the result of a joint evaluation study of the New Surgical Block at Guy's Hospital, London Bridge, carried out by the KEHF, the Ministry of Health and the Board of Governers of Guy's Hospital with assistance from the Building Research Station. The evaluation was partly a 'public relations exercise' to counter criticism of the 24 bed semi-Nightingale wards used in the surgical block. The foreword of the report however suggested the desirability of a 'further impartial study' to compare the Guy's wards with other teaching hospital wards of equivalent standard. The main aims of the Guy's evaluation were 1) to establish whether the building was fulfilling the intentions of the planners and the needs of the users, and 2) to provide guidance to other planning teams so that they could avoid mistakes made at Guy's and benefit from successful innovations.

The evaluation at Guy's consisted of visits, interviews with staff and a questionnaire survey of patients. For the staff interviews a checklist of specific aspects was used including siting and transport in relation to other departments, internal planning of wards, and ease of observation of particular rooms and areas in the ward. A simple yes/no type questionnaire was sent to 500 patients following their discharge and 67% were returned completed. The questionnaire covered seven topic areas:

noise - by day and night
privacy - spatial, visual, social
communications - nurse call system
toilet facilities
equipment - bed, locker, lighting
comfort - temperature, ventilation
day room - utilisation.

Details of patients' previous hospital experience were also recorded.

Subsequent ward designs at both Guy's and St. Thomas' hospitals seem not to have heeded the Guy's findings on the advantages of more open wards, and which were largely rejected by the planning teams of other hospitals in Britain at the time.

Although the Guy's evaluation was of a new multi-department hospital building it tended to be focused largely on the wards and operating theatres, as was the earlier Nuffield case history. In 1963 the Scottish Home and Health Department (SHHD) published a Hospital Design in Use report on the Vale of Leven Hospital, which was one of the first to be completed in Britain after the war. This study was followed by two others: on Victoria Hospital, Kirkaldy in 1965; and Bellshill Maternity Hospital, Lanarkshire in 1968. These Design in Use studies were largely descriptive although their intention was to identify any particular problems which were discovered by talking with hospital staff or by observation

A survey proforma was developed for the Vale of Leven study "to assist in obtaining a uniform and complete set of observations during visits to the hospital" (see appendix E^{2}). The evaluation report referred to the absence of a detailed architect's brief, as a result of which the evaluation team had difficulty in establishing criteria for evaluation.

During the 1960s a great deal of hospital building was undertaken in Britain, Europe and the USA, but relatively little effort was devoted to finding out how well they worked from the users' point of view, or whether they were the right sort of buildings for their purpose (Sommer 1972). A number of theoretical comparative studies of ward design were however undertaken, mainly to establish preferences for different shapes and sizes of ward layout (eg Jacobs 1961, Great Britain MoH 1963, Great Britain SHHD 1963, McLaughlin 1964).

In Britain the Ministry of Health and BRS jointly carried out a number of evaluation studies on particular aspects of hospital and ward design such as lighting (Ne'eman 1966), interdepartmental traffic (Black 1966), and drainage systems (Wise and Payne 1965). Several other individuals and authorities also carried out general evaluation studies in particular hospital buildings or departments (see appendix E[3]).

As a result of this growing interest in hospital design evaluation, the Kind Edward's Hospital Fund published in 1969 a report on Evaluating New Hospital Buildings which attempted to summarise the experience gained, and to suggest the most profitable lines of development. Many of the previous evaluation studies, it was found, had run into difficulties due to lack of a structured approach to evaluation. The KEHF report included summaries of a number of the earlier evaluation studies, including the Musgrave Park, Guy's and Vale of Leven reports. The comment was made that they had produced little of value as feedback to later designs, largely because their objectives were unclear or confused. Most of the studies were descriptive, and relied mainly on the researchers' impressions and on open-ended interviews with staff. Few had included any systematic comparative questionnaire or interview surveys of patients. The King's Fund Report nevertheless made some important recommendations which are summarised below:

1. evaluation studies should be undertaken by multi-professional teams of about five people
2. two kinds of information are needed:
   a) documentary evidence on planning methods, design details, costs etc.
   b) evidence from observations, questionnaire surveys, interviews etc.

3. objectives of the study should be stated explicitly at the outset

4. only information which was essential should be collected as much time could be wasted in detailed analysis of unimportant data

5. a quick 'walk-about' evaluation could reveal much useful information; it could either be used as a preliminary to a more detailed study or could provide quick feedback if time was short

6. presentation of findings was important in disseminating results of evaluation surveys to the people who needed them, eg by seminars, conferences and book reviews, in addition to reports.

The difficulty of organisations responsible for planning finding the time and resources to carry out evaluation studies was acknowledged in the KEHF report. A possible answer was to establish multi-disciplinary teams in university departments or government agencies. Design-in-use evaluation was seen as the 'final link' in the sequence:

functional analysis
↓
briefing
↓
design
↓
building
↓
commissioning
↓
operating
↓
evaluation

Fig 6.7 Evaluation in the planning sequence (from KEHF 1969)

The benefit of the experience gained in the SHHD evaluation studies was summarised in the King's Fund report from an article by Hunter (1965):

1. three types of evaluation study could be distinguished

   a) brief study of a whole hospital or several departments in a series of hospitals

   b) detailed study of a particular department or procedure

   c) an indepth study of a particular technical aspect such as lighting

2. evaluation should not be undertaken until a year or more after a new building had been completed and occupied

3. approval for evaluation had to be obtained from the appropriate authorities, and also clearance from trade union representatives

4. examine briefing documents before starting the evaluation; discuss and agree objectives of the study beforehand

5. avoid disrupting routine work in departments; several short visits is preferrable to continuous observation; allow hospital staff to express opinions but check for validity

6. record design details at time of visit and check against design drawings

7. details of staff movements can be useful if carefully recorded; in clinical areas medical or nursing members of the team may have to carry out observations

8. hospital staff should not be expected to make detailed records of their activities

9. proformas and questionnaires were of limited value except as checklists

10. clerical and graphical assistance is needed and must be planned for

11. reports must be simple and easy to read and should be specific about comments on design and use; technical details were best put in appendices

12. about two detailed studies a year could be undertaken by a full-time team.

Following the King's Fund report a number of general and specific hospital design evaluation studies were published in Britain and USA, but none of these included a general study of a whole hospital design in use. Most of the studies were either on methods of evaluating hospital design options, or were studies of particular departments, mainly wards. Some of the more interesting ward evaluation studies are described in two later sections of this chapter.

One very elaborate study of hospital design evaluation from the USA by Field et al (1971), was originally intended to be applied to the planning of the Tufts-New England Medical Center in Boston, Massachusetts. It ran into funding problems and delays however, which resulted in a severe cut-back in the project and in the scope of the proposed evaluation studies. It nevertheless provided a useful review of the state-of-the-art of design evaluation, although the main focus was on techniques for evaluation of design proposals. One chapter described means of measuring people's reaction to building designs by examining photographs of building interiors (in order to remove all other influences except the visual image of the design), and recording respondents' evaluations on a 7 point semantic differential scale (Ronco 1971). Other topics discussed in Field's report included a comparison of various means of measuring walking distances in hospital wards, and methods of using 'design directives' as a basis for evaluation of design proposals.

One of the most wide-ranging studies on evaluation of hospital design options was carried out by the US General Accounting Office for the US Senate Committee on Labor and Public Welfare and published in 1972. The main purpose of the study was to reduce the cost of constructing hospital facilities supported by public funds. Particular attention was given to innovative techniques and new materials, patient care facilities, operating costs, and means of reducing demand for new facilities. Design aspects investigated included pre-construction planning, construction techniques, labour and material costs, and life cycle costs of particular design innovations. Interstitial spaces, materials handling systems and nursing unit design were singled out for detailed comparison of options and cost effects. Recommendations included the establishment of a data base on innovative design methods and costs.

The operational cost consequences of design decisions are clearly of ever-increasing importance in times of inflation and economic restraint. Despite numerous attempts to produce means of calculating overall running costs of hospitals in the design stages, this has only been possible on an item by item basis. A Note on the 'Relationship between Planning Health Buildings and their Running Costs' was published by the DHSS in London in 1980 and briefly reviewed techniques which could be used to predict operational costs in the design phase. The Note emphasised that direct relationships between building costs and running costs could seldom be demonstrated, but that there were certainly relationships between the way hospitals were planned and their running costs. The preparation of a good brief and carefully considered operational policies were by far the most important contributors to economy in operation. 'Good layout' was also significant, although the effect of decisions on centralisation and sharing of facilities could influence staffing and equipment costs to a significant extent.

Other important design factors identified in the DHSS note as being related to running costs were the degree of adaptability provided and the extent of air-conditioning. The note listed nine points which designers should consider as a means of reducing running costs:

1. access to engineering services and equipment
2. costs of materials in relation to their maintenance costs
3. damage protection
4. floor finishes, especially carpeting
5. metal versus wood for trim
6. flat versus pitched roofs
7. comparison of different 'standards' of materials for specific purposes
8. methods of control of air-conditioning
9. the effects on flexibility of low maintenance materials.

Much of the advice in the DHSS note was based on evaluation studies of design options carried out on the Best-Buy, Harness and Nucleus projects. These included:

window size and energy demand
structural systems
numbers of floors (ie building height)
boiler room location
roof types and clerestory lighting
treatment room provision
methods of supply delivery
size of structural bays for wards
forms of bay windows in wards
types of lifts
materials for pipework and trim
types of thermal insulation for walls and roofs

The identical design of the two Best-Buy hospitals, and their relatively rapid design and construction period, meant that the longer term cost effects of the design decisions could be verified within about five or six years of completion of the building, and about ten years from when the decisions were made. Follow-up studies were planned on a number of aspects, and many of these have justified the original decisions (Willers 1980). The aspects considered were:

methods of construction on site
(not completed due to difficulties of obtaining data from contractors)

use of centralised treatment rooms
(favourable findings)

sound insulation in OPD consulting rooms
(not satisfactory due to low ambient noise level)

mechanical ventilation
(improved after long run of tests)

damage to walls and trim by tugs and trailers
(not satisfactory)

cleaning methods

ventilation in kitchens

adequacy of sign-posting
solar heat gain
glare from clerestory windows
performance of aerated concrete slabs

The results of the last six studies were as yet inconclusive. Another major study undertaken at both Best-Buy Hospitals, and also at another more orthodox new hospital for comparison,was concerned with utilisation of space (MARU 1977, DHSS 1978). The purposes of this study were 1) to test assumptions on how many rooms to provide for a given workload, 2) to develop methods of monitoring use of space, and 3) to improve DHSS guidance on standards of space provision. The overall conclusions on the Best-Buy evaluation in use study was that it had "largely succeeded in its objectives".

A contrasting comment by Kenny and Canter (1979) in relation to hospital design was that technological developments had:

> "set in motion an approach to hospital design which can at times owe more to factory production processes than to healing and caring for patients" (p 328)

Fragmentation of hospital design and management had been encouraged by divergence of the different professions and by separation of hierarchical levels. Hospital design could help to bring together the various viewpoints and slow the escalating technological spiral. Incorporating a variety of viewpoints in the design process was seen as necessary to achieve this goal, but post-design evaluations were an important input to the process.

Despite the varied approaches to design in use evaluations described above, the main criterion in any health facility design evaluation is whether the patient as the primary user, is satisfied with the results. This aspect is explored in the next section.

6.8 PATIENT OPINION SURVEYS IN HOSPITALS

A major gap in knowledge about the causes and effects of design was identified by Canter (1972) as a result of his psychological evaluation of a childrens' hospital in Glasgow. Design was strongly influenced by physical, economic and polital constraints in general, and by the way of thinking of the designer(s) in particular. As a result research findings, guidelines and 'scientific literature' tended to be ignored in the process of designing. While technological design data was plentiful and available, information on personal behaviour and attitudes was sparse.

In reviewing the early Nuffield Investigation literature on design and evaluation of wards, Kenny and Canter (1979) found little reference to patients' views or needs. It was not surprising therefore that patient opinion surveys in Britain revealed a "lack of control, by patients, of their environment" (Raphael 1977 b).

In the USA most of the ward evaluation studies have tended to concentrate on efficiency in terms of floor space, staffing and walking distance, and on privacy as determined by the degree of social isolation from other patients. Thompson, for example, carried out a number of patient opinion surveys on privacy in wards, as well as his better known traffic studies (Thompson & Goldin 1975). Paradoxically, more studies of patients' needs seem to have been carried out in children's hospitals, in psychiatric hospitals, and in homes for the aged and handicapped, than in general acute hospitals. Osmond (1957) made the comment that no equivalent investigation to the 1949/55 Nuffield studies of general hospital wards had then been made of psychiatric hospitals.

Since that time however there have been a considerable number of such studies in both psychiatric and subnormality hospitals in Europe and North America. Patients' views nevertheless continue to be noticeable by their scarcity. This is especially regrettably in the light of Raphael's patient opinion surveys of Psychiatric Patients and their Hospitals (1972), and Lindheim et al's book on Changing Hospital Environments for Children (1972), both of which attempted to give a clients' view of hospital environments rather than a providers' view.

The series of patient opinion surveys in nearly 70 general acute hospitals in Britain carried out by the King's Fund (Raphael 1969, 1973, 1977a, 1977b) were mainly intended to provide feedback to hospital management on how consumers viewed the service they had received while being inpatients. The survey results also provided some useful pointers to aspects of hospital and ward design which needed to be improved. The survey was based on a simple 'yes/no' questionnaire with opportunity for comments. The two page questionnaire covered five areas of hospital life under 17 specific topics in 28 questions, including two open-ended questions on 'likes and dislikes'. Details of patients' age and sex were also requested, but not their previous hospital experience.

The questionnaires were issued to a selection of patients at the time of discharge or shortly after. An average response rate of 73 per cent was obtained from general hospitals, this representing replies from over 10,000 patients in 68 hospitals over a period of six years. Analysis of the responses revealed a generally satisfactory reaction from patients, older patients tending to be more appreciative. Other factors, such as sex, clinical condition, type of ward, or hospital expenditure, did not appear to affect the level of contentment, although the results of more recent surveys showed a higher rate of contented respondents. The main criticisms concerning ward design were that they were often hot and stuffy, and noisy at night. Protective undersheets and plastic mattress covers were also disliked. Good marks were given for bright and cheerful decor. The lack of privacy of toilet facilities was the most criticised topic in the entire survey (few of the wards surveyed had bedrooms with ensuite toilets). On topics 'liked most', 93% of responses referred to human or organisational matters, only 7% referring to physical aspects such as food or ward design. Items 'liked least' were almost equally divided between human and physical matters.

Some of the surveys were conducted at the same hospital on two different occasions. A noticeable improvement was almost always reported from the second survey. There was also a generally higher level of satisfaction in the more recent surveys than in the earlier ones, suggesting that the effect of feedback to hospital management had indeed produced beneficial results in the eyes of the patients.

On the validity of the survey findings,Raphael (1977) accepted that there were serious limitations, especially in the pilot survey of the selected hospitals. Only English speaking patients were asked to respond,and nobody under 15 was given a questionnaire. Patients who had been in the ward for less than four nights were also excluded. The fact that an average of 23% patients did not respond may also have concealed their general dissatisfaction or their distrust of the consequences of making adverse comments. Despite these limitations Raphael concluded that the findings provided much useful feedback on areas of dissatisfaction and provided an agenda for remedial action.

On the value of measuring patient attitudes, Uuskallio (1970) considered that the results of opinion surveys in Eurpoean hospitals emphasised the relatively low importance most patients placed on the physical environment by comparison with human relationships and understanding. In which case, it might be argued, the most important contribution design could make to patients' well-being was to show that somebody cared about them.

Similar conclusions were drawn by Eardley and Haran (1979) who found that over half the patients in a survey of 136 patients in a Manchester teaching hospital put 'staff' as the thing they liked most, while 'ward conditions' and 'amenities' were both mentioned first by only one percent of respondents. These two features were however placed third and fourth in order of 'dislikes' by over one fifth of respondents in the survey. Specific points mentioned as 'dislikes' were lack of visual privacy in open wards and washing areas; poor maintenance of equipment, such as TVs and radios; and the use of plastic undersheets for all patients. Boredom and noise disturbance were frequent problems. The provision of adequate day space was suggested as a possible remedy.

Patient opinion surveys conducted at two major teaching hospitals in Australia (Hughes 1979, Curtis 1979) tend to confirm the kinds of results obtained by Raphael, and by Eardley and Haran, although the survey questionnaires and range of topics were very different in each case.

Hughes, for example, issued questionnaires to 1720 patients being discharged in 14 wards over a four month period. Only patients whose length of stay was over 48 hours, who could read and write English, and who were medically fit enough were invited to participate. The response rate was 82%.

Although Hughes' questionnaire contained 58 questions on a wide range of topics, the primary purpose of the survey was to obtain feedback on the acceptability of a disposable bedpan, vomit bowl and urinal system which had been incorporated in the design of the new 400 bed hospital. Other major topics on which 'yes/no' answers were invited were acceptability of carpets in main corridors, the frozen food catering system, lighting, and privacy in bedrooms and toilet facilities. Details of patients' sex, age and length of stay were recorded together with an invitation to mention items liked 'best' and 'least', and any suggestions for improvements.

Although all the 28 bed wards included in the survey contained a mixture of four bed and single rooms with ensuite toilets, a small but significant percentage of patients expressed dissatisfaction with the privacy of the ward (5.0%), and with the toilet arrangements (3.5%). The questionnaire was however worded in such a way as to influence respondents to give favourable rather than unfavourable responses, eg 'was the wc private enough?' No opportunity was provided for a qualified answer. Nevertheless the opportunity to make comments identified problems of auditory privacy in the four bed rooms, and of visual privacy due to toilet sliding doors not shutting easily.

Hughes' survey sought especially to provide information for management on:

1. degree of user satisfaction by a typical sample of patients
2. relative importance of different aspects of patient care
3. differences in adequacy ratings of different wards
4. which management practices caused most dissatisfaction
5. the effects of changes being introduced.

It was not evident from the report of the survey how respondents rated the importance of the different aspects covered, although it was apparent that some wards seemed to be rated better than others for acceptability of aspects such as noise disturbance, privacy and availability of toilets. However, noise at night, carpets, thermal comfort and interior decoration were rated relatively poorly compared with features such as lighting, privacy in wards and toilets, and the nurse call system.

The survey by Curtis (1979) aimed to determine whether there was a statistically significant difference between the kind of responses made by patients regarding their hospitalisation and what factors predisposed patients to give negative responses. Four hundred and thirty two patients were randomly selected and interviewed by graduate nurses as part of a 'Quality Control Program'. A short questionnaire of 13 items was used in the survey and covered items such as thermal comfort, rest, size of bedroom, call system, meals, information about the treatment given, and bedding. The findings indicated that younger patients and those hospitalised for longer periods tended to give more negative responses, although Curtis accepted that this may have been due to these patients being either more inclined to criticise, or less satisfied with their treatment. The use of nurses to conduct the interviews may also have had the effect of suppressing adverse comments in all but the foolhardy or the dying!

6.9 WARD DESIGN-IN-USE STUDIES

Among the influences which have shaped ward design and management over the last 30 years have been a number of studies of nursing efficiency as affected by layout, eg Nuffield (1955), Thompson's (1959) Yale Studies of Hospital Function and Design, Sturdevant (1960), McLaughlin (1964, 1969), Freeman & Smalley (1968), and Lippert (1971). The last-mentioned particularly emphasized how the order in which patients were visited by nurses affected the relative walking distances travelled in different types of layout.

The earlier Nuffield Studies on the Work of Nurses in Hospital Wards (1953), had been primarily concerned with the effects of nursing methods on the quality of patient care, whereas the American preoccupation with 'efficiency' had tended to neglect patients' viewpoints. Thompson, however, included patient opinion surveys in his studies of wards (see Thompson & Goldin 1975 chapter 13).

Some of the more recent American studies (eg Trites et al 1970) have investigated the effect of three shapes of ward layout on the activities and feelings of nursing personnel, and also on the feelings of patients and doctors. The marked preference of all three groups of respondents for radial ward units was shown to be positively correlated with the effect of the radial designs on reducing travel distance, and on efficient utilisation of nursing staff time in direct patient contact. Some of the staff time saved in the more efficient designs was however spent in non-productive activities. This finding has been substantiated in studies of efficiency in ward units in Australia (Cabban & Caswell 1977).

As wards have been the subject of more evaluation studies than any other hospital department, it is perhaps surprising that the feedback from these studies has not led to a greater degree of standardisation in design. A review of layouts of fifty or more recent ward designs in Europe, North America, South Africa, Australia and New Zealand reveals a bizarre collection of shapes and styles of accommodation which is clearly not due to the effect of local conditions or nursing policies (Pütsep 1981).

In an attempt to find out how ward designs affect their suitability for nursing care a number of descriptive and comparative evaluation studies have been undertaken over the last 15 years or so, and a selection of these are reviewed below as a background to the case studies described in chapter 10.

The earlier studies, eg by the Nuffield Team in Britain, and by Thompson and Pelletier in the USA, were mainly concerned with area standards per bed and with walking distance of nurses, although some specific aspects such as supervision, privacy, noise and toilet provision were also investigated. The first three in the series of Hospital Design in Use studies by the Scottish Home and Health Department (SHHD) in the 1960s included consideration of ward design as part of the hospitals evaluated, but the fourth evaluation (published by the SHHD in 1969) was a detailed analysis of an experimental ward block at Falkirk and District Royal Infirmary. This ward had been designed in 1962 by the SHHD team responsible for the SHHD's Planning Note on Ward Units in which the Falkirk layout had been described.

The Falkirk evaluation sought to test four main design features:

"a) a deep compact plan exploiting recent developments in lighting, heating and ventilation,

b) a plan which would facilitate grouping together on the ward those patients requiring concentrated nursing care,

c) an arrangement of accommodation and provision of facilities to allow a high degree of flexibility in use,

d) improved standards of privacy and amenity for patients." (SHHD 1969 op cit pl)

It was hoped that standards for NHS hospitals:

> "might be set by a practical trial of this kind and that these would remain acceptable for many years to come. This entailed a complete departure from the Nightingale ward towards a comprehensive nucleus of nurse-working rooms centrally related to divided bed areas". (loc cit)

The Falkirk experimental ward layout contained 60 beds of which four to twelve beds could form an intensive nursing care area. A combination of separate four-bed rooms and single rooms were used, all with en-suite toilets except for four single rooms in the intensive care area. Four bed rooms were considered to give "significant advantages in privacy and social acceptability", compared with larger numbers of beds per room, greater flexibility in use and a high occupancy rate.

Three main methods were used in the Falkirk ward evaluation:

1. collection of evidence by ward staff according to a list of headings applied by the evaluation team,
2. a detailed 24 hour survey of nursing journeys in the ward which was converted to string diagrams for analysis,
3. a two-day symposium involving a wide representation of interested people to assess the material collected and to express their views.

The design was based on earlier work by the NPHT Investigation, especially the experimental wards at Larkfield Hospital, Greenock and Musgrave Park Hospital, Belfast. Ideas were also obtained from a study tour of the USA in 1960.

The basic requirements of the ward design were:

1. to improve the level of amenity and privacy for patients
2. to encourage a high bed occupancy
3. to be economical in staffing
4. to be capable of being used flexibly
5. to aid control of infection
6. to meet the working requirements of nurses

In the course of planning and designing the Falkirk ward many floor layouts were developed and tested using the 'Standard nursing-day technique' devised by the SHHD team. Proposed design solutions were then thoroughly tested using full-scale mock-ups prior to construction.

The results of the 24 hour survey were that the ward functioned efficiently, calmly and quietly, and that the internal glazing of partitions gave an open spacious feeling and "provided good nurse/ patient observation". The ensuite toilet facilities, wardrobe cupboards and night lighting proved satisfactory. Points of criticism included:

day spaces and sisters' office too small
ward pantries unnecessarily spacious
unscreened inter-room glazing in the intensive care area
superfluous washbasin and sink in the same room
patients' call hand sets not easily accessible

Standards of floor area and costs were compared with other general acute wards in British non-teaching hospitals. This showed that the Falkirk ward came near the upper end of 'net floor areas per bed':-

Table 6.3 Ward areas compared with Falkirk ward

ward/date	sq.ft/bed	m^2
Vale of Leven (1955)	174	16.2
typical Nightingale ward	200	18.6
Larkfield (NPHT) (1955)	246	22.9
Greenwich (DHSS) (1965)	248	23.1
SHHD 6-bed	254	23.6
DHSS Building Note	285	26.5
Falkirk ward (SHHD) (1967)	302	28.1
Gartnaval (SHHD)	307	28.5
Greenock (SHHD)	324	30.1

The higher floor area ratio, and the higher building costs of the Falkirk ward were defended on the grounds of better standards of amenity for patients, and more efficient use of space and staff in achieving a high level of nursing care. It was acknowledged that a linear form of ward layout would have reduced the construction and operating costs. The SHHD would therefore only approve deep planned wards where it was "impossible to provide linear plans economically".

The issue of four bed versus six bed patient rooms was discussed at length in the report, it being acknowledged that six bed rooms could reduce circulation area per bed by about 20%, and the capital cost per bed by about 16%, in otherwise equivalent types of ward layout. The adoption of four-bed rooms at Falkirk was however defended on functional and amenity grounds, most patients preferring to be in a corner bed if one was available. Subsequent evaluation studies of ward design have done little to settle the issue of 'four or six bed rooms?' (some of both seems to work well).

The Falkirk ward evaluation was essentially a feedback exercise by the planners to see whether their original assumptions, objectives and policies had worked out, and if not, why not. Ten years after the Falkirk ward was opened in 1966 Health Bulletin (1976) published a short report on the continuing success of the ward in use attributed "in no small measure to the extent to which basic requirements were defined...and expressed in the design". Particular points of praise were flexibility of the design, the effective compromise between patient privacy and nursing observation, and convenient location of utility areas and patients' toilets.

In response to the need to develop more efficient ward designs in the spate of hospital building in the late 1960s in Britain, the Scottish Hospital Centre published (in 1967) a Guide on the Functional Analysis of Ward Plans. This was intended to be used in assessing ward planning proposals by planning authorities. The introduction emphasised the need for a systematic approach to assessment, particularly concerning room grouping and relationships. Good ward design was not an expensive luxury, but aimed to provide an efficient and comfortable environment for the activities it contained. The potential conflict between privacy and supervision could be overcome by suitably designed glazed partitions between bed rooms and ward corridor. The guide tended however to reflect the prevailing views of the SHHD on four bed rooms in preference to six bed rooms.

Concurrently with the development of the design of the Falkirk ward by the SHHD, the then Ministry of Health Hospital Design Unit in London (of which the writer was a member) was conducting a comparative study of ward designs based on a 60 bed ward floor of two ward units of 30 beds as recommended in the then current Building Note No.4 (Great

Britain MoH 1961). Eight different shapes of layout were compared, ranging from a straight single corridor layout to a deep square shape layout. Each layout accommodated the same number and type of rooms, but the circulation areas and the extent of internal accommodation increased as the layouts got deeper, as did the cost of construction and operation. The findings of this study (published as Hospital Building Note No.17) were similar to those of the SHHD with respect to increased capital and running costs in the deeper planned buildings. However, it was concluded that a simple double corridor layout offered a good compromise between staffing convenience, flexibility of accommodation and economy, <u>if</u> one accepted that the ward should be mechanically ventilated, <u>and/or</u> the site was too restricted to permit a naturally ventilated linear layout.

Several racetrack or deep-planned wards were built in England following the publication of HBN No. 17, including a 40 beds per floor double corridor layout at High Wycombe. This ward design was subsequently evaluated in comparison with the 80 beds per floor single corridor layout at Princess Margaret's Hospital, Swindon. The evaluation was conducted by the client authority, Oxford Regional Hospital Board, and their report was published in 1970. An ideal feature of the evaluation was that the two wards were designed to similar standards of accommodation by the same architects (Powell & Moya) and with the same planning consultants (Llewelyn Davies & Weeks). A number of American studies had compared the operational effects of different shapes of ward layout within one hospital (eg McLaughlin 1964), but their results had been inconclusive and could not in any case be applied to British conditions. One reason for conducting the comparative evaluation at the High Wycombe and Swindon wards was that the High Wycombe ward was found to be working exceptionally well and the client authority wanted to know why, and whether the higher costs of the deeper building were justified in terms of increased operational efficiency.

The results of the High Wycombe study showed that:

1. the deeper ward cost more to build and operate than the equivalent single corridor ward due to higher engineering costs, particularly ventilation
2. the extra costs of the deep plan permitted improved ward function not possible in a linear plan
3. the operational benefits of the deep plan were better staff utilisation and more contented patients due to a higher standard of nursing care
4. reasons for better care in the deep layout were closer integration of bed areas around the nurses' station allowing excellent observation, there was also less traffic disturbance because of the double access to the nurses' station
5. the benefits of the deep plan could not be achieved without incurring higher costs than then allowed by the DHSS cost limits
6. although linear designs could be produced which embodied some of the deep plan features, they were less satisfactory than the deep plan.

A variety of evaluation techniques were used in the High Wycombe study including:

1. floor area measurement
2. walking distance measurement
3. cost comparison
4. patient and staff opinion surveys
5. staff interviews and observation
6. recording of room occupation and traffic movements
7. comparison of design features with current requirements
8. discussion of ideas by the evaluation team and testing of alternative design ideas

A questionnaire survey of patients included the following topics (derived from the report - no example of the questionnaire was given):

bed space and ward design
privacy
heating and ventilation
lighting
noise
call system
toilet facilities
decoration
visiting
use of dayroom
equipment
storage of belongings
catering

The main complaints related to heating and ventilation. The High Wycombe wards were not fully airconditioned and the windows could be opened; Swindon was mainly naturally ventilated. Other problems mentioned by patients were:

glare from lighting
mixed sex toilets
lack of privacy (in mixed sex ward units)
noise of staff talking near the nurses' station

The main advantage of the deep planned ward was the 'U' shaped arrangement of beds around the nurses' station which facilitated supervision and gave easy access to utility rooms without causing undue noise.

The aim of the comparative study had been "to feed the information obtained into current and future planning". The introduction to the High Wycombe report contained the hope that the effectiveness of earlier planning work could be measured by evaluation,"and the experience gained transferred to the planning of later projects. The result of evaluation should be a steady, monitored improvement in the outcome of planning". Unfortunately assessment of design could "too easily become a measure of human adaptability". The evidence which was plentiful and easy to measure had "only a marginal effect on patient care, as the ultimate value".

One of the issues discussed in the 'case history' of Musgrave Park hospital, and in the evaluations of Vale of Leven hospital and Guy's hospital, was the spacing of beds. This varied from 6'7½" (2.33m) at Vale of leven to 9'4½" (2.86m) at Guy's where an 'overlapping' system of bed spaces was used. To test the theory that bed spaces could be reduced from 8'0" (2.44m) to 6'0" (1.83m) without loss of convenience by using overlapping bed spaces, an evaluation was undertaken by the North London Polytechnic Medical Architecture Research Unit (MARU) in 1968 in two six bed rooms specially converted to the proposed arrangement (Adams 1971). The bed rooms were operated normally and observations and interviews conducted by the survey team to assess the effects of the smaller bed spacing on convenience and personal privacy. Interviews, observations and questionnaires were used in the study which found that nursing convenience, personal space and privacy were adversely affected, even though the effective bed space for each bed could be increased to 8'6" (2.6m) by using the shared zone each side of the bed:

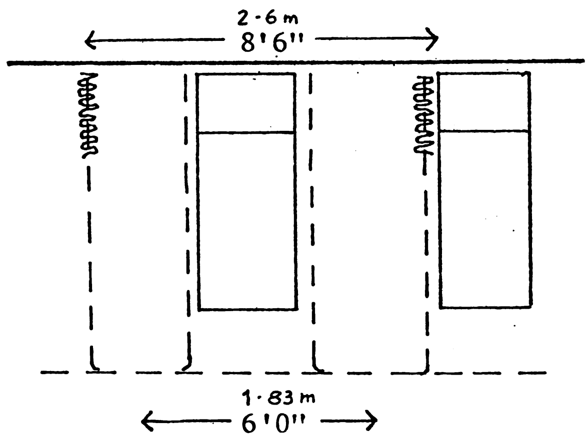


Fig 6.8 Overlapping bed spaces

The question of the effect of bed spacing on cross infection has also been debated, but no studies have yet been able to show that reduced spacing from 8'0" to 6'0" would increase the risk. A more significant effect would appear to be the extent of subdivision of the ward and the number of patients in multi-bed rooms (Smith et al 1980). Other factors, such as location of wash-basins, the type of mechanical ventilation system used, and the use of treatment rooms for 'dirty' procedures, are also important (Bagshaw et al 1978).

The effect of air movement on infection rates in wards was the subject of investigation by the Hospital Engineering Research Unit in Glasgow University in the early 1960s (Baird et al 1966). To trace the path of dispersal of pathogenic organisms in a specially converted ward an adjustable system of mechanical ventilation was installed. Nitrous oxide gas was used to simulate pathogens and its movement traced with the aid of sensing devices at strategic locations in the ward. The effect of turbulence in doorways was found to have a marked effect on air movement, but its significance on infection risk was overshadowed by many other factors.

Following Canter's Glasgow Children's Hospital evaluation study of 1972, a number of articles and publications were written by him on the psychological evaluation of hospitals and other buildings. Subsequently, with the help of a research grant from the DHSS, Canter formed the Hospital Evaluation Research Group (HERG) in the Department of Psychology at the University of Surrey. The result was a User Survey Evaluation Package (Canter et 1978) intended for use in getting feed-back on the effects of new hospital ward designs in use. The package consisted of:

1 a) a patient questionnaire of over 100 attitude questions on the ward environment using a seven point semantic differential scale, plus

1 b) ten questions on facts about the respondents, their previous hospital experience and their immediate ward situation

2 a) a nursing staff questionnaire of 105 questions using a seven point Likert scale, plus

2 b) six questions identifying the hospital, ward, and staff category

3. about 50 questions on the operational and design features of the ward surveyed to be completed by the survey organiser with the help of a senior nurse.

The survey method was initially tested and validated in a series of three pilot surveys involving 870 nurses in 14 hospitals and including 42 old wards and 38 new wards. A 'standardisation survey' of 23 further hospitals followed in which 139 new wards built between 1960 and 1976 were included. Over 1900 nurses completed questionnaires and nearly 100 staff were interviewed. The survey covered 22 aspects of design which were shown by statistical analysis to belong to four groups:

1. convenience of ward layout
2. facilities for nursing acitivies
3. design for patient care and comfort
4. pleasantness of the ward

The result of the survey in all 139 new wards placed the 22 design features in the following order of satisfaction:

call system
day lighting
treatment room layout
companionship in bedrooms
staff base layout
general atmosphere
storage of patients' belongings
nursing office location and layout
storage facilities
utility room location
sanitary facilities

> (median score level and mid point of item range)

dayroom location
dayroom layout
bedside nursing facilities
lighting by night
privacy for staff discussion
ward location in hospital
heating and ventilation
access to single bedrooms
observation from staff base
supervision and communication
patient privacy

Canter et al commented that neither supervision nor privacy appeared to have been satisfactorily provided for in nurses' opinion in the hospitals surveyed. The high rating for call systems did not however appear to affect the low rating for supervision. A new approach to ward design was therefore needed to resolve the conflict between patient privacy and nursing supervision. The hope was expressed that the 'Nucleus' ward design might achieve an improvement (see Billing 1977).

An unfortunate omission from Canter's pilot and standardisation survey reports was any analysis of responses from patients, this apparently being due to 'staff changes' in DHSS and HERG (Canter 1981).

The effects of physical characteristics of ward design in Canter's survey were analysed according to four main features:

1. size of ward and bedrooms
   (eg nos. of beds)
2. layout type
3. location of facilities
4. 'level' and type of provision

Ward unit size made little difference to the nurses assessment, wards ranging in size from 19 to 52 beds with a majority being between 26 and 32. Bedroom size was significant however, those wards with six and eight bed rooms being rated better by nurses than those with four bed rooms.

The most important layout characteristic from a nursing viewpoint was the 'percentage of patients visible from the staff base area'. Many of the wards surveyed had only 16% of beds visible from this area, whereas DHSS Building Note No.4 advocated 25% as a minimum. Wards with most or all beds in separate rooms scored particularly poorly on 'observation' but relatively well for 'privacy'. Glazed partitions were suggested as a compromise solution.

Ward layout type had little effect on evaluation ratings, although racetrack wards were marginally better than linear designs. Toilets opening directly off bedrooms were rated well for convenience and privacy, while individual toilets opening off the corridor were best for supervision and safety. Grouped toilets off the corridor scored poorly for all aspects.

Other aspects rated well by nurses were staff bases in the form of a desk in the corridor rather than a separate office, a central staff base rather than two sub-bases, and a forward view over most of the beds rather than having beds behind the base.

Canter summed up the results of the trial surveys by suggesting that they had helped to identify characteristics of ward design which could be used in computer-aided design, and in production of design guidance. A Hospital Evaluation Exploratory Program (HEEP) was described which had three main applications:

1. to evaluate a ward design from nurses' and patients' viewpoints and to compare its ratings with all other wards previously evaluated,
2. to explore relationships between functional requirements and design features,
3. to predict how a design would be evaluated by particular types of users.

Canter's proposals showed a possible way of obtaining feedback data from design-in-use evaluations and using these data in the evaluation of options and selection of preferred designs. Among the issues still to be resolved however is the conflict which often exists between different types of users' needs, and the weight or priority to give to particular requirements. An earlier paper by Canter (1977a) suggested five approaches to determining users' perceptions of priorities in building evaluations:

1. getting users to rank requirements or features in priority order
2. statistical analysis of users' satisfaction ratings of environmental features
3. comparison of ratings for individual features with overall rating for a design - features which most closely agree with overall rating are the most important
4. frequency of complaints about specific features or aspects
5. comparison of evaluation ratings with physical measurements of features, eg intensity of light in relation to rating of visual comfort

Canter suggested however that there were profound moral and political issues involved in establishing an order of priorities of requirements for different user categories, or the relative values to give to the needs of one user category as against another. Where several categories of users with different needs, such as patients and staff, share an environment in which there are potential areas of conflict, this may not be apparent until an evaluation of user attitudes is undertaken. A design which met some users' requirements at the expense of other users' requirements could be valued differently from one which met all users' requirements equally well, even though the mean rating for all users was the same (see fig 6.9).

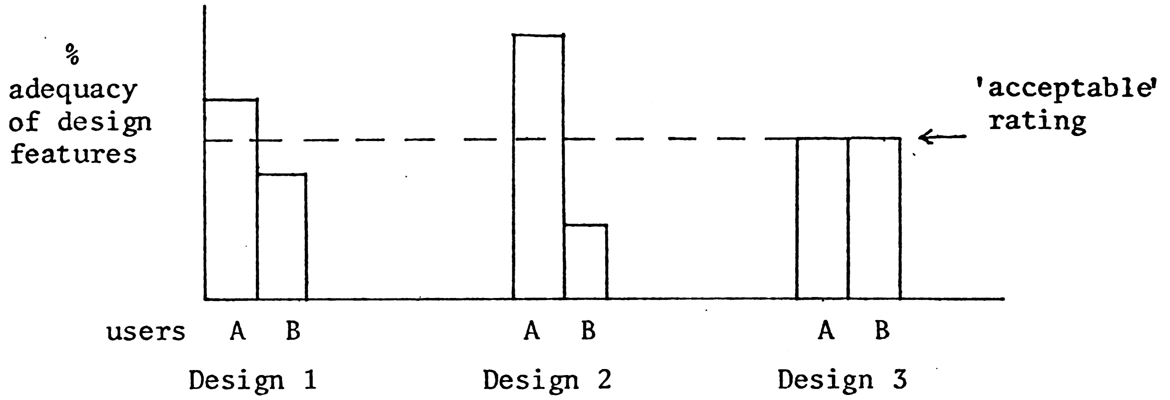


Fig 6.9 Comparative ratings of three designs

Design 3 is more equitable in meeting users' needs, but is it therefore a better design than 1 or 2? The wide disparity of satisfaction ratings in design 2 suggests that the needs of users 'B' have been unduly sacrificed to those of users 'A'. As hospitals are primarily intended for patient care it is axiomatic that patients' interests and needs should take precedence, unless putting staff needs at a lower level of priority places patient interests (such as safety) in jeopardy.

Another approach to evaluation explored by Canter (1977b) was the use of 'mapping sentences' and 'person/place synomorphy' or similarity of form. This approach consisted of classifying people's behaviour and attitudes, and also the physical characteristics of their environment. Constantly recurring relationships between the two could then be tested and demonstrated. Canter's pilot surveys of wards would seem to go some way to proving this hypothesis. However the absence of analysis of patients' views in the survey reports leaves the question open.

A later paper by Kenny & Canter (1979) emphasised the lack of consideration for patients' views in hospital design, and the predominating influence of medical technology on design and operational policies.
A hospital design evaluation became, in consequence, not only an exploration of doctors' and nurses' attitudes to their professional role and the hospital, but also an investigation of patients' attitudes

to staff attitudes. Kenney & Canter referred to Raphael's patient opinion surveys in general hospitals which revealed close similarities between nurses' and patients' views on priorities of needs, although these differed from doctors' and committee members' views. Patients' however tended to be more satisfied with their standard of care than nursing staff. If this is so then it might justify placing a higher value on nursing staff opinions.

Kenny & Canter also stressed the importance of evaluating the ward as a whole through the study of relationships between function and design, and between various aspects of each. Nurses were able to see the ward as a whole and reflected the views of patients. The implications of early ambulation and of the need for more patient education and support were seen as significant factors in adapting ward design for future needs.

Investigations of the views of senior nursing staff at a major Sydney teaching hospital (Heath 1981) would suggest however that many nurses do not see ward design as affecting nursing efficiency or standards of patient care. Their lack of perception in this respect was attributed partly to their lack of awareness of design and of its behavioural effects, and partly to the traditional belief that good nursing depended primarily on good nurses. Surveys comparing staffs' and patients' views on aspects of privacy, supervision and convenience in wards were studied extensively by Sears & Auld (1976) who found considerable differences in responses of each group. particularly in respect of supervision and privacy. This was also a conclusion of surveys conducted by the writer (see chapter 10).

Sears and Auld's study at the London University Joint Unit for Planning Research investigated differences in perception of the importance of various operational and design features of wards by four categories of users - doctors, senior nurses, junior nurses and patients. The ratings given by each of these groups of respondents regarding adequacy of features of the wards they worked in were compared with the overall importance attributed to the features by each respondent group. It was concluded that "users' attitudes vary according to the type of unit which they occupy" (Sears 1977). Sears' and Auld's survey was conducted in 34 medical and surgical wards in 16 different hospitals in Britain, and respondents were 'self-selecting' in response to advertised displays located at ward entrances. Over 1300 responses were obtained of which 404 were patients, 286 were unqualified nursing staff, 239 were qualified nurses and 82 were doctors. The ward designs were classified according to the floor areas allocated to multi-bedded wards, sanitary facilities, ward kitchens and general circulation. Five types of ward design were derived from this method of classification:

1. Nightingale wards with few amenities
2. older wards with large undefined bed areas
3. modern well-equipped wards with beds in two to six cubicles or bays
4. compact deep-planned wards with beds grouped closely round a nurses' station
5. modern or modernised wards with a high proportion of floor area allocated to back-up facilities and circulation

The kinds of ward design features which senior nurses and patients discriminated most strongly in Sears' and Auld's study are compared below with respect to the order of their perceived significance:

PATIENTS	QUALIFIED NURSES
observation of patients by nurses	surveillance of patients and ward layout
sanitary facilities, privacy, comfort and convenience	space round beds
spaciousness	colourfulness
quietness	cleanliness, maintenance
lighting	stuffiness, smells
ventilation	lighting
flooring cleanliness and colour	sanitary facilities
treatment facilities	facilities for 'up' patients
	lack of disturbance, clerical facilities
	view

Combining the order of significance for all four groups of respondents suggests that 'ease of observation of patients', 'privacy for patients when using toilet facilities', and 'lack of disturbance from noise', were generally regarded as the three most important features in good ward design. However, the differences in ratings for significance by patients and senior nurses for features such as privacy and absence of noise disturbance suggests that a ward designed for optimum patients' needs would not be satisfactory for nurses. This finding contrasts with Canter's view that 'what nurses like is good for patients'.

As a result of Sears' and Auld's evaluation, eight conclusions were drawn on how to improve users' opinions of ward design:

1. cubicalisation of bed areas is only beneficial if it allows direct observation of patients from the staff base,
2. patients appreciate privacy, comfort and convenience in toilet facilities,

3. improving the decor of wards increases the satisfaction of nursing staff,
4. adequate space round the bed is appreciated by all types of users,
5. adequate day space is appreciated by ambulant patients and by doctors,
6. patients and nurses appreciate good ventilation without draughts,
7. all types of users dislike noise, especially from outside sources,
8. lack of disturbance from people and equipment is appreciated by patients.

Sears and Auld also discussed the methods and purposes of design, and of design evaluation, drawing on an extensive literature survey for support. Their conclusions were described in a paper by Sears (1977) on 'User attitudes as a guide to the evaluation of nursing units' which may be summarised thus:

1. knowledge about attitudes of ward users is useful in design decision making
2. this knowledge may indicate the need for design changes or improvements
3. using this knowledge, the possible effects of alternative planning and design policies may be predicted
4. only generalised evaluation data from a large sample of different design types is valid for making predictions about the behaviour effects of design
5. useful feedback on consequences of design decisions can be obtained from the type of evaluation techniques used (by Sears & Auld)
6. using one evaluation method on a wide range of design types is more useful than detailed one-off evaluations
7. simple methods of evaluation can be used to obtain reliable feedback data, but responses from different categories of users must be distinguished
8. survey questionnaires and methods of analysis should be capable of easy interpretation by designers.

A comparative study on a more limited sample of wards than either Canter's or Sears' and Auld's was that undertaken by Noble and Dixon in three types of ward at St.Thomas' Hospital in London in 1976/77. The study had been initiated by Tatton Brown's reported experiences as a patient in a Nightingale ward at St.Thomas' and his assertion that, contrary to expectations, the open ward was surprisingly good from a patient privacy viewpoint. He also asserted that it encouraged a good social atmosphere and provided easy accessibility to patients, thus saving much nursing time and effort.

A more detailed evaluation was therefore launched to establish whether Tatton Brown's views were shared by other patients, and whether staff also preferred the old 30 bed open wards to the newer subdivided wards, some of which were arranged in four bed open bays, and some in four and six bed rooms with open doorways. The report by Noble and Dixon (1977) was essentially a sociological/architectural study which reflected the professional background of the authors, while Canter's studies were psychological in emphasis, and Sears' and Auld's reflected their interest in statistical techniques. Nevertheless the three differently orientated studies came to somewhat similar overall conclusions, ie that more open wards have a number of benefits for patients and staff not provided by subdivided wards of the type advocated by the Nuffield Investigation team, and subsequently by most hospital designers in North America and Australia.

The St.Thomas' study was conducted by means of observation and by interview in four wards of each type, a different questionnaire being used for patients, medical staff and nursing staff. Minor differences were made in the questionnaire for each ward type. A total of 235 patients were interviewed, 63 in the open wards, 85 in the bayed wards and 87 in the subdivided wards. All patients who could be interviewed were included in the survey (about 75% of the number of beds). Sixteen sisters in each of the twelve wards were interviewed and an unspecified number of medical and other staff.

A comparison of the standards of accommodation provided in each of the three types of ward showed the old open wards to be considerably less spacious than the newer wards in bays or subdivided rooms.

Table 6,4 Ward accommodation standards compared

FEATURE	OPEN	BAY	SUBDIVIDED
number of beds	31	28	28
area/bed in bedrooms (m^2)	7.0	9.3	10.8
overall area/bed (m^2)	13.4	22.5	25.0
area sanitary facilities (m^2)	24	69	63
wcs/bed	1:15.5	1:5.6	1:3.5
maximum distance walked from staff base to see patient (m) (excl. single rooms)	2.0	12.8	14.0

A list of requirements was drawn up as a basis for the evaluation, partly based on the literature and partly from discussion with staff in the hospital. The requirement for nursing supervision was stated thus:

> "Nurses need to assure and also to reassure themselves that patients are not in need of attention, ie not in medical, physical or emotional stress. There is no need for nurses to see all of the patients all of the time. Some patients need to be under fairly constant surveillance.. and others need virtually none...." (p 36 para 4.5.18).

The patients' need for privacy was described as follows:

> "The issue of privacy for patients is invariably accorded great importance and there is a strong body of opinion that most patients would prefer to be in single rooms for the privacy they afford. The survey of 235 found very few patients who thought they would prefer to be in a single room - and a large number who volunteered the information that they would definitely not like to be in a single room." (p 42 para 4.6.13)

Some bed-fast patients expressed distress at lack of body privacy with nurses, eg when having a bedpan or being bed-bathed.

The St.Thomas' Ward Evaluation report contained a curious mixture of descriptions of the wards, explanation of the survey methods and comment on the findings. There was little statistical evidence although some room utilisation survey material was presented as originally recorded. Patient responses were tabulated in terms of favourable/unfavourable comments on privacy (see table 6.5).

Table 6.5 Patients' responses on privacy

RESPONSE	OPEN	BAY	SUBDIVIDED
lack of privacy	14%	12%	12%
no lack of privacy	85%	88%	88%

The questionnaires for patients and nurses each contained approximately 50 questions covering a range of facts and opinions about the wards and the respondents. Opinions on about 30 design features were included in the questionnaire plus three open-ended questions on likes and dislikes, and suggestions for improvement. The design features included the following:

comfort
convenience
cheerfulness
social atmosphere
privacy - conversation, telephone
use of toilets and bedpan
clinical procedures, examinations
contact with nurses

noise nuisance and disturbance
safety
cleanliness, tidiness
access to toilets
ease of finding the way, orientation
adaptability
appearance
supervision - of nurses
of patients
reliability, ease of maintenance
simplicity in use
interest, colourfulness
emergency call
walking distances
tiredness
storage
supply and disposal
catering
organisation
ease of cleaning
security
staff relationships
things liked least and most
suggestions for improvements

The main conclusions recorded by Noble and Dixon were that despite the improved amenities in the newer wards the old open wards were more 'efficient' and more 'flexible', but they lacked the modern amenities that an ideal ward should have. Nine points were made regarding improvements to efficiency and patients' well-being:

1. efficient staffing is based on assessing workload and type of tasks, and not on bed numbers
2. nursing policies should allow a variety of specialties and types of patient to be accommodated in one type of ward
3. flexible designs should be developed to accommodate the changes likely to occur
4. some ward equipment needed to be replaced and some design details modified
5. ward receptionists could be shared between wards
6. a better patients' radio system was needed
7. an occupational therapist could help to relieve the boredom of some patients
8. patients needed to be told more about their rights and about amenities
9. patients should be treated as individuals, not as members of a group.

Publication of a summarised version of the St.Thomas' report in the Nursing Times (1978) aroused considerable controversy in the hospital media in Britain in the ensuing months (eg Metcalf 1978, Watkin 1978). This issue was pursued further in Australia in a seminar on ward planning (arranged by the writer and held at the University of NSW in May 1980) entitled - 'Nightingale or Nuffield?' (Green & Jackson 1980). The proceedings of the seminar included a report on the findings of a pilot comparative survey carried out in open and subdivided wards in three Sydney Hospitals (Hopetoun-Smith 1980) which largely corroborated Noble and Dixon's findings at St.Thomas' Hospital.

In South Australia a study by Shinnick (1979) compared opinions of 140 nurses working in two different ward designs with respect to 60 design features. The previous work by Canter, and by Sears and Auld, was used as the basis for Shinnick's study. The main conclusions reached were that nurses liked:

1. four bed rooms rather than six bed rooms
2. direct observation of beds from the nurses' station
3. ensuite patients' toilets
4. good lighting, ventilation and cleanliness
5. colourful decor
6. adequate space round the bed.

Although there was more space round the beds in the six bed rooms than in four bed rooms in the two hospitals studied by Shinnick, the nurses thought that the six bed rooms were more crowded than the four bed rooms. Shinnick suggested that this difference between fact and opinion needed further investigation by direct observation rather than by the subjective methods used.

.10 EVALUATING THE EFFECTS OF PLANNING AND DESIGN

This section uses conclusions drawn from the literature sources on design evaluation in the previous sections as a basis for proposing a comprehensive approach to evaluation in planning and design. A number of alternative methods of evaluation are considered and their application to various phases of the design process are discussed. The first issue is the extent to which the planning process itself can be evaluated.

For large scale design problems such as hospitals, with a time scale measured in years rather than weeks or months, it is not practicable to compare different methods of planning or design. Feedback from the effects of design in use is necessarily very delayed, so the chances of being able to modify any design process in time to affect the next projects are very limited. Nevertheless there are several aspects of the planning process which can be compared between concurrent projects as a means of improving the results and effects of planning:

sequence of tasks in planning
time allocated to specific tasks
methods of obtaining information
methods of decision making
organisation of planning team
methods of documentation
methods of evaluation
methods of cost control
the extent of user participation

A variety of planning and design methods were described and discussed in chapters 2 and 3, and the outcomes of three different methods of hospital planning and design formed the basis of the case study described in chapter 9. Despite many attempts to compare the advantages of different planning methods, no generally applicable method of planning or design has yet been clearly established as 'the best', although there are some common features among many of the planning processes and procedures in use. The existence of planning procedures, such as the RIBA Plan of Work, causes planners to adopt these procedures as models, making it difficult to know if they are the most efficient and effective available, or whether searching for further improvements would be worth while.

The method of evaluating needs and resources for public buildings is a case in point. Some people involved may want the project to be as big or costly as possible within the limits of available capital resources. If the project proves too costly it will be cut back or delayed. If it is too 'cheap' it will not produce the desired political impact (or design consultants' fees). Hence its suitability from the users' viewpoint is unlikely to be a primary consideration in deciding its economic or technical feasibility (Galbraith 1971).

'Feasibility' is a well-established element in most building planning procedures, and many health planning authorities require detailed statements of need and estimates of capital and running costs before approval is given to proceed with detailed planning (see chapter 3). A variety of checklists and procedures have been suggested for evaluating existing services and facilities, either with the aim of identifying areas for improvement or to compare different forms of service. The justification for proceeding with new development rarely, however, depends on a thorough and objective assessment of all the possibilities, partly because to do so would take up too much time. More often a number of broadly conceived alternatives are considered and a decision made on political grounds - funds are then allocated, subject to demands from other competing projects, and the design then proceeds in more detail.

Where new development <u>is</u> judged to be desirable, <u>feasibility</u> of proposed services and facilities can be considered in terms of the following topics (derived from DHSS planning procedures).

scope, range of services
relation to existing services and facilities
location, sites, siting
phasing, size, growth potential
transport, traffic, parking
surroundings, ecological effects
functions, activities involved
staffing and running costs
departmental divisions and relationships
buildings, shape, space, layout
engineering services and plant, energy use
construction, materials, finishes
equipment, supplies

The above topics are not in any particular sequence although an approximate 'general to particular' order of precedence is intended. A more detailed series of decision topics would be needed in order to evaluate building design <u>options</u>. The following are examples:

siting - locality, location, site, parking areas, orientation, position, site cover

shape - growth capacity, phasing potential, provision for change, adaptability, access points, traffic convenience

construction - dimensions, modules
structural systems, spans, bay sizes,
materials, finishes, components,
methods of manufacture and assembly

services - types, capacity, number of outlets, distribution system, methods of access, integration with structural system, emergency stand-by, control methods

equipment - types, makes, models, sizes, capacities, materials, finishes etc.

methods of operation - activity sequences, responsibilities, control methods, coordination

economics - site development costs
accessibility costs and benefits
building costs - space, materials, services
running costs - energy, staff
maintenance costs - repairs, replacements
benefits - social, technical, political

Although each of the topics above requires a somewhat different approach to evaluation a typical procedure would be:

1. define project requirements
   objectives
   goals
   limitations

2. establish criteria
   priorities - urgency, importance, benefit
   potential conflicts
   standards to be achieved

3. consider users' viewpoints
   list users
   seek user views
   establish user requirements
   establish order of importance

4. analyse requirements
   human factors
   economics
   technical
   political
   social
   educational etc.

5. seek alternative solutions
   use existing concepts
   develop innovations
   make adaptations

6. consider each solution in relation to:
   criteria, standards
   preferences of users, planners, public

7. identify areas of conflicting needs
   - differences between user groups:
     - age groups
     - social classes
     - ethnic groups
     - professional groups
   - incompatabilities due to:
     - operational factors
     - design factors

8. resolve conflicts by:
   - discussion between proponents of conflicting aims
   - analysis of conflicting factors
   - exploration of least conflicting solutions

9. compromise on remaining conflicts
   - in relation to agreed priorities

The choice of a preferred design option for each of the topics listed earlier may however tend to conflict with other preferred options. Various methods can be used to test each design option, although some methods are likely to be too costly or take too much time for all but critical decisions. The following are some of the <u>methods</u> used to evaluate building and equipment design <u>options</u>:

construct simple physical model(s) and judge by inference with similar known situations or measure by instruments

simulate typical day's activity in terms of movement patterns to arrive at most economical layout

make mock-up(s) and get users to vote on their preferences from visual inspection or test by instruments

make prototype(s) and put into use for limited period - get users to vote on preferences and obtain cost data

simulate physical characteristics mathematically or by computer eg structural or thermal behaviour

estimate construction costs and annual running costs over various periods of use with allowance for inflation and depreciation

estimate time required to construct in consultation with contractor(s)

determine energy consumed in relation to given output

compare with published standards

put on public display and request order of preference votes

determine range of requirements in order of importance and get panel of experts to assess

determine least costly to build and ignore the running costs

'political expediency', ballot box approach.

The choice of method of evaluating design options will depend on several factors operating separately or independently eg:

degree of client/user/public participation
the interdependence of design elements
effects of other fields of interest
time available - for planning or evaluation
building lifespan - 'temporary' or 'permanent'
number and range of options to be evaluated
degree of detail involved/required
number of aspects to consider for each type of option
emphasis on cost, quality or time
political significance of project
commercial/professional prestige involved
flexibility of requirements, resources, constraints.

Making a selection from a number of design options implies either that the outcomes can be predicted, or that the chances of one option achieving the desired objectives are rated better than the other options. For such predictions to be made, or the chances estimated, the outcomes of all previous designs ideally need to be known, based on feedback from their evaluation in use. There is however a subtle distinction between measuring the results of building performance in physical terms, and determining how that performance affects users and what they feel and do. Without knowledge of both physical results and their social effects, evaluation of design options is meaningless if not misleading.

The physical results of a completed building can be measured and compared with other similar buildings as a means of identifying desirable and undesirable trends, and so that corrective action can be taken. The following aspects could be included in a 'results evaluation' of a building after it had been in use for a year or more, ie when all major defects and omissions had been corrected, and when the first phase of changes in use had been made:

SPACE	- allocation to functions, departments, activities (compared to original intentions)
	changes in use since completion
	circulation/usable floor area
	no. of places, beds etc actually provided compared with intentions
	proportion of space with no daylight or view of the outside
ENVIRONMENT	- visual - natural/artificial lighting, brightness, glare ratios, colour
	thermal - temperature range/variability, humidity levels, heat gain/loss
	auditory - noise levels, frequency, duration, attenuation
	air conditions - flow and change rates, flow direction, dust and pathogen content
DAMAGE (in use)	- building - structural, movement, cracks, leaks, corrosion, staining, wear, fire
	services - breakdowns, overload, blockages, leaks
	equipment - breakages, wear, damage to walls, door frames etc, 'down time' under repair
COSTS	- building - elemental costs at final account
	engineering - costs per output unit
	equipment - repair, replacement costs
	charges - fees, insurance, 'development'
	maintenance - cleaning, repair
	activity - charges, subsidies

Some of these statistics will change with time, for example repair costs tend to increase as a building ages, space utilisation may change after a period in use, energy use may vary with changes in utilisation and weather. But however reliably and accurately these statistics are collected and analysed, their value will lie in the effects they have in improving subsequent designs.

The evaluation of effects of a design in use can only be undertaken by studying how it is used and what people who use it say about it. A variety of techniques have been developed to study user behaviour, attitudes and opinions in different kinds of social and environmental settings, but the problem is to ensure that people are behaving 'normally', or are responding to questions in a way which reflects their true feelings. Bias can arise due to methods of sampling, influence by the form of questions, or the desire of respondents or researchers to 'make a point'.

Opinion surveys can be conducted among specific users of a design, as well as among those concerned in its design and construction. The public in general can also be canvassed for their opinions.

Behaviour can be studied by recording movement patterns of people, for example in their use of hospital entrances, or in their utilisation of different hospitals in an area. Staff absenteeism and high turnover rates may indicate dissatisfaction with an environment or with management. A high incidence of thefts and vandalism may indicate either a lack of adequate security arrangements, or the presence of environmental factors predisposing people to behave in this way. Productivity may be affected by many factors, some of which are directly attributable to design.

Worker performance or output can be measured in a variety of ways which may be significantly affected by such environmental influences as light, colour, noise level, air quality, spaciousness, temperature and visual interest. Staffing levels in different environmental settings can be compared in relation to given workloads or occupancy rates, eg numbers of patients of defined dependency levels in nursing units.

Accidents to patients or staff in hospitals are usually recorded for each month and for each department. Details of causes of accidents may indicate prevalence of certain kinds of accidents, eg back strain in relation to given activities or areas. But it is also evident that many accidents are not reported due to fear of legal liability by the institution involved, or to loss of employment opportunity by a staff member, or because it involves too much trouble to fill out an incident report form. Detailed records of accidents are nevertheless a valuable means of identifying whether accidents are due to design faults, poor management or inadequate staff training.

Incidence of infection is of continuing concern to health facility planners, managers and users, but the relative importance of planning and design in controlling infection is very difficult to establish. Over-use of antibiotics and consequent development of resistant strains of pathogens are significant contributory factors in outbreaks of hospital acquired infection. Design may help in controlling air and traffic movement patterns to isolate sources of infection or people at risk, but behaviour is also a significant element in controlling infection risks (Bagshaw et al 1978).

Costs in use are a significant factor in design evaluation, although the accuracy with which costs in use can be attributed to specific design features is limited by the accounting methods used in most hospitals. A number of studies have however been undertaken which have provided data on operational cost consequences of health facility design decisions, some of which were described earlier in this chapter (eg Great Britain DHSS 1968, 1980; United States, General Accounting Office 1972, Stone 1975, American Institute of Architects 1977, 1978; Mathers & Haldenby 1979).

The longer term cost effects of design decisions are difficult to predict accurately, due both to lack of cost in use data, and to lack of incentives to monitor costs in relation to functions and activities. New hospitals cost more, sometimes much more, to build and operate than equivalent existing facilities - mainly due to higher standards of comfort and convenience. For commercial or political reasons these higher costs are often concealed.

Factors influencing health facility costs in use include the following:

size - floor area
building space
number of beds
staff
students etc.

quality - materials
engineering services
equipment
maintenance

utilisation - supplies
energy
labour - time
rates of pay

adaptability - spatial
engineering services
functional

'Value' in relation to costs will largely be determined by how much people will be prepared to pay for certain quality levels or kinds of products. Variations in attitudes between different users also makes objective cost valuation of particular qualities of design difficult to assess. The price of a product is often no indication of its utility value, and many people evaluate product designs more by prejudice than by systematic checking of performance against requirement criteria (Norton 1978).

The ultimate value of planning and design is the degree to which it satisfies the people for whom decisions are made by planners and designers, which Ackoff (1976) says is essentially 'a matter of aesthetics'. Satisfaction also depends on the degree of freedom users enjoy in being able to modify their environment to suit their needs and wishes. A high value may therefore be placed on adaptability of a design, not only to be able to change things to meet changing purposes, but to be able to accommodate the different desires of individual users, even though these may not be the most cost-effective way of achieving results.

CHAPTER SEVEN

INFORMATION FOR PLANNING AND DESIGN - Synopsis

The chapter explores various means of organising information in libraries, filing systems and documents.

Information is examined first for its value in creative design and problem solving. Applications of information in planning and design are then considered from the viewpoint of planning team members' needs for information.

Selected methods of classifying and coding information in filing systems and libraries are reviewed; indexing and retrieval being considered for their value in providing appropriate information when needed.

Sources of planning and design information are described in section five, particularly those developed specially for the health facility field.

The results of surveys on planners' preferences for types of information are reviewed in section six. This is followed by descriptions of information services for health facility planning and design in Britain and Australia, and an evaluation of how these services appear to answer their users' needs.

The last section considers briefly some ethical, political and social issues concerning uses of information and development of information systems.

7.1 INFORMATION FOR INNOVATION AND PROBLEM SOLVING

At a meeting of an International Hospital Federation Study Committee on Documentation and Information Handling (World Hospitals 1974) it was reported that:

> "the real difficulties (of information providers) lay in trying to match availability to needs, in giving the individual enquirer relevant information WHEN HE NEEDS IT (capitalisation in original). Literature and data are broadcast in such ways that many users, or potential users, legitimately complain that on the one hand they are subjected to too much general information, while on the other hand they often encounter difficulties in obtaining specific information when they need it to assist in problem solving and decision making. Clearly many problems of information transfer are related to our inability to make effective and efficient use of available material".

In 'The Use of Lateral Thinking' De Bono (1967) commented that the form of information (verbal, visual and printed) was often based on preconceived ideas of dominant subject groups by a majority of users. The information was therefore already biased by the form in which it was presented, regardless of its content. De Bono continued:

> "the wealth of new information that is made available by the media (TV, radio and the printed word) very rarely gives rise to new ideas in the audience who, through laziness, remain dominated by the ideas of those who present the information". (p33)

Information systems for planning and design ideally should permit problem solvers to select information on any topic that may help in their task. But control is also needed to ensure that the information retrieved is relevant to the problem in hand. One of the biggest problems in planning any large and complex facility such as a hospital, is that planning can stretch over a decade from inception to completion (Cruickshank 1973). Many hospitals are considered already obsolescent by the time they are opened. The long time span also makes communication channels very extended. Decisions on how a particular facility was meant to function may have completely changed by the time it is ready for operation. Informatiom has therefore to maintain its relevance to the problems to be solved even though the problems may have changed since the information was originally obtained.

Many forms of communication of information are used in planning and design. No one form is suitable for all purposes. Graphic forms tend to be regarded as more definitive by some people than spoken or written forms (Abercrombie 1960). In communicating ideas on future possibilities there is the added difficulty of trying to explain unfamiliar concepts to a pre-conditioned audience. Diagrams, narrative documents and filing systems all tend to represent thoughts frozen at a particular time (Honey 1969). The ideal is a means of revealing new ideas and possibilities without the constraints of previous solutions. Three-dimensional adjustable models appear to encourage some people to explore new ideas, but by their very nature such models stress visual and physical aspects rather than organisational relationships. Mathematical models tend to overemphasize quantitative aspects (Swan 1976), while written or spoken words may obscure intended meanings by poor semantics or confused logic (Lyons 1970).

Computers can provide instant access to stored data, but language and the need to link concepts in a pre-determined pattern limit their use in problem orientated innovative design (Tucker 1965). Computers have however helped in developing new approaches to problem solving and in exploring the logic involved in decision making (Campion 1968, Tomlinson 1975 , Mitchell 1977). Nevertheless the application of computer techniques to planning and design has not resulted in the breakthrough once regarded as inevitable (Souder et al 1964, Negroponte 1970, Great Britain DoE/PSA 1978).

The varied nature of planning and design, even within one field of application such as health facilities, means that a wide range of possible forms and topics of information has to be covered (Bishop & Alsop 1969). Descriptive models of planning and design (eg RIBA 1964, Woolley 1970, CHI/SMP 1976) have certain features in common, and these could form the basis for a design information system. Honey (1969), for example, suggested four main lines of development assuming existing design methods were continued:

1. presentation of information on user activities and functional spaces in an ordered way - related to briefing procedures, regulations and recommendations for good practice

2. product information presented so that the properties of alternative products can be compared and evaluated for each stage of design

3. historical data on building types with a critical assessment of performance

4. data on assemblies of products or parts of buildings (ie standard details) with assessments of performance in use.

Several criteria were suggested by Honey for implementation and acceptability of a comprehensive information system for architectural design, the main features being:

1. an "adequate means of describing the form of projects in detail and with the fluidity now enjoyed",

and

2. "means of classifying and stating the properties of building types, functional spaces and user activities, products and parts of buildings ... " (pp 10-11).

Here lies the problem - how can one link functional requirements and design forms in a fluid way, and yet allow rapid and comprehensive revelation (and evaluation) of possible solutions to user needs without perpetuating the patterns of the past? The assumption that yesterday's problems are a basis for planning and design for tomorrow has resulted in failure to find appropriate solutions to many planning problems (Michael 1968, Hall 1980).

One possible way out of this dilemma is to educate and encourage people to think for themselves in more creative ways, unfettered by professional training courses which are often anything but fluid (Postman & Weingartner 1971). Toffler (1970), however, warned about the unsettling effects of too much uncertainty, too rapid change. The human mind cannot adapt quickly enough to unfamiliar concepts; it needs some known base from which to start exploring. Information on past experience can provide the foundation, but the information <u>system</u> also has to encourage people to develop new ideas.

7.2 INFORMATION IN THE PLANNING AND DESIGN PROCESS

The process of planning buildings is not only difficult to describe and understand, it can also inhibit transfer of information and ideas unambiguously between the people involved. The means by which understanding of technical details is effected in building design is fairly well established by convention in the professions concerned (Higgin & Jessop 1965). What is less well established is how to determine the needs and conditions upon which policies and proposals for physical planning and design are based (Bruton 1974).

Designs for some large and complex systems such as motorways, housing schemes, aircraft, and hospitals have failed mainly because they were unresponsive to changing conditions, or did not allow sufficiently for user involvement. Jacobs (1964) for example cited new housing schemes in Boston which generated social problems which did not exist in the older types of housing being replaced. Other similar examples have been quoted since (eg Goodman 1972, Sommer 1972).

A common feature about many such failures is that the information or evidence was available that could have prevented wrong decisions being made. In other words the fault lay with the decision process rather than with the information on which the decisions were based. It may nevertheless be argued that the function of an efficient information service is to present planners and designers with facts and expert opinions that they ought to know about to be able to design properly. Conversely a proficient designer should ensure that he has all the necessary information to enable him to design adequately. Concern with man's ability to cope with the volume and complexity of information available suggests that a means must be found to rationalise the production of information at the outset, rather than try and cope with the ever-expanding 'mushroom cloud of knowledge' (Wilson 1972). This information explosion concerns many professions involved in hospital planning who not only find difficulty in communicating with one another, but are often unable to agree on terminology or priorities (King Edward's Hospital Fund 1971). In some of the professional areas concerned, eg medicine, there are well developed information systems and languages designed to suit the particular needs of the people concerned. In other areas the problems have barely been recognised, let alone solved.

Some form of 'interface' is needed between these various professional fields which can facilitate retrieval of information for joint decision making. This interface has to link the main user interests (medical, nursing and management) with those of the designers (architectural, engineering and building).

Many planning decisions with far-reaching consequences have been made on inadequate information, or in the face of contrary information and opinion (Hall 1980). Proposals are often presented in forms which confuse rather than clarify the issues involved, perhaps deliberately (White 1970). Information seekers frequently don't know what they are really looking for, or if they do know, they don't know how to get it before it is too late (Burnette 1979). Indexes, abstracts and other retrieval devices are not designed to answer specific questions or solve particular problems, they mainly provide references to documents which are often not readily available (Bunch 1979). Some of the indexes or abstracts are cumbersome to use and they are seldom right up to date.

All too frequently 'perfect' information retrieval is a chance occurance, unexpected and unplanned (De Bono 1967). It can however be assisted by appropriate grouping of related topics in documents, libraries and indexing devices (Foskett 1977). But 'appropriate grouping' for one professional field may be nonsensical to another (West & Katz 1972).

Making a planning decision assumes an ability to predict likely outcomes from sets of interacting data and opinions. The data elements may or may not be obviously related. Even when the elements are closely interconnected, they may not be capable of rational analysis, either because not all the facts are known, or because circumstances change in unpredictable ways (Mitchel 1968).

Licklider (1965) suggested that the ideal information system was a question answering service using a typewriter keyboard for input and a projected image as output. Since that time developments in computer technology and semantics have made such systems practicable. Doubts exist however whether they can be made economically viable within a field such as hospital design or building technology. There are still, for example, problems of ambiguity of widely used terms to be overcome (Great Britain DoE 1978).

Because of the problems of professional and ethnic languages the idea of developing a universal 'switching language' or common terminology seems attractive. For this reason the Universal Decimal Classification system (UDC) has been suggested as the basis for such a universal language (Wellisch 1972). Its hierarchical structure, and complex and cumbersome notation, tend to limit its applicability in planning and design. No classification scheme, however well designed, can meet the requirements of human communication without making assumptions which predetermine answers to some extent. Even the Library of Congress scheme is accused by progressive librarians of being loaded against women's liberation (Marshall 1972).

Research on classification schemes is carried out in many parts of the world through the Classification Research Society (CR Soc), a branch of the International Documentation Federation (FID). From its headquarters in Bangalore, India, CR Soc publishes a quarterly newsletter which records developments in information classification and retrieval. Much of the research,however, is detached from practical problems of planners trying to find up-to-date information on hospital function and design.

To help bridge the gap between scientific research and the problems of decision makers,the concept of 'information brokerage' has been developed both in Britain and the USA. Valdez (1974) reported British experiments with an 'information broker' attached to a hospital planning team. In North America similar experiments have involved information specialists being assigned to scientific research teams (Wax & Morrison 1973). Despite hopes that the teams would welcome help with their information retrieval problems there were mixed feelings about the results. Team members apparently resented being 'told' what information was relevant to their problem, and feared being brainwashed into accepting information they did not want.

The role of an information specialist attached to a professional group, is a difficult one. Much may depend on how the attachment was initiated: by invitation or by imposition. The former may work, the latter is unlikely to.

A useful idea which has been applied in hospital management and planning is the 'information room'. This is a central place in the organisation where up-to-date information is displayed on current events, progress of 'the project', and the latest items of interest (Luck et al 1971). Agron (1973) turned the information room into an 'information wall' in his firm's architectural office in San Francisco, but the idea is the same. Information needs to be continually updated, and this could equally well be achieved by a regular bulletin which was self-cumulating. The effect of the central room or display wall may however be more significant in bringing people together to discuss their problems and ideas.

Conferences, seminars and simulation exercises are other means of getting people to be more aware of the information available. There is a need to reach senior levels of government departments, not only in terms of getting support for development of information services, but also to ensure that senior managers are aware of the value of information (ASLIB 1978). Much useful research is wasted because the results are poorly presented or expressed in an inappropriate form to the audience. Architects, for example, do not readily understand tabulated data and prefer scale drawings or diagrams to photographs (Goodey and Matthew 1971). There is often a long delay between research work being completed and its presentation in the technical press (White 1973), and this diminishes the acceptability of the research findings.

Information workers need to be more involved in the problems they are providing information for if they are to be more effective. Librarians are often inadequately trained in providing information of the type required by decision makers (Clibbon 1973). They may therefore miss valuable references due to lack of understanding of the problem being investigated.

Some research workers develop personal classification and filing systems as the best way to organise information in support of their line of enquiry. Despite availability of classification schemes which would suit their purpose, many people prefer to devise their own systems to suit their way of thinking. There may therefore be more purpose in providing guidance on how best to do this than to try and develop a universal classification scheme for general application. Vickery (1960), Aitchison (1972) and Jahoda (1970), for example, give advice on ways to devise classification and indexing schemes for small scale applications.

Various methods of obtaining and using feedback data on details of building design in a large architectural practice were compared by Harries (1971) at an International Conference on 'Information Systems for Designers'. Two methods of collecting data were tried:

1. systematic collection from current projects using data sheets
2. ad hoc monthly collection from project architects

There was apparently little to choose between the two methods. Methods for storing the data were similar. Three methods of getting feedback to the designer were then tried:

1. feedback notes issued to all designers
2. feedback notes placed in office library
3. alteration of office standard drawings as a result of feedback on defects.

The last method was the only one which was found to be effective because it presented information to the designer in such a way that he had to make an effort to avoid using it.

As a basis for developing better information processes in project planning, four <u>kinds</u> of information can be identified which are used in the planning of a typical facility:

1. 'General' information applicable to any kind of project or problem, eg scientific data on lighting and vision
2. 'Project' information which was originated for and within a project under consideration, eg workload of a proposed department
3. 'Other project' information which may be applicable to the project in hand, eg findings on relationships between workload and space requirements
4. 'Personal' information which has been collected by an individual on a variety of areas of interest, but which may also apply to other people's information needs, eg notes taken at meetings or conferences. (Green 1970)

These four kinds of information differ not only in their degree of specificity and their applicability, but also in their form and degree of accessibility. The most useful information is often the least accessible and vice versa. Data on research findings, for example, may not be generally available in published form until some time after the research has been completed. Current research data are usually restricted in availability until they no longer pose a threat to the originator.

The main <u>requirements</u> of a planning and design information system derived from the foregoing discussion are that it should:

1. be usable both manually and with the aid of computers
2. encompass both general and project orientated information
3. make project based information more generally accessible
4. reflect the needs and interests of all the professions involved
5. be 'hospitable' to new concepts and relationships
6. be understandable by people unskilled in information coding and retrieval techniques

7. be applicable at all levels of complexity
8. facilitate the linking of 'ends and means' (or problems with possible solutions)
9. cover all kinds of information, eg books, journals, files, drawings, brochures, notes, etc.
10. be able to absorb information from related fields of interest, eg sociology, medicine, engineering.

Where standard procedures for planning, such as Capricode, are applied consistently over a number of years, it is feasible to base the arrangement of planning information on the procedural stages. But if the procedures are likely to be changed periodically then it is clearly undesirable to standardise permanently the manner in which information is arranged. Sharing information between projects is however made more difficult if each project's documentation follows a different sequence and pattern. The ideal would be a neutral or universally applicable pattern for collecting and organising planning information so that it can be applied to any kind of project, using any planning process, and by any profession. The implications of this approach are explored further in chapter 12.

'.3 CLASSIFICATION AND CODING SYSTEMS

Five methods can be used to identify and describe information contained in a document so that it may be filed and retrieved:

1. By using a classification scheme which splits the knowledge field covered into 'hierarchical' groups, each of which is split into further divisions and subdivisions. The scheme may employ alphabetical or numerical codes to represent concepts and levels of division.

2. By use of alphabetically arranged subject headings which are 'pre-coordinated' so that they reflect the range and depth of information likely to be contained in the information file.

3. By keywords or descriptors which are pre-selected from analysis of the literature to be covered, and which are allocated to documents according to their subject content. Documents are found by 'post-coordinating' the keywords representing the subject of the enquiry.

4. By use of titles of documents as they occur in the original or in a 'rotated' form.

5. By use of automatic (computer-based) searching of the full text of a document (or an abstract) in machine readable form.

In a classified retrieval system the subjects are tabulated in numerical or alphabetical order of the codes used. An alphabetical subject index enables enquirers to find appropriate codes for particular documents or enquiry topics. Documents are retrieved by looking in the part of the file corresponding to the codes given in the index.

In a subject heading or 'pre-coordinate' system, documents are listed in an index, bibliography or abstracting journal in either a 'systematic' order (as in a hierarchical system) or an alphabetical order of 'preferred names' given to particular subjects. The arrangement of subject headings may be explained in a guide or list of contents. An alphabetical index may also be provided.

In the keyword or 'post-coordinate' system, filed entries or documents are given identity numbers or codes and are kept in serial number order. The keywords are listed alphabetically for ease of reference, or may have code numbers to simplify filing. Related concepts or synonymous terms may be found by referring to a master index. For example the keyword SAFETY may also represent the concepts HAZARDS and/or ACCIDENT PREVENTION, all of which are given the same number in the keyword list. Each keyword used is represented by a card which may either be a punched card or a 'write-on' card, or the system may be computerised (see Jahoda 1970).

Whichever method of keyword indexing is used, a document on HOSPITAL ELECTRICAL SAFETY, for example, can be found by comparing cards bearing keywords HOSPITALS, ELECTRICITY and SAFETY and seeing which document serial numbers occur on all three cards. Post-coordinate retrieval systems are complex and laborious to set up, but can reveal the location of specified information in documents very quickly.

In systems using titles effective retrieval depends on how accurately the subject is reflected in the title, and on how the rotated forms of the title emphasise significant aspects of the document contents.

Systems using full text analysis by machine offer possibilities for cheaper retrieval, but are still somewhat experimental for general use.

All methods of indexing and retrieval of information depend on an analysis of the subject field to be covered. This is necessary in hierarchical systems so that the main classes, and the sub-classes within them, can be determined. If the subject 'hospitals', for example, is to be classified, a decision has to be made on the primary method of division. This might be by 'type' of hospital:-

Teaching hospitals
General hospitals
District hospitals (including base hospitals)
Community hospitals:
Special hospitals: TB
paediatric
maternity
psychiatric etc.
Private hospitals
Nursing homes

This method is used in library classification schemes like Dewey, where 'Hospitals' as a subject appears in two different places; firstly in the main division SOCIAL WELFARE 360, within which 362.1 covers 'welfare services for the physically ill' as follows:

362.11	general hospital services
362.12	dispensaries, clinics, medical centres
362.13	establishments for incurables
362.14	domiciliary care
362.15	maternity hospital services incl. infant care
362.16	convalescent and nursing home care
362.18	ambulance services
362.19	services for specific diseases

Class 362.2 'welfare services for the mentally ill' is followed by:

362.3	welfare services for the mentally retarded
362.4	for physically handicapped and disabled
362.5	for the needy
362.6	for the aged
362.7	for children (with children's hospitals at 362.8)

The second main division of Dewey where Hospitals as a 'type of building' are classified is 720 ARCHITECTURE, 725.5 being 'health and welfare buildings. 'General hospitals' and 'Sanitariums' are at 725.51, followed by:

725.52	psychiatric hospitals
725.53	mental deficiency institutions
725.54	physically handicapped persons' institutions
725.55	institutions for the indigent
725.56	institutions for the aged
725.57	child welfare institutions (including hospitals)
725.58	veterans and other welfare institutions

As with many such classification schemes the method of division reflects the method of organisation of hospital services in the country of origin when the classification scheme was first devised. The Dewey system was originated in the USA in the late 19th century, and its overall structure has changed little. A problem with the Dewey system, and others like it, is that it splits up the subject field into academic disciplines like MEDICINE, MANAGEMENT and ARCHITECTURE, each of which has its own viewpoint on methods of sub-division regarding health facilities.

This method of division results in a number of alternatives for filing a book on 'the planning and design of hospitals', which may either be placed in 362.11 'general hospital services', or at 725.51 'general hospital buildings' according to which aspect predominates. Books on precisely the same subject may therefore be found in both places in the classified shelf arrangement depending on the cataloguer's viewpoint or the bias of the book towards 'health services' rather than 'building design'. Books dealing with hospital planning from a medical aspect are more likely to be found in 614 'public health', or in 616 'medicine', while those dealing with management aspects may be at 658.91362.

Another classification scheme used in the health and hospital field is the Bliss Bibliographical Classification which has been modified for the King's Fund Library and the Department of Health and Social Security Library in London. It is also used by the Scottish Health Services Centre Library in Edinburgh, and by the NSW Hospital Planning Advisory Centre Library in Sydney. This scheme uses an alphabetical code with 'H' representing Health, and 'HO' Hospitals. The HO division has been specially developed for use in the King's Fund Library, and most other libraries in the hospital field have followed suit (see appendix C^1).

Another system which uses decimal subdivision is the Universal Decimal Classification (UDC) developed in Belgium in 1894 and based closely on Dewey. It differs from Dewey in being more complex, particularly in respect of the method of building up compound subjects. This is done by linking related concepts by means of a colon (:). Thus 'electrical safety in hospitals' is given the class number

699.887:725.51

This stands for:

69	Building
699.8	Protection, safety installations in buildings
699.88	Measures against light, electricity, radiation etc.
699.887	Electric shock proofing

coupled to:

72	Architecture
725	Public, civic and industrial buildings
725.5	Health and welfare buildings
725.51	Hospitals

The above classification could also be reversed,ie 725.51:699.887, which would place a document on 'electrical safety in hospitals' in a subdivision of 'hospital design'. This option would, in practice, depend on the bias of the book as well as the preference of the cataloguer or the orientation of the library towards a particular group of users.

Faceted classification is a method of combining related concepts to describe a compound subject and was invented by Ranganathan in 1935. In some classification schemes, such as UDC and Bliss, a series of 'auxiliary' symbols and lists of concepts can be used to analyse compound subjects by facets or viewpoints. But the sequence in which the facets are expressed is predetermined. This sequence not only affects the way a document is classified for filing, but also how subjects are grouped in the file.

Facets describe features such as time, place, kinds of things, materials, parts, physical properties etc. Various methods of 'faceting' are used in classifying documents to reveal their full character. The aim is to lead an enquirer quickly to the most useful documents in a file. The sequence of facets should therefore help to group the documents for easy referral, but also to reflect a 'logical' way of thinking, such as 'whole' before 'parts'.

Foskett (1977) suggested a sequence for analysing documents by facets which can be applied to most concrete subjects:

THINGS	buildings, equipment
KINDS	hospitals, schools
PARTS	floors, roofs
MATERIALS	steel, concrete
PROPERTIES	stength, durability
PROCESSES	design, construction
OPERATIONS	bricklaying, concreting
AGENTS	sun, people

This method of analysis may be applied to some concepts more easily than others. Consequently each subject field tends to have a preferred range and order of facets.

The main purpose of classifying documents is to arrange them in groups for easy filing by librarians, <u>and</u> for quick retrieval by enquirers. A 'helpful' sequence is to put 'general' subjects before 'special' subjects. Thus 'health services' precede 'hospitals which precede 'hospital catering' which precede 'types of catering systems'.

The SfB classification scheme, originally developed in Scandinavia for building documentation in 1947, uses a classification code consisting of five facets:

Table 0	Physical environment	numbers 00 to 99
1.	Building elements	numbers (00) to (99)
2	Construction parts	letters A to Z
3.	Construction materials	letters a to z
4.	Activities & requirements	letters (A) to (Z)

A document on 'cleaning of vinyl floor tiles in hospitals' would be classified, using the SfB facet sequence, as follows:

KIND of thing	HOSPITALS	41
PART of thing	FLOOR FINISHES	(43)
FORM of part	TILES (rigid tiles)	S
MATERIAL of part	VINYL (plastics)	n
PROCESS on part	CLEANING (maintenance)	(W)

The classification code would be expressed thus:

41	(43)	Sn	(W)

Filing documents classified by SfB (or any other faceted system) presents a problem however. If the file is arranged to follow the sequence of facets used for analysis of documents, all documents dealing with say 'floor finishes' will be scattered according to the kinds of buildings in which they occur. While this brings all documents dealing with 'hospital floors' together, it separates documents referring to floors in schools, factories or housing. The same problem also exists for the next stages of analysis. All documents on 'tiles' will be together, but items on various kinds of flooring material will be scattered, as the following 'cross-section' through the classification scheme illustrates:

KIND (building type)	PART (element/sub-element	FORM (shape)	MATERIAL (substance/ composition)	PROCESS (requirements)
schools	walls	boards	cork	acoustics
hospitals ——	floors ——	tiles ——	vinyl ——	cleaning
housing	ceiling	sheets	wood	fire resistance

Making the 'logical' sequence of facet analysis correspond with the order of documents in a file thus causes 'general' subjects to be at the end of a file rather than at the beginning. This results in the 'principle of inversion' whereby the filing sequence of 'general' topics before 'special' is the reverse of the logical sequence of analysis in which special aspects are considered first (Mills 1963).

The order of subjects in a facet may also determine the order of documents in a file. Some sequences of subjects are obvious, such as clinical services before non-clinical, or national issues before local.

The main classification system used in the building design field in Britain and Australia is SfB, although UDC is also used by the DoE in Britain. From its Scandinavian beginnings SfB was further developed in Britain, principally by the RIBA, the 3rd edition of the 'Construction Industry SfB Filing Manual' being published in 1976 (see appendix C^2).

Early versions of the SfB system used only three main facets:

1. Building functional elements, eg wall
2. Shape of building products, eg brick
3. Material or composition, eg burnt clay

By combining this system with the hierarchical UDC scheme it was possible to cover a much wider range of topics, but the system had an illogical structure and clumsy notation. Many attempts were made to improve it, (eg Mortlock 1966, Plowden 1966/8, Carter 1967). The development of SfB and its derivatives aimed to rationalise the process of planning, design and construction through coding of data coupled with greater standardisation of building components and specifications.

Some of these developments have affected hospital design and construction, although the Harness hospital system developed by DHSS generated its own system of data coordination and coding for computer design aids. In Australia McDowell and Kimstra (1974) of the Australian Department of Construction have developed the Design Information File (DIF) for general construction and design data. It uses a six facet code with twelve sub-facets (see appendix C^3). An extended version known as Hospital Information File (HIF) has been developed for hospital design (see appendix C^4).

HIF depends almost entirely on an alphabetical index for identifying enquiry topics, the relevant documents being filed by the facet codes. There is little opportunity to browse in the files due to the scattering of related concepts that occurs with this type of system. There is also a high degree of code redundancy, although this does allow the subsequent addition of new concepts very easily, but not in strict alphabetical order when there is no suitable gap in a numerical or alpha sequence.

A survey of 280 architectural practices in Australia conducted for the RAIA by Kennedy in 1980 revealed that classification schemes such as SfB were little used for filing of technical information in office libraries. Most practices tended to organise information, firstly by its type or format eg. trade data, text books, acts, standards, periodicals, and individual articles or reports. Within this last division simple alphabetical subject headings were mostly used to label and retrieve wanted items. In some cases the subject headings used were derived from SfB classes, but in many cases they had simply been selected by common usage (RAIA 1981).

The survey findings showed that classification schemes were not favoured by a majority of architectural practices, the reason being that they were unduly complicated and did not help to organise information in a useful way. The suggestion was made, however, that computer-based referral systems would be feasible for keeping up to date with trade data, but that other kinds of data would be more easily retrieved by conventional means suited to each particular kind of data.

Most library users tended to go direct to the shelf and retrieve information by visually scanning the items rather than by using an index or classification schedule (RAIA op cit).

In summary it may be said that although the purpose of classification schemes is to arrange information for easier perusal and retrieval, many of the schemes in use tend to fragment knowledge concepts rather than emphasise their interrelationships. Hierarchical classification schemes, such as Dewey, create problems in a multi-disciplinary field such as health facility planning and design because related concepts such as health, medicine, planning and buildings are in entirely different parts of the classification scheme. Faceted systems, such as CI/SfB, provide a better basis for integration of information, but they do not fulfil the special needs of a health facility planner because they are biased towards a particular discipline - building construction in the case of SfB. Bibliographic systems, such as Bliss, by being based on the categories of information found in the literature, tend to reflect the writers' and publishers' viewpoints rather than the information users' or decision makers' needs.

Some more recent approaches to information classification and coding, such as HIF, by being based on the types of concepts used in information processing and decision making, appear to offer more opportunity for integration and application of knowledge contained in documents. The development of computer-based information systems will require increasingly sophisticated and accurate means of describing information concepts. But as much planning will continue to be done by ordinary people using ordinary words, there will still need to be simple methods of labelling, storing and handling information for use in planning and design of health facilities.

7.4 INDEXING AND RETRIEVAL METHODS

Documents, such as journal articles, can be indexed using several descriptive terms, the number of terms depending on the complexity of the subject and the anticipated usefulness of the terms in a subsequent retrieval search. The document contents need to be analysed prior to filing, descriptive terms being selected from an agreed list of preferred terms or key words.

In pre-coordinate indexing descriptive terms identifying each document are entered in an alphabetical list of topics making up the index. More than one entry usually needs to be made, although not all indexing terms need to be used as the first term in each entry. Index entries for a document on 'hospital ward planning in NSW', for example, might be:

Hospital planning - wards
Hospitals, NSW - ward planning
Nursing units
Wards, planning

Rules for indexing in an economical and systematic way are complex; some are described by Foskett (1977). The aim in indexing is to lead enquirers to relevant articles in periodicals, to page numbers in books, or to class numbers in libraries. There may be a number of levels of detail for each index entry. The four entries above, for example, vary from one to four levels of detail:

Nursing units	1 level
Wards, planning	2 levels
Hospital planning - wards	3 levels
Hospitals, NSW - ward planning	4 levels

In post-coordinate indexing documents are analysed for content, their document numbers being entered on cards bearing relevant descriptive terms. There are several ways of doing this including index cards, aperture cards, edge punched cards and computers.

The studies of data coordination and coding in the building industry undertaken in Britain in the late 1960s revealed that words were used inconsistently to describe concepts relating to planning, design and construction. It was proposed,therefore,that a comprehensive list of descriptive terms be developed to cover all topics relating to planning, design, manufacture and building. This work was undertaken at the Polytechnic of the South Bank in London in conjunction with the DoE Property Services Agency,and resulted in the production of the 'Construction Industry Thesaurus' (CIT),(Gt Brit DoE/PSA 1972,1976).

The development of CIT grew out of an analysis of problems associated with the use of SfB and UDC, particularly regarding inconsistent meanings and use of terms in various specialised fields of application in planning, design and construction. The second edition of CIT was published in July 1976 and contained about 14,000 terms, 12,000 of which were indexing terms and 2,000 were 'entry points' or lead-in terms to cover synonymous words and phrases. Ten facets were used in its compilation:

- A Forms of record (format)
- B Peripheral subjects,eg science generally
- C Time
- D Place
- E Properties and measures, composition and content
- F Agents of construction, personnel and equipment
- G Operations and processes
- H Materials
- J Parts of construction works including services and equipment
- K Construction works including building types and activity spaces

Hospital planning is included in facet B together with hospital organisation, hospital treatment and hospital waste. Hospital equipment is in facet J, while hospitals are in facet K (under the heading Welfare spaces) together with parts of hospitals such as wards and intensive care units. Clinics are designated "= health centres" and are defined as "medicine spaces by type of care". The five or six levels of subdivisions are indicated by indenting, but appear to bear no relation to degree of detail, viz:

```
Welfare spaces
   Medicine spaces
      Hospitals                    (type of care)
         Wards                     (parts of hospitals)
         General hospitals         (by scope)
            District hospitals     (by area served)
         Mental hospitals          (by specialty)
      Clinics = health centres     (by type of care)
```

Applications of CIT were envisaged primarily in post-coordinate indexing, but also for filing or shelf arrangement of documents in a collection, and as a means of comparing classification schemes already in use. In the latter context it was "intended to form the basis for a 'meta-system' to demonstrate the relationships (and possibilities for convergence) of systems" (Great Britain DoE 1972).

Proposals for the development of a meta-system for information in the Construction Industry were described by Gilchrist (1972) in a report from ASLIB to DoE which aimed to provide not only a "switching mechanism between existing descriptor languages", but also "a control facility....to minimise the possible variations in linguistic and symbolic expression and use". The aim essentially was to standardise terminology in the construction industry and to provide a base for coordination of the various classification and coding systems currently in use.

Developments in Data Coordination in the Construction Industry in Britain up to 1979 have followed a number of directions apart from the CIT. These included production of a Handbook of Information Practice "to effect the better use of information" which was aimed at senior and middle management, as well as information service operators (Great Britain DoE/PSA 1979). Another development has been the production of a 'Teaching Framework' on Construction Information by the University of Strathclyde. This guide was intended to improve education on information for those entering the construction industry which was found to be "unstructured and incomplete" in a 1976 survey (Gt Brit DoE op cit).

In the medical and some scientific fields there has been a long tradition of indexing technical literature in journals and the production of abstracts and bibliographies. One of the most developed systems is 'Index Medicus' and the related MEDLARS and MEDLINE information retrieval systems operated by the National Library of Medicine (NLM) in Washington and available internationally.

Many information retrieval systems work by translating an enquiry into descriptive terms which are then matched with terms allocated to documents in the file to be searched. Such terms can either be pre-coordinated, as in the subject headings used in 'Hospital Literature Index', 'Excerpta Medica', 'Index Medicus', 'Hospital Abstracts' or 'Abstracts of Hospital Management Studies'; or they can be post-coordinated, as in a MEDLARS or MEDLINE search using computer systems or punched cards. Pre-coordinated systems can be linked with post-coordinated systems, eg the Medical Subject Headings used in 'Index Medicus' which are also used for MEDLARS searches. Some additional terms need to be used in MEDLARS searches which are not used in

'Index Medicus'. There are however limitations in using Index Medicus (and MEDLARS) for enquiries on subjects relating to hospital planning and design. An enquiry by the writer on the topic 'electrical safety of hospital equipment' revealed that it was not listed as such, either under Equipment - electrical, or Electrical - safety, or Hospital safety - electrical equipment, or any other combination of the terms. The nearest heading that could be found was Hospital Equipment and Supplies under which was a sub-heading 'standards'.

Perusal of subject headings in MeSH is facilitated by grouping them under main headings which correspond to facets:

A Anatomical terms
B Organisms
C Diseases
D Chemical & drugs
E Analytical, diagnostic & therapeutic technics
   and equipment
F Psychiatry and psychology
G Biological sciences
H Physical sciences
I Anthropology, education, sociology etc.
J Technology, industry and agriculture
   (which includes Hospital design & construction)
K Humanities
L Communication, library science & documentation
M Named groups of persons
N Health care (which includes:
   N2 health facilities
   & N4 health services administration)
O Place names

Each section of MeSH is arranged alphabetically with subordinate terms indented, these being listed in alphabetical order under superior terms. The subordinate terms are also repeated in the main sequence of headings, thus in section N2 one finds:

*HOSPITAL DENTAL SERVICE
HOSPITAL DEPARTMENTS
   Hospital Central Supply
   *Hospital Dental Service
   Hospital Emergency Service

Terms which also occur in other main sections are marked with the appropriate section code, thus under HOSPITAL DEPARTMENTS one finds:

Hospital Purchasing
Intensive Care Units
Libraries, Hospital (L)
Operating Rooms

'Hospital Libraries' are therefore to be found in Section L thus:

LIBRARIES
    Libraries, Dental
    Libraries, Hospital (N2)
    Libraries, Medical
    Libraries, Nursing
LIBRARIES, DENTAL
LIBRARIES, HOSPITAL (N2)

A very large number of terms is needed to provide a comprehensive list of subject headings in the fields of biological science, medicine, public health, planning, design, construction and equipment. The number of pre-coordinated terms can however be reduced substantially if single terms only, or keywords, are used for a basic list of indexing terms. The terms are then combined (or coordinated) only when an enquiry is made, rather than when a document is indexed.

The writer has conducted several literature searches using the MEDLARS and Lockheed DIALOG keyword computer retrieval systems on topics such as seating systems for the aged, lifting aids for patients in hospitals, and devices to reduce the incidence of pressure sores. In these searches only about 10% of the items identified were relevant to the enquiry, although some additional items listed were of interest on other related research (see also chapter 11).

Many simple and effective retrieval systems merely use an alphabetical arrangement of titles of books or journals to determine their filing order, either for whole collections of documents on a variety of topics, or within broad subject areas. Names of authors are also used, either as the only basis for shelf arrangement, or within broad or narrow subject categories. This method is widely used in bookshops, for example.

Methods of indexing and document retrieval in the health facility planning field have tended to suffer from similar problems of fragmentation and specialisation as in the classification field. Current awareness services, such as abstracts and bibliographies, vary enormously in their use of indexing terms, thus inhibiting the sharing of common sources of information awareness between the professions. Developments such as the CIT and MeSH have improved retrieval methods in the two distinct fields of Building and Medicine, but have done little to bring these two interactive disciplines together in the solving of health facility planning and design problems.

Another cause of fragmentation and discontinuity in use of information appears to be the different outlooks of professional information providers and the information seeking professions. The former are symbolised by classification and coding schemes which organise information for filing, while the latter are represented by indexing methods which aim to explain the classifieation schemes and to enable information to be found when needed.

Unfortunately many classification schemes in use seem to be more suited to concealing useful information rather than revealing it. The lack of coordination between terminology used in classification schemes, and the terms enquirers commonly use in seeking information, seems to be part of the problem. Ideally classification and indexing languages should be the same.

Development of simple faceted indexing systems based on commonly used terms in health facility planning and design would perhaps help to reduce the barriers between information specialists and people with problems to solve.

Describing information according to symbols in a prestructured classification scheme is an artificial and constraining process. The analytical method of selecting suitable descriptive terms from a range of facets allows information to be filed and retrieved by a variety of methods. It thus appears to offer greater opportunities for integrating information concepts and for utilizing knowledge.

7.5 SOURCES OF PLANNERS' AND DESIGNERS' INFORMATION

The following range of information sources are usually available to health facility planning teams:

- published guidance by government authorities or professional organisations
- codes of good practice, standards, regulations and ordinances
- books on the 'state-of-the-art'
- research reports, theses, dissertations
- journal articles, newspaper cuttings
- briefs and operational policies from previous projects
- designs and contract documentation from other projects, eg layout drawings, specifications
- consultants' and experts' opinions
- advisory centres, information agencies
- other people who have had some knowledge and experience in the field
- one's own previous experience on similar projects
- visits to other buildings and discussions with their users and designers
- reports of evaluation studies of similar projects
- analogies from other fields, eg physics, biology
- correspondence, memos, notes
- statistics on population, climate, building costs, health expenditure, morbidity, etc.
- discussions with actual or prospective users
- observations in existing facilities performing a similar function to the proposed facility
- imagination, inspiration, intuition
- attendance at conferences, seminars and courses

Any or all of the above sources may be used in project planning.

A danger of using information from other projects or from other countries is that however valid and relevant the information may be in its own context, it may not be relevant to the situation being planned for.

Hospital planners and designers, whether in private consultant firms or government organisations specialising in this field, use many methods to obtain information as a basis for making decisions. These methods vary from use of specialised computer-based information retrieval systems operated on a national or international scale, to relatively simple indexing, filing and classification schemes in personal or office libraries.

Some planners and information providers have described increasing difficulties in finding information relevant to particular problems (Agron 1973, White 1973). The problem is partly that the form of the information makes it difficult to understand or apply in practice (Goodey & Matthew 1971). Many journal articles are written more for the sake of publicity or academic status than to help readers solve practical problems (Gray & Perry 1975, Pidd 1980). Indexes to journal articles can help in identifying authors, titles, or general topic areas, but they are often not specific enough in subject analysis, nor are they sufficiently up-to-date for articles published recently.

Books are often inadequately indexed and many information providers agree that sections or chapters of books should be individually listed in indexing journals (Morton 1974, Bunch 1974, Swertz 1974). To achieve this ideal involves time and effort, but if done internationally it allows relevant information to be quickly identified.

The MEDLARS and MEDLINE systems operated by the National Library of Medicine in Washington, DC are highly developed systems for document identification and retrieval in the fields of health, biological and medical sciences. But they have only limited application in the field of hospital planning due to their strong clinical orientation. Some widening of the data base has occurred, but books are not covered in any detail, and journals in the fields of hospital management, design, building and engineering are inadequately covered, although integration of the Hospital Literature Index into the MEDLINE computer-based retrieval system in 1979 has improved matters considerably.

In Europe there has been considerable activity among professional librarians and information officers in both national and regional organisations. In Britain, for example, there has been active cooperation between the Kings' Fund Centre, the Scottish Health Services Centre, and the Wessex Regional Health Authority. More active leadership from government departments has been urged to set up coordinated information services and systems within the National Health Service (Morton 1972, 1978). Over eighty 'librarians' and information officers in regional and area authorities have sought affiliation with one of the professional librarians' organisations as a means of making their views more strongly felt. But as many members of this group lacked professional qualifications this objective was defeated (Bunch 1974, Kahn 1978).

Development of a more coordinated and integrated health service planning framework in Britain in 1974 offered the opportunity to provide an effective information service network, but this did not occur (Barnard 1974, Wilkin 1976, Valdez 1978).

In Europe the many national and international hospital institutes and agencies have cooperated in examining the possibilities for information sharing within the European Economic Community (Morton & Swertz 1973).

This appeared to be an ideal opportunity to establish an international hospital planning information centre. The difficulties of natural language translation, and of compatability of computer languages and systems, has however, hindered progress (Kahn 1978).

Many problems of obtaining support for developing improved information services in Britain, and in Europe and North America, results from an apathetic attitude among senior administrators and public servants to the need for more efficient information services in planning and in management (Leigh 1974, Morton 1978, Valdez 1978). Improved access to information is seen to constitute a threat to those in power (Greenleaf & Clerk 1977). The potential political or commercial value of information is therefore jealously guarded (Epstein 1978).

Many successful information services in use in commercial, professional or academic organisations have originated, either from realisation that a crisis could have been averted if information had been available, or because some enthusiast in the organisation went ahead and developed an information service and built it up until it became indispensible (Snel 1967). To argue the case for an information service on economic grounds is virtually impossible (Goulden 1976, Great Britain, Department of Environment 1978). Some good commercial information services ('good' in the sense that they were used extensively by their subscribers) nevertheless failed financially (Wears-Milne 1969, King's Fund 1970).

It is difficult accurately to allocate costs on a 'per enquiry' basis for information services as so many variable are involved (Swertz 1974). Most commercial services operate on a subscription basis, or are free to accredited enquirers. The cost of information services for commercial or government organisations are generally included in overheads rather than being charged to individual projects, and cannot therefore be cost related to results.

One of the most developed information retrieval services operated on an international basis in the hospital field was that set up by the Deutches Krankenhaus Institute (DKI) in Dusseldorf in association with the Technical University of Berlin (Steudtner & Swertz 1973). This system was originally established in the early 1950s using conventional index cards. In 1968 it was transferred to an aperture card post-coordinate indexing system using a selected range of keywords. It was subsequently operated as a fully computerised on-line system with CRT display and output in both German and English languages. The possibility of linking the DKI/TUB system with the MEDLARS network was still being investigated in 1978 after several years of negotiation (Morton 1978).

Information abstracting and indexing systems for hospital and health care subjects have also been developed in various centres in Western and Eastern Europe including Norway, Sweden, Netherlands, Belgium, West and East Germany, Poland, Switzerland and Great Britain (International Hospital Federation 1973).

Health service organisations in USA and Canada have participated in proposals for establishing an international network through the Cooperative Information Centre for Hospital Management Studies at Ann Arbor, Michigan. This centre, which publishes the quarterly abstracting journal 'Abstracts of Hospital (now Health Service) Management Studies', acts as a world repository of reports, theses and unpublished material in the health and hospital management field. The abstracts, which are both concise and informative, are arranged following a unique classification scheme which is semi-mnemonic and semi-systematic (see excerpts at appendix C^5). There are also comprehensive author, source and serial number indexes for alternative approaches to the contents. Cumulative indexes are published annually.

In the Netherlands, the Excerpta Medica Foundation publishes a monthly abstract journal in nearly forty subject fields of medical and health services. No. 36 deals with Health Economics and Hospital Management and includes some information relevant to hospital planning and design.

In Sweden the Hospital Planning and Rationalisation Institute (SPRI) publishes the ten times yearly 'Litteraturtjanst' which includes abstracts in Swedish and English. Abstracts are printed on perforated cards which can be filed cumulatively according to a decimal subject index system (Steudtner & Swertz 1973).

In the USA the 'Physicians' Record' used to publish an abstracting service on hospital management topics in card index form, but it was discontinued in 1967. Similar ventures in the building and architectural field relating to building products, and to technical literature, have appeared from time to time, but most have failed for want of support, enthusiasm or demand (eg Architectural Design and Architects' Journal Product Indexes).

One of the more successful abstracting services, namely 'Hospital Abstracts' published monthly by the British Department of Health and Social Security Library is, paradoxically, one of the most frustrating to use. The abstracts themselves are informative and easy to understand (see sample entry, appendix D^1). The arrangement of each issue follows the Bliss classification scheme (see appendix C[1]). Critics of 'Hospital Abstracts', while praising its consistency, scope, and handy format would prefer it to be more easily cumulated. There is an annual cumulative index which includes entries under subjects or authors. To find abstracts on a specific topic over the last two years can therefore involve scanning up to thirteen individual issues. No keywords are used for identifying individual abstracts. The DKI system uses 'Hospital Abstracts' in its information service, and assigns keywords from the DKI/TUB Thesaurus for post-coordinate indexing purposes.

The American Hospital Association (AHA) library in Chicago has, since 1964, published the quarterly and annual Hospital Literature Index and the Cumulative Index to Hospital Literature which appears every five years. The scope is multi-national with a bias to North American periodical articles. Entries are brief and include title, author, source and publication details only. Until 1977 they were grouped under a unique system of alphabetical subject headings, but since that date the Medical Subject Headings (MeSH), as used in Index Medicus and MEDLARS, have been used in an extended form. The print size of each entry makes rapid scanning and reading somewhat difficult (see sample page, appendix D[2]).

A Hospital Documentation and Information Centre at The Hague operated by 'Netherlands Hospital Planning Consultants' provided a service for hospital planners and designers on a world-wide basis. Membership (for a fee) entitled one to receive 'International Hospital Review' which contained selected abstracts of recent journal articles and publications, and brief details of hospital equipment and products. The library of the centre held a wide range of international journals in the hospital planning field, copies of journal articles being filed in over 3000 subject folders. A specially devised classification and coding system was used. The information service was available in English, German and Dutch. 'International Hospital Review' ceased publication in 1973,but the information centre is still believed to be in operation.

The library of the Kings' Fund Centre in London also has a collection of subject folders which may be borrowed. The Kings' Fund library, although primarily for users in the London area, is nevertheless well known internationally. Conferences and exhibitions are frequently held there, and the headquarters of the International Hospital Federation is housed in the same building. The Kings' Fund library experimented in the 1960s with an abstracting service produced by its staff, but the effort involved was not worthwhile as other abstracting services were already in existence. The Bliss classification system, as modified by A.E. Fountain for the Department of Health Library, is used for the Kings' Fund library. It has been further developed and published by the Kings' Fund Centre (1970) (see appendix C^1).

One of the most useful current awareness services in the hospital planning/design field is the Health Building Library Bulletin published monthly by the DHSS Health Buildings Library at Euston Tower in London. The Bulletin is arranged following the Bliss classification scheme's subject headings in broad categories, within which items are arranged in alphabetical order of authors' names. Sufficient details are given in the citations to indicate relevance of the publication, and in some cases short abstracts are given (see appendix D^3). Some entries subsequently appear in 'Hospital Abstracts' or in 'Current Information in Health Services'.

Bibliographies on selected subjects are published at irregular intervals by libraries and organisations such as the Scottish Health Service Centre, the DHSS Main and Health Building libraries (see appendix D[4]), and NSW Hosplan library. These bibliographies are useful as comprehensive collections of references on specific topics, but unless regularly updated they omit more recent items appearing in the regular library accession lists and bulletins.

Bibliographies appear to be little used by planners and designers, but are used more by researchers and librarians. Abstracting journals and indexes such as Hospital Abstracts and the RIBA Architectural Periodical Index seem to be more popular with the architectural profession. The latter is now arranged directly under subject headings (see appendix D[5]). Even in this alphabetical list of headings a semi-hierarchical system of subheadings is used.

7.6 PLANNERS' INFORMATION PREFERENCES

Since 1966 a number of surveys have been carried out in order to find out what types of information and types of information services were most used by architects and planners.

In the USA Burnette and Hershberger (1966) surveyed 19 architects involved in hospital planning projects and obtained the following ranking of the ten most frequently used sources and methods of gathering information for hospital planning:

administrators and department heads
conversation with individuals
participation in meetings and conferences
experience, chance or current awareness
medical and paramedical staff
reference books and professional journals
codes, standards and operating rules
private files and books
periodicals and review articles
visits to existing facilities and displays,

eleven other sources and methods were mentioned (Burnette 1979 p 35).

In Britain Goodey and Matthew (1971) surveyed 423 private and local authority architects in England regarding their offices' main sources of technical information. The ten listed sources were placed in the following order of preference:

trade literature	nominated by 90% of offices
journals, magazines	85
phoning or writing to manufacturers	71
trade representatives	59
research literature	57
building/design centres	37
phoning or writing to research centres	28
trade exhibitions	17
films	9
courses	6

Goodey and Matthew commented that:

> "traditional sources of technical information have still not been supplanted by newer methods" (p 30).

The survey was conducted for the Building Research Station and aimed to find out the extent to which architects used information from BRS and the forms of technical information they found most useful. The results showed that architects used advisory centres and research literature when there was a special problem to be solved, but to keep up to date the most used sources of information were exhibitions, courses and conferences.

The BRS survey findings were similar to those of White (1974) who found that the ten most frequently cited sources of information in a collection of publications on planning were:

journals
commercial publishers
government publications
unpublished material, including theses
universities and other tertiary institutions
independent research organisations
local authority departments
central government departments
university research organisations
specialist interest organisations

White (1971) also commented:

> "The overall picture which emerges is of a profession which has at its disposal a wide range of information sources, but which in general fails to exploit any category fully, even those which it ranks most important...
>
> If planners were more fully aware of the range of..... sources which already exist....their information usage would improve also, not only in terms of quantity, but also of quality." (p82)

The present writer's survey of information sources used by hospital planners in Australia in 1975 revealed the following order of preferences for 14 listed kinds of information (see also chapter 8):

advice from specialists/consultants
evaluation studies
personal assessments of other projects
guidelines on standards
mandatory minimum requirements
unbiased evaluation of product data
newsletters, journal articles
state of the art studies
seminars
other people with similar interests
bibliographies with abstracts
bibliographies with subject headings
bibliographies with keywords
computer printouts of references

In the field of urban and regional planning in Australia, Donaldson (1977) investigated the main sources of information used by planners in the University of Melbourne in relation to practice, research and teaching needs. Of 55 types of information sources the ten most frequently referred to were:

own research notes and research
professional journals
personal contacts - individuals in faculty
general books
textbooks
government acts
personal contacts - friends and relatives
architectural library - personal enquiry
meetings of more than two people
standards

The five surveys of planners' and designers' preferred sources of information which are summarised above all show a preference for journal articles, personal contacts, and specialised technical information in the form of standards or trade literature, rather than more sophisticated sources such as bibliographies, computer-based retrieval systems and research reports. Heavy investment in computer-based retrieval systems may therefore only be justified if information workers can be brought into the planning/design team, or designers and planners are trained in the use of more sophisticated information techniques. Both approaches are likely to cause fundamental changes in the way planning and design projects are managed.

7.7 INFORMATION SERVICES FOR HEALTH FACILITY PLANNING AND DESIGN

Scope for improved information services for hospital planning is closely linked with the role of both national and state government authorities, (a) as financing and approving bodies, (b) as guidance publishing agencies, and (c) as innovators in sponsoring research and development programs. The degree to which performance, cost, floor space and construction standards are mandatory for approval will influence how information is used in briefing and decision-making. Policies on standardisation will also affect the type of information needed for design.

The British Harness and Nucleus hospital systems radically altered the roles of planning authorities and design consultants working on hospital projects in Great Britain. The use of computers in structural and cost analysis, building and department layout, and equipment scheduling, completely changed the need for specific types of planning information (Great Britain, DHSS and RHBs 1972).

Three significant developments in information retrieval for health facility planning have occurred in Australia since the 1974 and 1975 information usage surveys were undertaken (see chapter 8):

1. development of the Hospital Information File (HIF) by the Hospitals Facilities Services Branch (HFSB) of the Australian Departments of Construction and Health,
2. development of the NSW Hospital Planning Advisory Centre (HOSPLAN) as a major resource centre for hospital planning and design information,
3. establishment of the Australian Hospitals Association (AHA) Reference Centre at Monash University Biomedical Library in Melbourne.

The Hospital Information File was established in 1974 and was built up from information obtained in planning and building health facilities in Australia, mainly by Commonwealth Government Departments. It also contained (at the time of writing) much published and unpublished data derived from overseas sources including the US Department of Health, Education and Welfare (DHEW), and the British Department of Health and Social Security (DHSS). A six facet classification system was used to index and retrieve data with the aid of a computer. The HOSPLAN library in Sydney operated a computer terminal for obtaining off-line printouts of HIF references held in files in the Department of Health in Canberra and elsewhere in Australia.

The HOSPLAN library was originally established by PA Management P/L for the redevelopment of Sydney Hospital in the late 1960s, but was taken over by the then NSW Hospitals Commission in 1974 when HOSPLAN was established (National Hospital 1974). The School of Health Administration at the University of NSW provided advice on setting up the centre, and the school's librarian and the writer were both involved in a consultant capacity (Green & Winter 1974). HOSPLAN services are financed almost wholly by the NSW Health Commission and include a library, exhibition area, conference centre, advisory service and a research and development section which has produced a number of guidelines on planning and design. There is also a mock-up facility for experiment with room layouts and equipment.

The AHA centre was initially established with support from the Kellogg Foundation in 1976, and with advice from Keith Morton of the Kings' Fund library in London. At the time of its inception discussions were held with members of the Board of HOSPLAN to avoid duplication of services, but there seems nevertheless to have been some overlap and confusion of aims and services between the two libraries (Baker 1980, Lapthorne 1980). The AHA Centre answers enquiries on sources of likely information on specific problems and provides lists of references obtained from Hospital Abstracts, Abstracts of Health Service Management Studies, Excerpta Medica, Index Medicus, and Hospital Literature Index. Enquirers may request copies of articles or borrow books referred to in the list of references from the Monash Library or may obtain these from other sources.

Another centre which provides information on health facility planning is the library of the Victorian Health Commission which was originally established as the John Lindell library in the late 1960s in the Victoria Hospital and Charities Commission (VHCC). This library now has a substantial holding of books and journals in the hospital planning field and circulates a bulletin on new acquisitions and holdings in particular areas of interest.

Information services on facilities for physically and mentally disabled people were described by Fanshawe (1980) in relation to the types of enquiries made to organisations such as the Disabled Living Foundation in London. After 'aids centres' had been opened in a number of places in Britain it became apparent that enquirers needed more than just to see and try out the aids on display. Persons enquiring about wheelchairs, for example, needed to know about the types available, where to obtain them, how to use them, how to get them in and out of a car, how to maintain them, what adaptations might be needed to the home, what financial assistance was available, and possibly other information regarding travel and employment problems. The aids centres also provided information for use in teaching programs for students in the therapy professions.

In Australia the National Advisory Council for the Handicapped (NACH) has acted as a stimulus to the establishment of information services and centres for the handicapped. In a report to the Expert Committee on Rehabilitation Engineering (ECORE) Scull (1981) defined the requirements for a central information clearing house for rehabilitation engineering. Two areas of need for the dissemination of information were discussed: firstly

> "a wide range of general information to keep professionals in the area, client groups and interested clients .... in touch with activities.... Such information needs to be pertinent, up to date, easily read and well edited."

Several kinds of general information to be included were suggested by respondents in the survey conducted by Scull:

- innovations in design
- sources of advice and service
- synopses of R & D activities
- reports on government activities affecting delivery of aids
- details of conferences etc. in Australia and overseas
- reports on conference proceedings
- reports on activities of NACH, ECORE and other national and international agencies.

An advice bureau and a 'Choice' for the handicapped were also suggested.

The second area of information activity proposed was an information exchange between research centres to avoid costly duplication, and to stimulate speedy delivery of services to clients. Several means of effecting exchange were suggested:

- workshop meetings to train staff and pass on skills
- routine meetings to coordinate research activities
- transfer of information between centres on design details, research data, information on materials and components, etc.
- selective bibliographies and abstracting services, such as Medline.

In addition a regular bulletin system was proposed to help people in the field keep in touch with the latest developments. A computerised data transfer system was however considered premature. Cooperation was urged between the various organisations involved, such as Independent Living Centres, Technical Aid for the Disabled, Australian National Library, CSIRO, and so on.

Development of structured information services for health facility planning and design has, in many instances, tended to lag behind the need for these services, especially in countries such as USA and Australia where responsibility for planning is often split between the federal, state and regional authorities involved. In such mixed situations much of the information used in project planning tends to originate informally from private consultants, from within individual institutions and design teams, and from professional and commercial agencies.

Even in the early phases of a large program of facility planning most of the information has to be found by experiment, or 'borrowed' from external sources. Only when the program has begun to provide some feedback, and as experience on early projects is accumulated, will 'hard' data become available and more formal types of information systems be developed. If there are insufficient resources locally to conduct research and development programs on a substantial scale, much information used on individual projects will come from outside sources, often at considerable cost. This has been particularly evident in hospital and health centre design in Australia and New Zealand, sometimes with unfortunate consequences, due to lack of knowledge on whether, or how, to adapt 'external' data to local circumstances.

Development of more sophisticated information retrieval systems such as HIF, or of more comprehensive information services such as provided by HOSPLAN, has ironically occurred in Australia just when the cutbacks in health building programs have reduced the demand for information on the scale anticipated when these information services and centres were originally set up.

Increasing financial support for research and information services on facilities for the handicapped has, on the other hand, occurred as a result of greater public awareness of this area of need. In consequence, proliferation of data on 'design for the disabled' has now itself become a problem in that considerable variations occur in recommendations on matters such as ramp gradients and dimensions of wheelchair toilets (USA DHUD 1979). Lack of properly conducted evaluation research is one possible cause of this problem. Another is that publication of research results is often unduly delayed due to lack of funds or to 'the time it takes' to process research data into a usable form.

Both types of problem - time lag and inappropriateness of data - may be reducible by linking information users and information providers by more 'formal' types of information services. But this will depend on continuity in the financial and political support given to such services. If this support is lacking, responsibility devolves onto professional and private organisations, some of which have, in the past, provided useful information and advice.

The growing division of responsibility between public and private authorities in the health facility planning field in many 'western' countries does not however appear to offer good prospects for efficient utilisation of knowledge gained from evaluation. Since there is often a negative relationship between the use of information services and 'productivity', due apparently to the stimulus of having to reinvent things already discovered by others rather than rely on literature sources (Paisley 1980), it may be argued that provision of 'better' information services may have the opposite effects to those sought.

7.8 COOPERATIVE OR SPECIALISED INFORMATION SYSTEMS?

The development of systems to identify what a bit of information is about and to describe its contents has occurred mainly in response to the need to organise documents for filing and retrieval. Information structures have not, however, sufficiently recognised the different viewpoints of the various users of the information, nor provided a satisfactory method of communicating ideas and instructions between the professional members of planning and design teams.

Some information structures have evolved into highly sophisticated systems in which long and complex alpha-numeric codes are used to identify compound subjects. Others have retained simpler, but fairly rigid structures, or have used natural language descriptive terms based on controlled languages and rules for application. The gaps between these approaches has resulted in development of specialised information systems orientated towards the needs of specialist professional users, or the retention of more comprehensive knowledge by the elite who have access to experience and sophisticated retrieval services (Kent 1978).

Information which is organised in particular patterns will inevitably be biased in favour of the users whose needs the pattern was designed to meet (Halloran 1978). There also appears to be a negative relationship between quantity of information provided and quality of decisions which result (Buchanan 1978).

The four main groups of information users - 1) planners and designers, 2) information service operators, 3) educators and students, and 4) research workers - each produce and use information in different ways.

Yet they all deal with essentially the same kinds of concepts. The development of a common means of access to planning and design information will probably lie with the simpler systems based on empirical development, rather than those based on 'information theory' and complex means of analysis. The users of any information system will be its ultimate arbiters - it is no explanation of the failure of an information system to say that it is not being used correctly. The design of the system should therefore include training of users in its use, but this should not exclude users unable to master complex and sophisticated procedures.

The personal attitudes of information providers and users play a significant role in the extent to which knowledge is utilised. Not even the most comprehensive and sophisticated information system will overcome the resistance of many planners and designers to advice from someone with experience (Morton 1978). Publications are relatively ineffectual in keeping people informed, and research findings are regarded as 'too academic' by many planners and designers (Valdez 1978).

Indexes and bibliographies are a means of identifying sources of information about planning and design research. But current planning projects and problems require access to digests of the state-of-the-art, or to enquiry services with knowledgeable staff able to answer technical questions or to put enquirers in touch with experts.

Information users and information providers tend to distrust each others' ability to understand <u>their</u> problems. The result is that information is retained in individuals' private systems rather than shared. Political and commercial pressures also lead to secrecy about useful information (Foskett 1979).

Much useful information has been 'discovered' inadvertently and unexpectedly - information systems should therefore allow unsystematic approaches to searching (White 1978). This conclusion coincides with Jones' (1981) view that design cannot be systematised and that the best designs are often developed by very unstructured methods. Hence the conflict between developing more highly structured systems to meet the specialised needs of particular professions, and the evolution of simpler general-purpose systems in which all can share. Both are probably essential; the next step is to provide a means of linking the various specialised systems with a general system.

The development of better or more integrated systems will not, of itself, solve the problem of utilizing information more effectively. The answer to the problem lies equally in the field of human attitudes and behaviour. To improve feedback of knowledge of results therefore requires information systems that not only ensure continuity through the phases of planning, but which also bridge the gaps between specialised fields of knowledge. The gaps, paradoxically, have largely arisen through the classification of knowledge into separate categories for the purposes of organising information, and of education.

CHAPTER EIGHT

INFORMATION PRACTICES AND USAGE - Synopsis

This chapter describes some surveys and experiments conducted by the writer concerning use of information in health facility planning. The first questionnaire survey investigated information practices and problems of over 30 hospital planners in Australia, and how they organised technical data.

Following the first survey two experimental bibliographies on hospital lighting and outpatient departments were compiled using different methods of presentation. These two bibliographies are compared for their effectiveness in information retrieval.

A second survey on information usage by health facility planners was conducted by interview, mainly in New South Wales. Results of the structured interview survey of 50 respondents in Sydney are presented in summarised form together with a more detailed analysis of suggestions by respondents on means of improving information flow in planning and design.

The last section of the chapter reports on experiments by the writer in methods of organising a personal document collection and a photographic slide library.

8.1 INFORMATION PRACTICES AND PROBLEMS OF HOSPITAL PLANNERS*

In 1974 a questionnaire (see appendix I[2]) was sent to 62 offices and individuals, all but 16 of whom had attended a Health Service Building Planning Seminar held at the Institute of Administration, University of NSW, in February 1973. Replies were ultimately received from 32 respondents, all but 4 of whom sent back completed questionnaires.

The 62 questionnaires were originally sent to individuals, firms and organisations distributed according to 'professional interests':

Table 8.1 Distribution of questionnaires

Type of organisation or firm	no. sent	no. returned
Architectural consultants	17	7*
Hospital or health service institution	14	5*
State or territory government hospital or health authority	8	3
Hospital planning offices	4	4
Quantity surveyors	4	1
Services engineers	4	1+1 letter only*
Management consultants	3	2
State government works depts.	3	2
Federal government hospital or health authorities	2	4, 2 from sub-libraries
Charitable organisations	1	1
Professional institutions	1	letter only
Structural engineers	1	nil
Total	62	30 + 2 letters

*includes incomplete or late questionnaire not included in analysis.

*A version of this report was published in 'Hospital and Health Care Administration' in November 1974.

The respondents were geographically distributed by states or territories as below:

NSW	21
Victoria	4
S. Australia	1
W. Australia	1
ACT	5
Total	32

The size range of the 27 respondents' organisations which were analysed in the survey was distributed fairly evenly throughout the sample. 'Size' was measured by the number of full time staff in the offices served directly by the library or information service.

Offices with 1 - 10 full time staff	5 replies
11 - 50	7
51 - 100	4
101 - 500	3
500+	8
Total	27 answering question

The pilot survey indicated that the most developed and best equipped libraries for hospital planning were in state or federal government organisations, but there was evident dissatisfaction with access to information sources by private consultants and by individual hospitals, both within their own organisations and as provided by outside bodies and central authorities.

The more informed and constructive comments referred to the need for:

1. greater coordination between information agencies so as to reduce overlaps and gaps and to make better use of limited resources,

2. multi-level information networks so that there was greater awareness of what was going on up and down the system,

3. widening the scope of existing information retrieval systems and services so that planners were not restricted in their outlook by using narrowly focused specialised information sources designed for particular professions.

The most widely used reference and retrieval aids were published indexes, bibliographies, abstracts, directories, and home-made indexes, rather than more sophisticated aids. The most popular publications originated from the King's Fund Centre, London, and the Australian Standards Association, followed by the UK Department of Health and Social Security, and the American Hospital Association. Hospital Abstracts topped the list of other information sources most used by respondents, followed by Hospital Journals (various), Index Medicus, and Hospital Literature Index.

Of 28 respondents who answered the question on classification methods, 36% used either Dewey or UDC to classify their document collection, while 14% used SfB in its original or modified form. The remainder either used no system at all (18%), or various other library systems such as LC, Barnard, AIA or MeSH (32%). In addition 29% said they used alphabetical subject headings for indexing and for organising documents in their libraries. No respondent in the survey at this date used the Bliss Bibliographical Classification. A number of respondents commented on lack of a suitable classification system covering literature in the hospital planning field. General systems such as Dewey caused too much scatter, while special purpose systems such as SfB and AIA excluded general concepts needed in the health planning field.

Respondents were also asked what methods they used for indexing and retrieval. Several respondents used a variety of methods, the most popular being pre-coordinate subject headings (24%), followed by alphabetical list of authors (22%), shelf list (22%) and alphabetical titles (21%). Four of the 27 respondents said they used some kind of post-coordinate keyword indexing system for retrieval, while three respondents used no system at all.

A question on knowledge and use of 20 specific document titles by respondents revealed no particular pattern of preference for kinds of publications. In terms of literary awareness architects' offices and hospital and health authorities scored best, but size of organisation had little effect on either knowledge or use. The degree of detail in the listed publications also had little effect on their use, although more general books were slightly preferred.

Although a relatively large proportion of the pilot survey respondents provided detailed comments, few made any specific constructive suggestions for improving access to information for hospital planners. Some comments of this nature had been made (a) in correspondence arising from circulation of a discussion paper describing the intended scope of the proposed research program, (b) as a result of conversations with various hospital planners and librarians, and (c) in discussions arising during the 1973 Health Service Building Planning Seminar.

It might be assumed that exposure to discussion on possibilities for improving information services for hospital planners, such as occurred at the 1973 seminar, would lead to more informed comments from those survey respondents who attended the seminar. That this was not the case is probably explained by the fact that many of the questionnaires had actually been completed by librarians who were not at the seminar, and who therefore had relatively little experience in the hospital planning field as a user of information.

Despite the relative absence of 'diagnostic' comments or prescriptive suggestions by survey respondents, the general feeling expressed in replies was that easier access to reliable information was needed, and that this could be helped by getting more coordination of information services at international, national and local levels, and also between government and private organisations. Other respondents stressed the need for some kind of unifying agent or agency so that different professions involved could understand each other's technical terminology better, and were not dependent on a limited range of specialised information sources or services.

8.2 EXPERIMENTAL BIBLIOGRAPHIES

Following the writer's investigation of hospital planners' and designers' information problems and needs in 1974, two experimental bibliographies were produced, one on 'Hospital Lighting Design' and the other on 'Planning and Design of Outpatient Departments' (Green & Heath 1975, 1976a). These were intended to test information users' responses to two different ways of presenting information about information sources: namely by keywords and by short summaries or abstracts. The first was intended to be used as a means of indexing and retrieval of information sources by descriptive terms arranged in a predetermined order of facets, the second was a selection of abstracts of publications arranged alphabetically by names of authors (see appendix D[6,7] for sample entries).

The selection of keywords for the Hospital Lighting Bibliography was based on a preliminary analysis of the subject field as presented in the literature, and from knowledge of the information needs of designers. The compilers set out to assist enquirers in finding information which would help solve their design problems, but without predetermining the solution. The keywords were also intended to be used in an edge punched card indexing system, or in a computer based retrieval system. A trial index was set up using edge punched cards and a number of experimental document selections were made with it.

The 111 keywords were arranged in nine main facets as below, one of which, 'Function' (of facility), was divided into five sub-facets:

1.	LOCATION	interior or exterior
2.	MEASURE	form of measurement used, eg metric
3.	SOURCE	of light, eg natural, artificial
4.	MEANS	of lighting, eg rooflights, wall fittings etc.
5.	PROPERTIES	of light source, eg glare, flicker etc.

6. FUNCTION
   i. main function of building, eg educational
   ii. function within health facility, eg nursing unit
   iii. special users of facility, eg aged people
   iv. times of day, eg evening
   v. special activities, eg surgery
7. ADMINISTRATIVE & ECONOMIC FACTORS, eg cleaning, costs, safety etc.
8. GEOGRAPHIC LOCATION & CLIMATE, eg Australia, NSW, sub-tropical etc.
9. PSYCHOPHYSICAL FACTORS, eg colour, comfort, efficiency, etc.

Each abstract was identified as follows:

AUTHOR - including affiliation details and qualifications (where known)

TITLE of publication (and series if applicable), chapters of books were included

PUBLICATION - place, publisher, date

FORMAT - size, no. of pages/page nos.

INTEREST - professions most likely to use

SOURCE - libraries where known to be held in Australia/NSW

KEYWORDS to indicate scope and content arranged in order of facets and sub-facets

In addition a PRIORITY RATING and a TECHNICAL RATING were given. Priority was judged in terms of relevance to hospital lighting design in Australia and how up to date it was - a three point scale was used. Technical rating was based on whether the publication was aimed at specialists and/or non-specialists.

The information sources used in compiling the bibliography were restricted to books, chapters of books, reports and 'guidelines'. Journal articles were excluded for two reasons, 1) they usually appeared in book form later if they were of sufficient technical standing, and 2) journal articles were relatively well indexed in regularly published abstracts and bibliographies. An alphabetically arranged list of 22 recent and relevant journal articles on hospital and general lighting design was however appended to the bibliography. In addition a short list was included of people and organisations in Australia who could provide information on the subject.

In order to find out how information users reacted to the form and usefulness of the experimental bibliography, a questionnaire was included for feedback. This asked for professional details of the respondents, their special interests and experience, their use of published literature in general, their attitudes to information retrieval, and their comments on the experimental bibliography, eg form of presentation, additions wanted, ease of use.

The bibliography was sent to 94 people in Australia and 24 people in overseas countries, including some 30 or so by request after the original distribution. Completed feedback questionnaires had been received from 34 respondents when the responses were analysed, although a further 23 responses were obtained verbally and by correspondence.

The main points to emerge from an analysis of the lighting bibliography recipients' responses were:

1. those people who currently used information sources welcomed new sources and used them,

2. a few people who did not make use of existing sources of information could be persuaded to do so by suitable promotion methods,

3. many peoples' comprehension of the written language was poor; bibliographies were likely to be little used by practising designers; keywords were unfamiliar to people other than librarians and information specialists,

4. QUALITY of information was more important than QUANTITY,

5. easily digested state-of-the-art reports were the most valued kinds of information source,

6. there was a generally more favourable attitude to the bibliography from overseas than from Australia,

7. there was a need to develop and publicise information sources on health facility planning in Australia; development of information sources and services needed to be coordinated otherwise there would be overlap and waste of resources,

8. many people were unaware of useful sources of information relevant to their professional work; education in the use of information services and systems was needed as part of professional training courses.

Some specific responses to the feedback questionnaire are analysed below. (Further details are given in Appendix I.[3])

USEFULNESS of bibliography generally	very useful	4
	useful	14
	little use	0
	no use	0
	no response	16

		useful	superfluous
USEFULNESS of aids to use	priority rating	15	7
	technical rating	19	4
	professional interest	17	3
	keywords	22	2
	geographical application	11	9

FORMAT

very easy to understand	8
easy to understand	16
rather difficult to understand	5
incomprehensible	0
	29

One respondent subsequently made a specific request for a bibliography on outpatient clinic planning and design, preferably with short abstracts. This was therefore selected as the topic for the second experimental bibliography (Green & Heath 1976a). The outpatient bibliography contained 46 abstracts of books, reports and some journal articles arranged in alphabetical order of authors' names, together with title of publication, source of publication, format and number of pages. The abstracts were either in the form of a summary of the contents and findings, or a list of contents where a summary was inappropriate.

The introduction to the outpatient bibliography requested users to report on their evaluation of its use, especially in relation to the format using abstracts compared to the lighting bibliography using keywords only. However there was little feedback on this aspect as no specific questionnaires were sent out with the outpatient bibliography.

The research was subsequently reorientated towards an indepth investigation of a wider range of information users' needs (see next section). This wider investigation included an evaluation of indexes, abstracts, bibliographies etc. in comparison with other forms of information retrieval. Out of 14 listed forms of information retrieval, respondents rated 'bibliographies using abstracts, subject headings and keywords' as 11th, 12th, 13th respectively in order of 'value' as information sources, while advice from specialists and evaluation studies of design in use came 1st and 2nd respectively. It was therefore concluded that the effort involved in compiling bibliographies using keywords and/or abstracts was not the most profitable line of attack in improving design of health facilities. This kind of work was better carried out by information specialists with good access to primary information sources, but it also needed competent professional advice in the fields of application being covered by the bibliographies.

8.3 INFORMATION USAGE IN HOSPITAL PLANNING

As a result of the 1974 pilot survey on 'Hospital planners' information practices and problems' the National Hospitals and Health Services Commission in Canberra agreed, in 1975, to fund an eighteen month research program to investigate more fully how information was used in the process of planning and design of health facilities. A number of questions were formulated which the proposed research was intended to explore:

1. What kinds of information do health facility planners and designers need in their jobs as decision makers?
2. What types and sources of information do they use most, and find most useful?
3. Is available information effectively utilised?
4. What are the costs and consequences of not using available knowledge?
5. What improvements are needed to get more effective feedback from users of health facilities?
6. How can unnecessary design errors be avoided?

In the original application for the research grant it was suggested that the sequence of decision-making on two or three selected planning and design projects might be monitored over a period of several years in order to see how information was sought, recorded, transmitted and applied, and with what results. Difficulty of getting open access to such a situation prevented this approach. The time factor also made it impossible over the limited funding period of eighteen months.

Part of the research program as executed consisted of an extensive literature search on the information problems in other professional fields and areas of application. A common feature of the search findings was that non-documentary sources of information were often better regarded by information seekers than sources such as libraries, journals and guidance publications. This aspect was therefore considered worth investigating in some depth, particularly with regard to attitudes of various professions to different sources and kinds of information.

Several studies in the USA and in Britain (Rees 1975, Valdez & Wilkin 1974, Ginsburg 1975) had reported on experiments using 'information brokers' as an intermediary between information providers (such as librarians) and information users (such as researchers and planners). As some attitudinal problems had been revealed in these studies it was considered worthwhile to explore a number of possible roles for information brokers in the health facility planning field, ideally by providing an experimental service in several types of situations. Unfortunately lack of support from the state authorities concerned prevented this approach, despite initial enthusiasm from several potential user organisations who welcomed the idea.

A major element of the research program consisted of a series of unstructured interviews with hospital planners, designers, users, research officers and librarians. This survey covered over 60 respondents in capital cities and rural areas in New South Wales, Victoria, the ACT and Queensland. Respondents included people with a wide range of professional experience and practice in public authorities and in private and commercial organisations.

As a result of these unstructured interviews a draft questionnaire was prepared for application in more structured interviews with a stratified sample of 50 health facility planners, designers and users.

The population of information users from whom the sample could be drawn consisted of all health facility planners, designers and users in the Sydney metropolitan area. To enumerate such a population was clearly impossible within the resources of the research project. The sampling frame therefore had to consist of those organisations and individuals whom the chief investigator knew to have been involved in health facility planning and design within the previous ten years. Given the limited number of major hospital projects in NSW, and the chief investigator's awareness of the professional field involved, this method of selection should not have biased the sample unduly. Each of the principal Sydney architectural firms practising in the health facility design field was represented in the sample. The proportional representation of different professions could only be determined by an arbitrary decision and a form of quota sampling was used to select the respondents. The results of the survey are therefore not claimed to be statistically significant, but simply aim to provide useful indicators of various kinds of information users' experience and needs.

Respondents were contacted initially by letter explaining the purpose and background of the survey. This was followed up by a phone call from one of the interviewers to make an appointment. No interviews were refused, although in a few cases the person nominated was not available and a substitute with similar background was found. Each interviewer covered roughly half the sample which was distributed over the whole metropolitan area of Sydney. Interviews lasted up to two hours in some cases, the interviewers making detailed notes which were written up immediately afterwards on prepared proformas. Strict anonymity was assured.

This questionnaire was tried out initially on ten students taking the 'Hospital Planning' subject in the School of Health Administration. All the students concerned had some experience in the hospital planning field and represented a good range of professional experience. Following this pilot study some improvements were made to the questionnaire. Two experienced free-lance interviewers were briefed on its application. Neither interviewer had had any previous contact with the School of Health Administration or with the specific subject field, although one had some experience as an architectural librarian and the other had carried out market research in the construction industry and in the medical field.

The results of the preliminary unstructured series of interviews had shown that the needs and problems of health facility planners and designers in other states and in country regions differed little from their colleagues in Sydney. A survey sample drawn from the Sydney metropolitan region was therefore considered to be reasonably representative of the situation throughout Australia.

The survey sample was selected to give a balance between the professions involved, parity between people in public and private sectors, and a range of degrees of planning experience. Twenty-one designers were selected including fifteen architects, four engineers and two quantity surveyers. Hospital users numbered nineteen, six being medically qualified, seven were hospital administrators and six were nurses. Of the ten planners selected, six were from Health Commission regional offices, three were with commercial consultant firms and one was with a federal government department. Seventeen respondents had had less than five years experience in the field, fifteen had between six and fourteen years, while eighteen respondents had logged over fifteen years.

Questions covering nine topics were put to the respondents (see appendix I[4]), encouragement being given to elaborate on some points. Four questions required value ratings on a six point scale to each of a range of options listed on a card presented to respondents. The questions may be summarised as follows:

1. What information sources do you have within your own organisation? (interviewer to probe after unprompted reply).

2. What information have you sought from outside organisations over the last 3 years? Give 3 examples? Where did you try to obtain it? How successful was the search? (give value rating for each example).

3. What recent first-hand knowledge do you have of absence or non-use of information leading to mistakes? Give 3 examples and describe what costs were incurred and why?

4. Should organisations supplying information be the same or different from those making and implementing policies? Rate the acceptability of 9 (listed) types of organisations a) to provide information, and b) to make policies.

5. Rate the value of 15 (listed) kinds of information a) to yourself, and b) to your organisation.

6. What recent projects have you worked on which have produced information of use to other planners/designers? Would you/your organisation be prepared to share this information? What kinds of information would you be prepared to share? How? (five methods listed).

7. Do you see a need for education programs in health facility planning and design a) for designers, and b) for users? Why? What form should they take?

8. Rate the value of 6 (listed) roles for 'information brokers' a) to yourself and your organisation, and b) nationally.

9. Have you any other suggestions for improving flow of information in health facility planning and design in Australia?

8.4 SUMMARY OF RESPONSES TO INFORMATION USAGE SURVEY

The full report on the survey (Heath & Green 1976b) gave a detailed analysis of the responses to questions 1 to 8 and provided anecodotal evidence in the form of selected quotations where these illustrated a common viewpoint or indicated a significant divergence from the norm. The three characteristics by which respondents were selected, namely 'professional group', 'affiliation to public or private sector', and 'length of experience', were used to analyse the responses to the value rated questions (2, 4, 5 and 8) as a means of indicating each group's preferences for kinds of information sources, kinds of information, forms of education, and forms of information brokerage.

A topic which aroused considerable comment in the press reports on the survey (Sydney Morning Herald 1977), namely question 3 on 'costs and consequences of mistakes attributed by respondents to lack of information', was analysed in the full report in terms of kinds of mistakes described, their effects, and their likely causes.

Responses to question 9 on suggestions for improving information flow were not described in any detail in the survey report, but are included more fully here to indicate respondents' expressed views on the need for improvement. Responses to questions 1 to 9 are summarised below:

Question 1. Availability of information within own organisation

Use of available information often appeared to be minimal. Nevertheless many respondents were concerned about lack of design-in-use feedback from previous projects. Another problem revealed was lack of continuity in information during the planning, design and construction of a project.

Decisions were often not properly recorded or followed through to execution. Use of in-house libraries was claimed to be difficult due to problems with classification schemes, inappropriate orientation of the document collection, or lack of relevant and up-to-date publications. Although larger firms and public authorities often had substantial book and periodical collections and library staff, even here there was often lack of knowledge of what was available. Many respondents preferred non-documentary means of obtaining information, 'colleagues' being nominated as a prime source of information by over two-thirds of the survey sample. Other valued sources were visits, meetings and seminars. More experienced respondents, particularly the 'user' group, made more use of non-documentary information than their less experienced colleagues. Planners tended to be the more information conscious group, while designers were more document orientated than either planners or users.

Question 2. Use of information sources outside own organisation

The most frequently used sources of information were NSW State Government departments and Australian public and private libraries. Next came commercial consultants and hospitals in Australia and overseas, followed by respondents' personal contacts, federal government departments, educational and professional institutions and overseas government and non-government departments. By contrast, the most successful searches were made at some of the least used sources of information, namely educational institutions in Australia and overseas non-government institutions. The King's Fund Centre in London and the Scottish Hospital Centre came in for particular mention. Least successful searches were with 'personal contacts' and overseas government departments.

Subjects on which information was sought most frequently were concerned with equipment and fittings, planning and design of complex departments, general principles of hospital design, and commissioning. Subjects which returned the highest success rates for relevant information retrieved were equipment and fittings, general principles of hospital design, and statutory requirements and statistics. Least successful were planning and design of hospital departments and planning of non-hospital facilities.

Many planning and design decisions appeared to have been made with little or no information to support them, often because the time and effort involved would have been too great, or the job would have been held up while an exhaustive search was made. Overseas visits were regarded as an important source of information by many respondents from both public and private sectors. However there appeared to be little sharing of the information so gained. Many respondents said they found no suitable answers as a result of their enquiries and ended up 'doing their own thing'.

Poor communication between designers and users seemed to be a familiar problem with many respondents. Lack of time and opportunity for adequate discussion of user requirements, and the seeming irrelevance of much documentary information to the enquiry topic, contributed to designers' difficulties in understanding what they were designing for.

Preference for non-documentary information suggests that greater effort and resources should be directed to this type of information, eg study groups, planning team discussions, evaluation visits and information brokerage. As speed of retrieval and relevance were also considered important in any kind of information search, whether documentary or non-documentary, these aspects deserve high priority in improving library and advisory services alike.

Question 3. Effects of insufficient or non-use of information

The objective of this question was to establish the cost or other consequences of insufficient or incorrect information with the aim of trying to justify expenditure on improving information services. Inadequate information resulted in seven main categories of 'mistakes': inappropriate design for function, maintenance problems, unnecessary duplication of research, inadequacy of services provided, non-compliance with regulations, over-provision of facilities, and unfortunate environmental effects.

The main application areas of mistakes appeared to be traffic and transport systems, toilets, operating theatres (particularly electrical services), and comfort of patient bedrooms, especially lighting, noise, and access to fittings.

Effects of mistakes were increased costs, patient discomfort or distress, and staff discomfort or inconvenience. Extra expense was incurred in correcting mistakes, alleviating problems, repairing damage, providing extra equipment, or providing extra staff.

Causes of many faults appeared to be ignorance that information was available, poor communication within planning teams, failure to understand human needs, lack of cost awareness, lack of flexibility in planning and design, and making changes in functional or design requirements without ensuring that other people concerned were fully informed. In many cases it appeared that knowledge was readily available, but it was not known to the person making the decision. Many faults originated in lack of appreciation of other people's needs and viewpoints.

Question 4. Information provision and policy making

Opinions differed on desirability of one organisation being both 'provider of information' and 'policy maker/planner'. A majority of respondents thought each function should be performed by different organisations, fearing bias or selectivity in information provided by organisations which also provided funds or acted as the client.

Most respondents preferred a hypothetical 'autonomous national organisation' to provide information, and a 'state government organisation' for policy making and planning, both preferences being marked by a clear lead over other contenders. Public sector respondents, however, gave joint top place for information provision to 'autonomous national organisation' and 'educational institution', while the private sector respondents clearly preferred an 'autonomous national organisation' with 'state government' and 'regional office' coming second. Respondents with longer experience preferred an 'autonomous national organisation' to provide their information.

Length of planning experience made little difference to respondents' order of preference for 'policy maker/planner', except that 'autonomous national organisation' was preferred by most users. Respondents generally placed a low value on the kind of organisations to which they belonged, perhaps because unfamiliar concepts usually seem more attractive.

Question 5. Information types most valued

Certain kinds of information appeared to be much better than others in helping to solve planning and design problems, but the different groups of respondents agreed fairly closely on the kinds of information they found most valuable. Preference for non-documentary kinds of information was emphasised, with 'expert advice', 'evaluation studies', and 'visits to other projects' coming top of the list. A particular need was expressed for unbiased evaluation of manufacturers' products, and for information on current research and building projects. State-of-the-art reports and seminars were well regarded as information sources.

Planners' and designers' lack of enthusiasm for bibliographies and computer print-outs of references suggests that these are better regarded as tools for specialist information workers and researchers rather than primary enquirers. Respondents with greater length of experience expressed a strong preference for non-documentary types of information.

'Advice from specialists/consultants' scored well with private sector respondents compared with the high mark given to 'evaluation studies of design in use' by the public sector group. This contrasted with the findings of the previous question with respect to the private sectors' suspicions of private organisations as information providers.

Question 6. Information sharing

Sharing information between planning teams or private consultant firms was regarded as an ideal by four-fifths of respondents, but some reservations were expressed in terms of feasibility in the real world.

Information was seen as being commercially or politically valuable by most of the thirteen respondents giving qualified replies in answer to the question on their readiness to share information with other firms/ organisations. Planners appeared to be more enthusiastic than designers about sharing information, although a third of the planners, all from the private sector, would impose conditions. Clients or users were the most enthusiastic group, but were less confident than planners or designers that information produced in the course of a project they had worked on would be useful to others. Some hospital administrators said they would share information but would stop short at disclosing mistakes.

Out of the thirty-four respondents who specifically identified topics and types of information they would be prepared to share, twelve said "anything and everything", eight specified planning and design of specific departments, while costing, design principles, evaluation studies, and design of whole projects were each mentioned by five respondents. Other topics nominated included equipment, computer programs, building construction and catering systems.

The preferred method of sharing information appeared to be 'by informal verbal communication and/or correspondence with enquirer', while the second preference was 'by giving a research worker access to staff meetings or documents'. Third was 'by publishing a report', and last of the specified options was 'by inviting an evaluation'. Sixteen of the forty 'willing to share' respondents were against the idea of sharing their information by inviting an evaluation of one of their projects. This conflicts with the generally high proportion of respondents who would like to have the results of evaluation of other projects, thereby suggesting that making evaluation studies and publishing the results is alright so long as it is not one's own project that is being put in the limelight!

Question 7. Education

There was general and enthusiastic support for education programs as a means of improving access to and use of information in health facility planning. Reasons given for this support included the general benefits of education as such, improved use of resources, reduction in mistakes, provision of 'tools of the trade', improvement in understanding between users and designers, increased accessibility of information, keeping up to date, rationalising building, and achieving a better balance between functions, aesthetics and cost.

The need was repeatedly stressed for improving communication between the professions involved through joint education. The North London Polytechnic Medical Architecture Research Unit one year postgraduate course was mentioned by several respondents as one example of what might be organised in Australia. Other respondents expressed a preference for shorter evening or weekend courses due to the difficulty of taking time off from work. Formal courses were however the preferred format for education programs, while a small minority of respondents suggested meetings and publications as the best means of reaching the audience.

Users expressed the need to learn how to prepare briefs, how to estimate running cost implications of building projects, how to assess sociological needs, how to understand statistics, how to commission, and how to evaluate. Designers were more interested in learning the functional needs of different departments, keeping up to date with technical matters, and learning from other people's mistakes. The resistant attitude to admitting mistakes was mentioneed by a number of respondents, and it was felt that the more relaxed atmosphere of a project based seminar would help in getting people to discuss common problems without feeling threatened.

Question 8. Information brokerage

Respondents' reaction to the concept of information brokerage was hindered by lack of experience of this kind of service. Nevertheless it was possible to get relative preferences for different roles for an information broker on the basis of respondents' awareness of current problems and needs. Opinions were sought on six different roles (see Appendix B) which were not mutually exclusive, although some respondents interpreted them as such. Respondents were asked to rate the value of each role both to themselves and to planning and design generally.

A majority of respondents tended to give slightly higher ratings to all six roles in terms of 'national' benefit compared with 'personal/own organisation's' benefits, thus suggesting that they may have seen others' needs as greater than their own. The roles regarded as most valuable at both levels were 'link' between information sources and users, 'instigator of evaluation studies', and ' promotor of information awareness'.

Facility users were the most enthusiastic professional group for all roles, but exceptionally so in respect of 'link' and 'instigator'. The designers were slightly less in favour of brokerage generally than were the users, but they gave top preference to 'instigator' of evaluation studies. Planners were least supportive of brokerage, considering the benefit nationally to be greater than their own. Several respondents were concerned that any person acting as a broker had to be seen to be politically and commercially neutral.

Question 9. Suggestions on improving information flow

Many of the more experienced respondents expressed disappointment with lack of progress in improving flow of information, their reasons for slow progress included the rivalry between organisations involved, and attitudes (both political and personal) which obstructed use of knowledge.

Many respondents commented on the need for greater coordination of government and other agencies involved. There appeared to be considerable duplication and competition between federal and state authorities, between state and region, between different government departments and agencies, between professional interests, and between public and private sectors. The resultant confusion, and in some cases contradiction, left the information searcher little better off after spending much time and effort trying to answer a simple-seeming question. Many respondents thought information centres such as the King's Fund Centre to be the ideal.

There was repeated demand from all categories of respondents for evaluation studies to be carried out, both on new buildings in use, and on equipment and products, so long as the studies were done by disinterested and objective organisations. The results should be published so that people 'could learn from each others' mistakes', although it was realised that legal factors might prevent this.

The examples of 'problems' and 'needs' listed in appendix I[5] illustrate the range and depth of difficulties experienced by people of all kinds and degrees of experience.

8.5 CONCLUSIONS ON INFORMATION USAGE SURVEY

The full report included fifty-three 'findings' arranged in groups related to each question. Based on these findings twenty recommendations were made covering the following topics:

Making information more relevant and accessible
Evaluation of buildings and products
Coordination of information services
Presentation of information
Encouraging use of information in decision-making
Education of planners and designers
Development of information services

The following summary of findings and recommendations appeared in the original report together with a commentary, both of which are repeated here in an amended and abridged form:-

A resistant attitude to use of information in decision-making and problem solving was evident, both in individuals and in organisations, whether public or private. The comment of a senior medical administrator that 'unfortunately people read journals' expressed this viewpoint succinctly!

Limited awareness of information available, both within people's own organisations and generally, stemmed from lack of understanding by information providers of the needs of practising information users.

Organisations providing information should be independent of policy making and planning authorities so as to be free of bias or political pressure. There should be no commercial strings attached to any organisation providing information involving professional services or commercial products.

Lack of relevant and unambiguous information at the right time and in the right place was a likely cause of many mistakes and omissions in design, some of which were costly to remedy while others caused considerable discomfort and inconvenience to health facility staff and the public.

Some respondents were confused as to the origin and status of design guidance publications produced by some health and building authorities. Frequent changes in name and function of organisations and publication series caused uncertainty and doubts as to their application and validity.

Many planners and designers preferred non-documentary forms of information such as people and projects. Books and journal articles were of limited value to practising planners and designers who often preferred to 'nut out' a problem rather than go through a laborious literature search only to find no ready-made answers. Bibliographies and computer printouts of references were of little use to the majority of respondents.

'Information sharing' was regarded with some suspicion in that trade secrets, politically sensitive information, or evidence of professional incompetence might be used against one in the real (rather than the ideal) world.

Educational courses of short duration, both at basic and advanced level, were desired by most respondents, particularly to develop skills needed for effective interprofessional team work, and to acquaint planners and designers with the latest ideas and knowledge on particular problems and techniques.

'Information brokerage' was a concept unknown to all respondents. Nevertheless many felt that well qualified and unbiased people who could act as 'link' between members of planning teams and sources of available knowledge could save time and get better information on which to base decisions. An information broker could promote evaluation studies and get feedback from health facility users on effectiveness of design-in-use.

Generally there appeared to be both mistrust and lack of awareness in most respondents that much could be done to improve quality or accessibility of information, given personal, political and commercial attitudes in health facility provision which often seemed to come before professional and moral principles.

8.6 DEVELOPMENT OF A FILING AND RETRIEVAL SYSTEM

A problem which has preoccupied information specialists and designers over the last twenty years or so is how to arrange collections of information in offices and technical libraries so that it facilitates filing and retrieval (Calderhead 1972). Much information is generated in the course of planning, designing, constructing, commissioning and operating health facilities, but a large proportion of it is irretrievably lost because no common system exists by which 'other people' can gain access to it. The search for a common filing and retrieval system has been influenced by a number of factors, many of which conflict. Library orientated systems, for example, tend to be bibliographic in emphasis, ie they follow the form and subjects of the literature rather than the needs of information users. Design orientated information systems on the other hand tend to reflect planning and construction processes and products, or the needs of cost analysis and control. In health facility planning the medical orientation of hospitals and the social aspects of community health dictate the form of terminology and classification schemes used in indexing and in document organisation.

The writer's involvement in this problem was generated by the need to organise document collections for research and education. These documents covered the whole spectrum of planning and design, health services and facilities, and building products and equipment. No library system such as Dewey, UDC or Bliss provided appropriate concepts or structures, and the building design and planning systems such as SfB or CBC were orientated too much towards construction processes and building products. The clinically orientated systems such as MeSH and NLM classifications were deficient in the fields of planning and design. The choice therefore lay between 1) adapting or extending one of the existing systems, 2) merging two or more of the best existing systems, or 3) developing a system specially for the purpose. Attempts to extend, modify or merge systems, such as UDC, Bliss and SfB, proved to be unrewarding for the organisation of personal files, project data, office libraries, and research publications. The subsequent development of complex data classification and indexing systems, such as DIF and HIF, appeared to offer possibilities, but the time needed to analyse, code and index material using these methods was prohibitive. An ideal system would need to cover material as diverse as photographic slides, drawings, books, journal articles, project meeting records, teaching notes, and survey data. It should also avoid influencing the information users' way of thinking towards a predetermined solution, yet it needed to encourage innovative thought and enable knowledge on good solutions and mistakes to be quickly identified.

Each of the four basic approaches to organisation of information was examined and a series of trials conducted on both small and large document collections. Hierarchical classification schemes such as UDC proved too rigid in their organisation and too complex in their coding systems, while the more flexible faceted systems such as SfB were more adaptable to a variety of purposes. In more complex subject fields however the facet codes became unduly complex and prone to error. Systems using natural language in the form of keywords offered better prospects for reliable document identification. The exclusive use of authors and titles to identify documents was both simple and un-biased, but relatively unhelpful in retrieval by 'problem topic'.

It seemed therefore that a combination of natural language and a simple but flexible hierarchical structure based on facet analysis would offer possibilities. This was the approach adopted in the CIT. Unfortunately CIT is relatively unhelpful in the field of health facility planning and design, and far more detailed than needed in areas such as building components, chemistry of materials, and engineering design.

A system which offered a more useful array of topics at several levels of detail, and which reflected typical planning, building and operational concepts, appeared to be possible to develop. However it was likely to be difficult to persuade other people to use it. As the sharing of information between professions, and feedback from practice to theory, were also important needs to be answered, it was necessary to prove the system in use before it could be 'sold' as a workable proposition. It also had to be markedly and evidently better than any other systems already in use to make it worthwhile for people to make a change.

The various experimental systems developed by the writer have been tried out on most kinds of documents and information used in planning and design of health facilities. Most have facilitated filing and retrieval on a wide range of topics and types of material. Nevertheless no one approach has emerged as obviously superior to all others. The outlines of some of the more useful approaches are described below and further examples of each are included in appendix C.[6-8] Some comments follow on their relative merits and defects.

A classification system developed initially in the early 1960s for both the organisation and filing of documents <u>and</u> the recording of project information was based on alphabetical codes used mnemonically.

This Subject Filing Code (or SFC) system has been used continuously by the writer over a period of 15 years for filing books, reports, articles and drawings in a personal document collection, but which is also made available to students and other personal enquirers. The system uses two levels of subdivision represented by capital and lower case letters. Capital letters are consistent in meaning, whereas lower case letters are always related to a capital letter and imply a sub-category of the subject represented by the capital letter.

Codes using Arabic numbers 1 to 12 are used to represent levels of size or application, while Roman numbers I to X are used for phases of planning. These codes/concepts can be used either independently or to amplify an alphabetical subject code. The basic tables are set out in appendix C[6].

The SFC system has proved relatively flexible and hospitable in use, and the mnemonic basis of the codes has saved time in looking up codes for filing and retrieval. The relatively short codes for compound subjects also saves time and helps to ensure accuracy. The labels on documents show the word form of the subject description as well as the code, the former being found more useful for visually identifying the required folder.

A keyword indexing system was developed concurrently with the classification system described above for general application in indexing and document identification. This Subject Facet Descriptor (or SFD) system distinguished firstly between facets used to 'identify' documents or objects, and facets used to 'describe' the contents of documents or the nature of objects (see appendix C[7] for details).

The SFD system was used in the compilation of a general bibliography on health facility planning and design which was indexed on edge punched cards. Titles, authors, publication details and keywords were recorded on the cards, and the notches round the edge corresponded to the concepts represented in each document. The bibliography was arranged alphabetically by authors and a keyword index was compiled using topics as the point of entry, each document being identified by the name of the author followed by the date of publication, eg:

ward evaluation
    Canter 1977
    Noble & Dixon 1978

Each entry in the bibliography included the author's name(s), full document title, and place and date of publication. The master index cards also recorded the publisher, source of information and local libraries where held.

Another type of information system developed by the writer was for indexing photographic slides and which was based partly on the faceted systems described earlier. Initially an indexing system using 178 keywords was used whereby individual slides were given serial accession numbers which were punched into the keyword cards representing the various topics included in the slides. This method proved far too time consuming and was abandoned in favour of simple alphabetical abbreviation codes for subjects which were used to arrange groups of slides in alphabetical order of codes. Slides were then arranged in serial number order within each subject group. A master index indicated which slide numbers were to be found under which subjects; a reversed index identified the slide numbers filed under each subject. Slides covering two or more subjects were therefore indexed under their respective subjects and their location identified by underlining the relevant subject code where they were filed.

This system was essentially pragmatic and flexible if somewhat inconsistent, but it worked sufficiently well to be maintained in use over a ten year period and enabled a collection of well over 6000 slides used for lecturing to be filed and retrieved quickly. The coding system was subsequently superseded by subject headings arranged under broad categories as below (see appendix C[8] for details).

1. Hospitals - generally, by location and name
2. Information
3. Planning and design
4. Environment
5. Building and engineering
6. Equipment and furniture
7. Building types (excluding health facilities)
8. Health facilities
9. Wards and patient spaces

The evolution of the slide indexing system illustrates (in the writers' experience) the superiority of a method based on practical experiment and development rather than one which obeyed all the theoretical principles and rules, but which was wasteful in time and did not produce the results desired by the user. The latest version of the system was essentially experimental, but it reflected the nature of the actual subject matter rather than a hypothetical model.

DESIGN, EVALUATION AND INFORMATION FEEDBACK IN THE HEALTH FACILITY PLANNING PROCESS.

VOLUME 2

JRB GREEN

University of New South Wales

1982

This thesis is submitted in fulfilment of the
requirements for the degree of
Doctor of Philosophy

CASE STUDIES Chapters 9 to 11

The next three chapters report on some evaluation studies of health facility designs in use conducted by the writer between 1977 and 1980.

The studies represent three levels in the health facility hierarchy:- whole hospitals, hospital departments (wards), and therapeutic equipment (posture seating).

The aim in all three studies was to compare the effects of designs in use with the objectives of their planners and users. The findings were intended to provide a basis for further improvement in health facility design.

CHAPTER NINE

THREE HOSPITAL DESIGNS COMPARED - synopsis

Following a brief introduction, each of the three hospital designs is described in terms of building layout, methods of construction and ward design.

The survey methods used are then described together with details of the respondents and the means of selecting the sample for interview. The interview survey results are presented in terms of stated preferences, ratings for adequacy of specific design features, and features which respondents considered were the two most important in an ideal hospital.

Statistical comparisons are made between the hospitals in terms of capital and running costs, and numbers of staff in various categories. Floor areas of departments, and changes in the use of space in each hospital, are also compared.

Records of accidents to patients and staff are presented next, together with comments on any design features which would appear to affect accident rates. Building shape, extent of interior and exterior space, and lighting characteristics, are then examined in relation to respondents' comments and ratings on aspects such as view and daylighting.

Many respondents reported difficulties in finding the way in all three hospitals. This aspect is therefore investigated in some detail with recommendations on means of reducing the problem.

Finally the lessons learned from the evaluation survey are reviewed in terms of their value as inputs to hospital briefing and design.

9.1 INTRODUCTION

During a twelve month special studies program from June 1978 to May 1979, the writer made a comparative 'design-in-use' evaluation survey of three large new hospitals, one in Britain and two in Australia. The purpose of the study was firstly to find out how the design of new hospital buildings appeared to affect their users, their functions and their costs.

Each of the three hospital designs surveyed represented different approaches to meeting similar objectives such as economy, adaptability, reliability and comfort. The design-in-use evaluation sought to compare how adequately each design had succeeded in meeting these 'general' objectives as well as satisfying the specific requirements of each project.

The second main purpose of the study was to develop simple methods of evaluating complex buildings based on opinion surveys of users, and on measurements of design and operational characteristics. The survey was therefore regarded more as a pilot study to explore the possibilities of whole hospital comparative evaluations than to obtain feedback on specific design aspects. Some aspects of design were however investigated in more detail, for example lighting, finding the way, adaptability and safety.

A third purpose of the study related particularly to the hospital in Britain which was an innovatory design when it was planned in the mid 1960s. The evaluation study was intended as a follow-up of the design in use nearly ten years after the first phase of building was completed.

9.2 DESCRIPTION OF THE THREE HOSPITAL DESIGNS

Each of the three hospital designs which formed the subject of the comparative study adopted different approaches to 'deep planning'. All were airconditioned buildings with a relatively high proportion of their rooms being 'internal', ie with no windows for view, ventilation or daylight. This approach to hospital design has been criticised as inhuman by many people, particularly in Britain and in Australia, yet in the USA it is regarded as relatively 'normal'. The effects of internal environment on hospital users was therefore an important aspect of the study.

Hospital A was a low compact rectangular shape on four floors; hospital B was a ten floor tower on a two storey podium; while hospital C was fairly compact but varied in height from two to seven floors and was situated on the side of a hill.

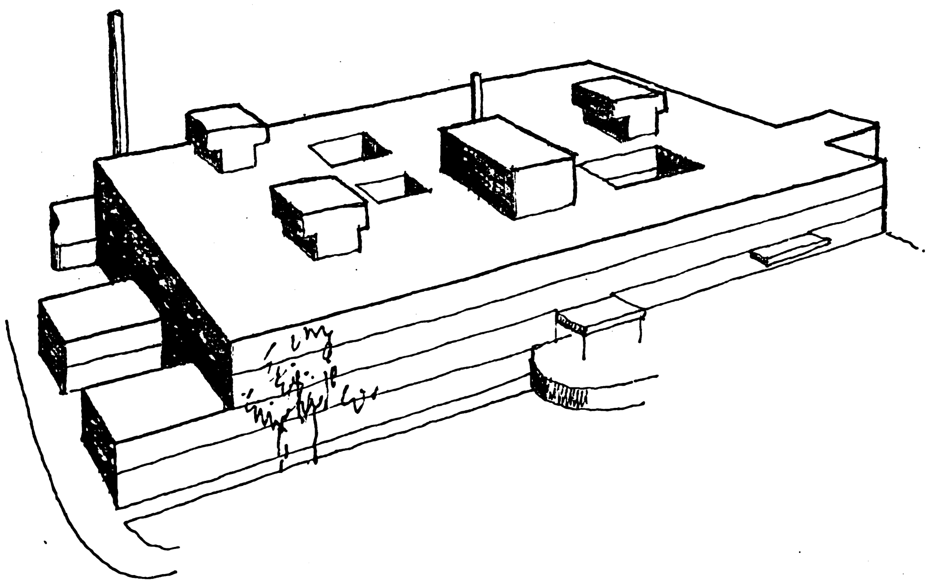


Fig.9.1 Hospital A, general view

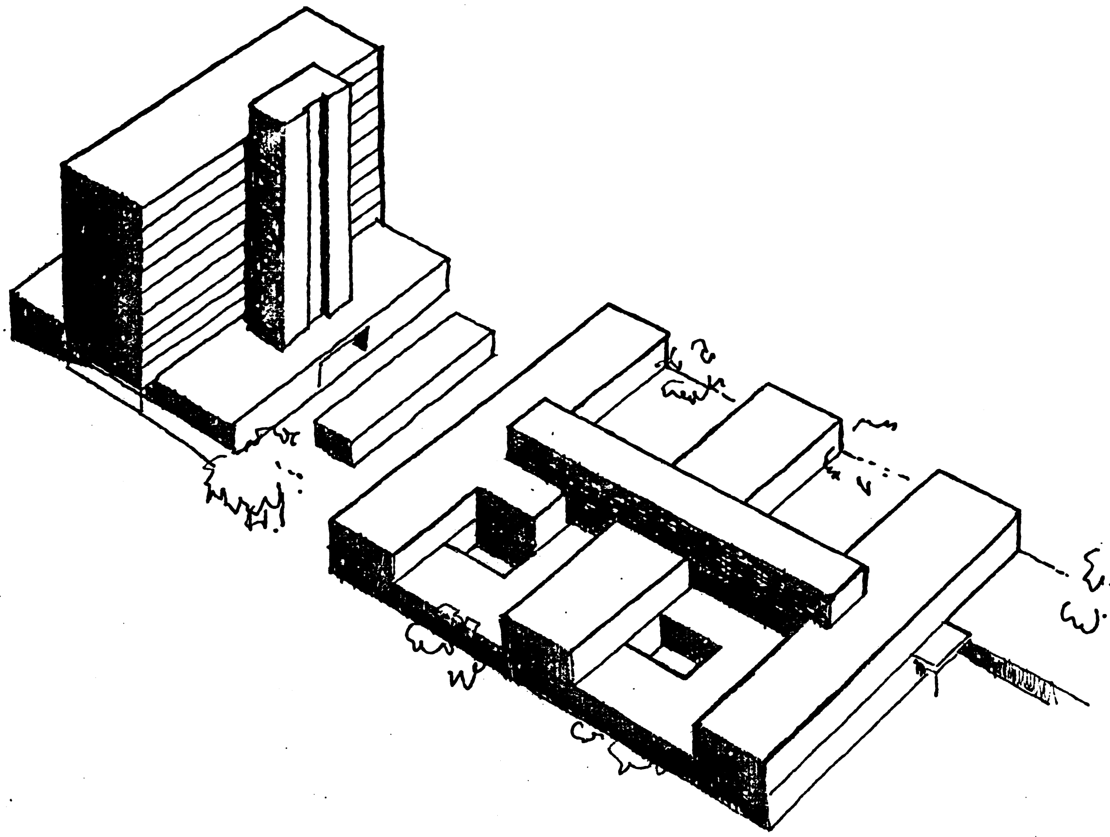


Fig.9.2 Hospital B, general view

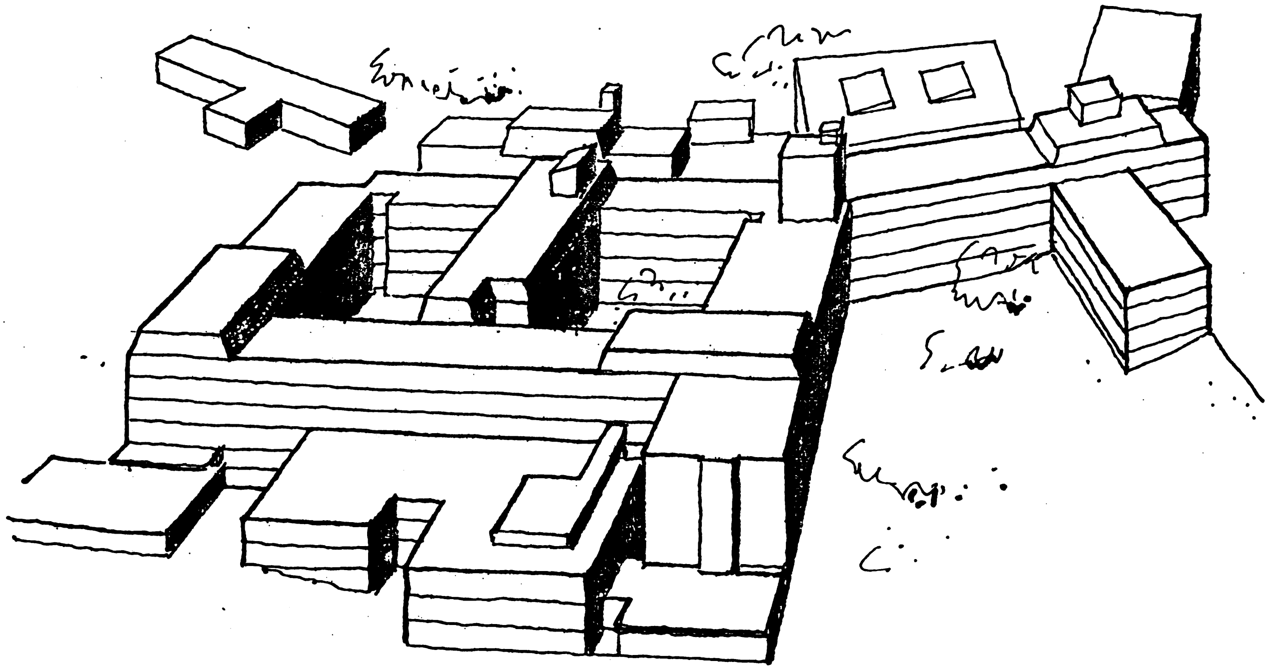


Fig.9.3 Hospital C, general view

Each of the three building designs approached ward layout, traffic circulation, and provision for growth and change in different ways.

Hospital A had 300 beds on two main floors in 33 bed ward units. Wards were arranged outside the main hospital street which enclosed other departments in the central area of each floor.

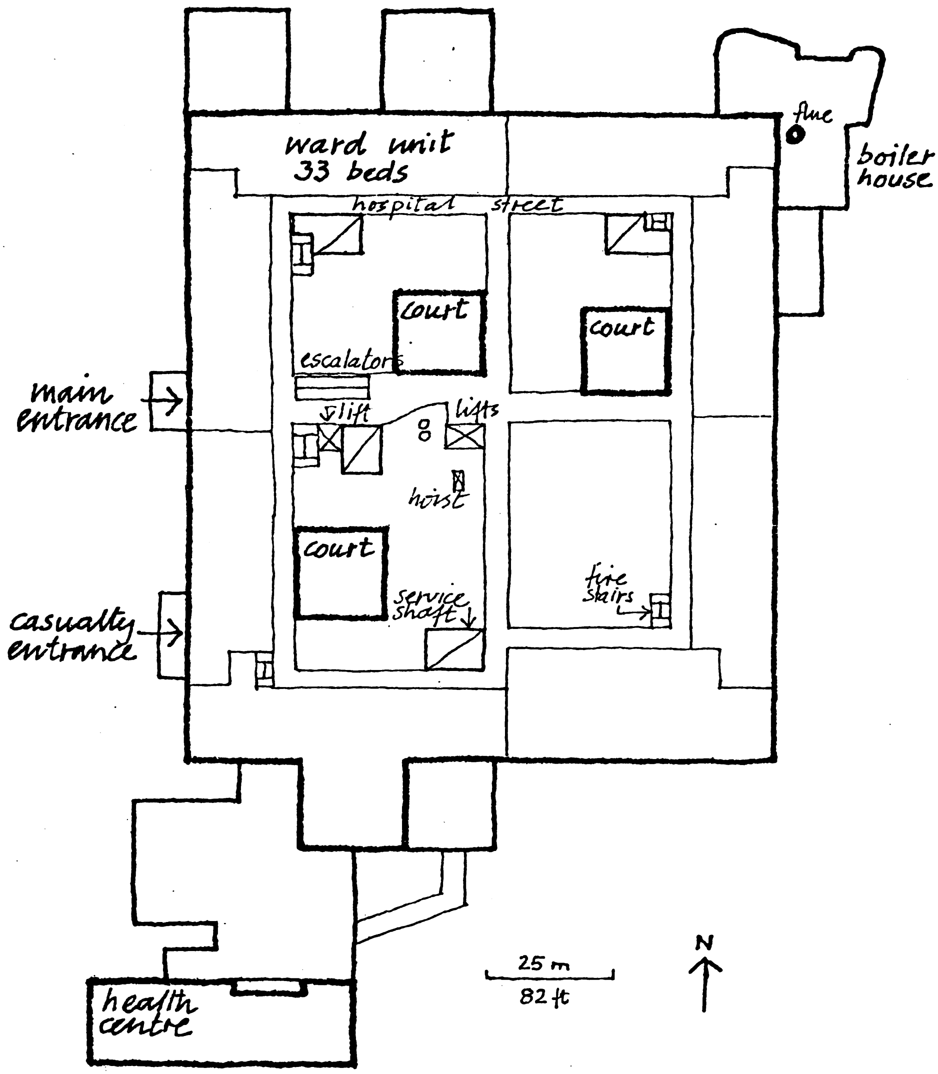


Fig.9.4 Hospital A, general layout

Traffic circulation in hospital A was mainly horizontal, each of the four floors being served by three passenger/bed lifts, an escalator, a good hoist and two refuse chutes.

Each standard ward unit in hospital A had six five bed rooms (or alternatively five six bed rooms and a large day room) and three single rooms with ensuite toilets. Toilets for multi-bed rooms were across the corridor. Each ward unit could expand or contract by adding or subtracting rooms at each end.

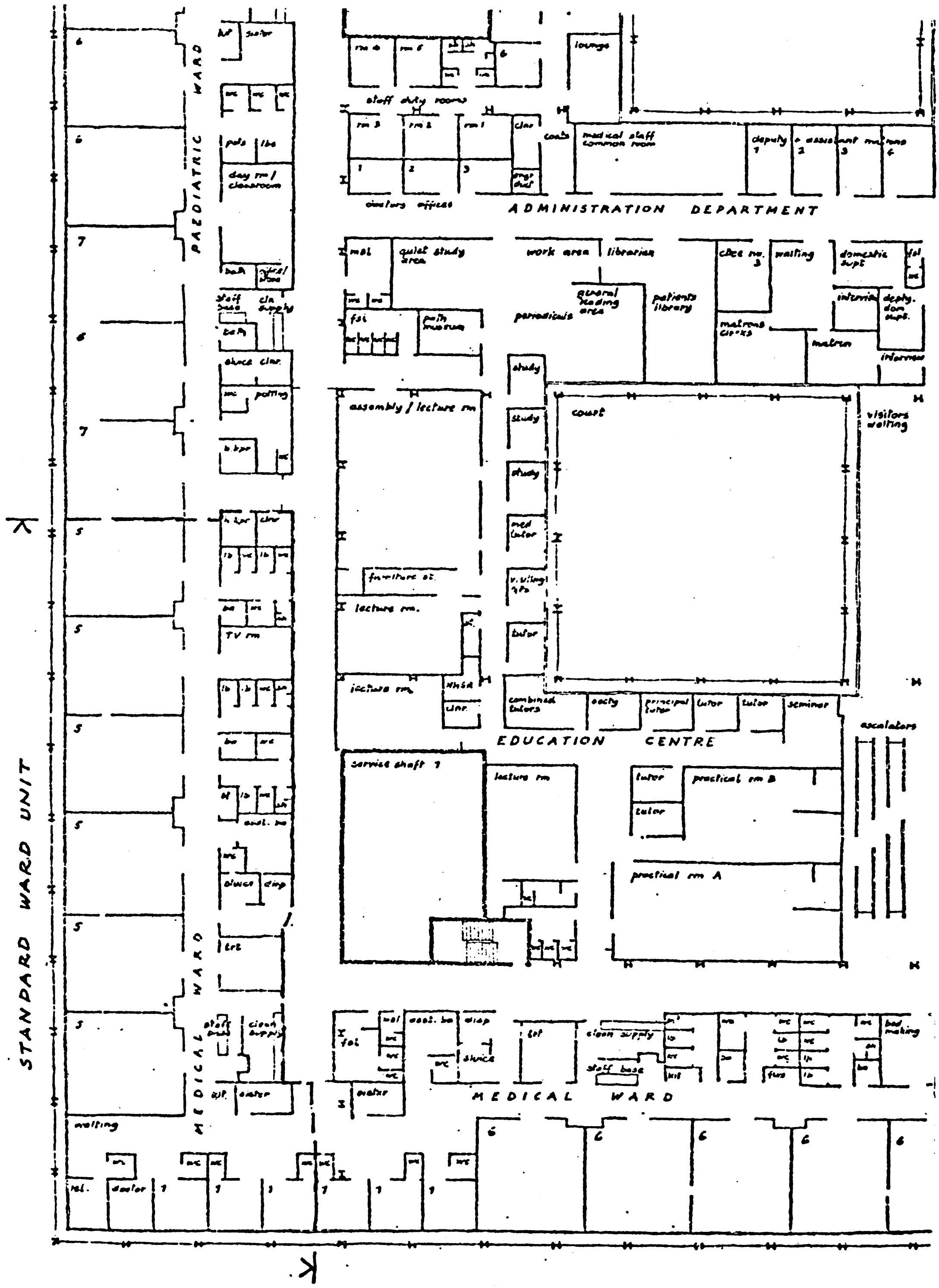


Fig.9.5 Hospital A, second floor layout (part)

Growth was provided for at hospital A by allowing for an additional floor to be added onto the existing four floors, and by horizontal extension of one 64 ft (19.5m) bay along two of its four sides.

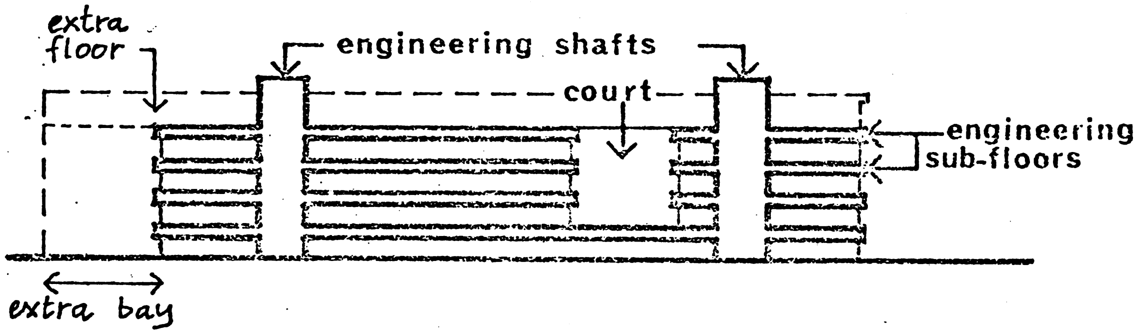


Fig.9.6 Hospital A, cross section

Adaptability was catered for in hospital A by long span beams which provided large unobstructed floor areas, all engineering services being distributed through four large vertical shafts linking deep service sub-floors between the main floor levels.

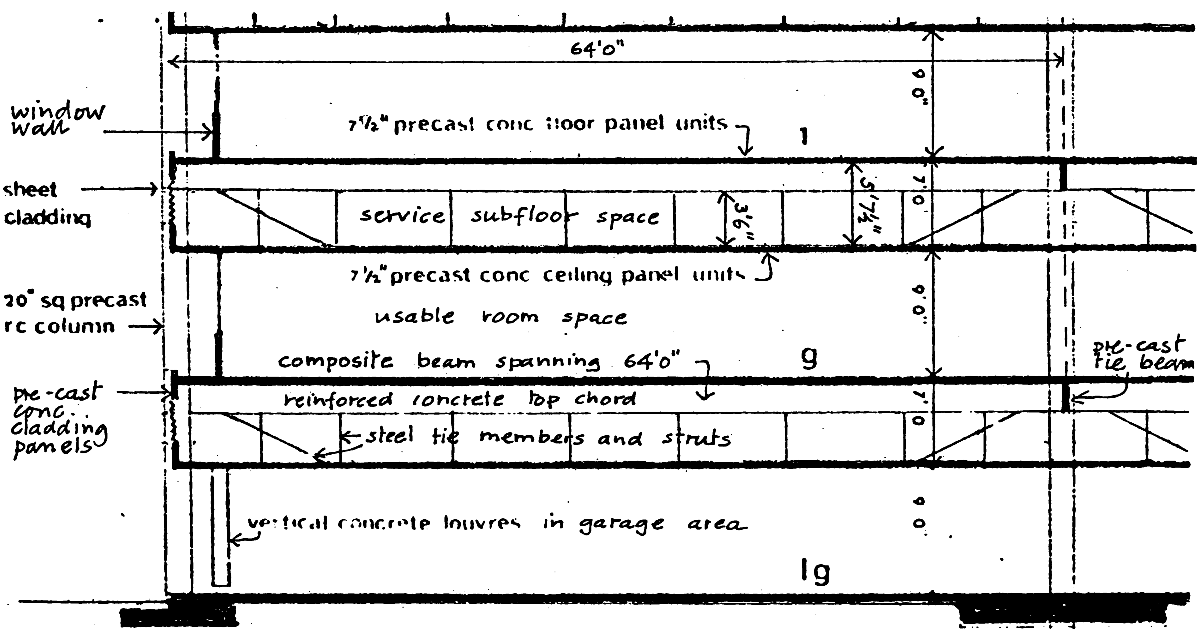


Fig.9.7 Hospital A, constructional details

The main ward block of hospital B had double corridor wards with 72 beds on each of the main ward floors arranged in four units of 18 beds. There were also single corridor ward units in the low block, each of which contained 34 beds.

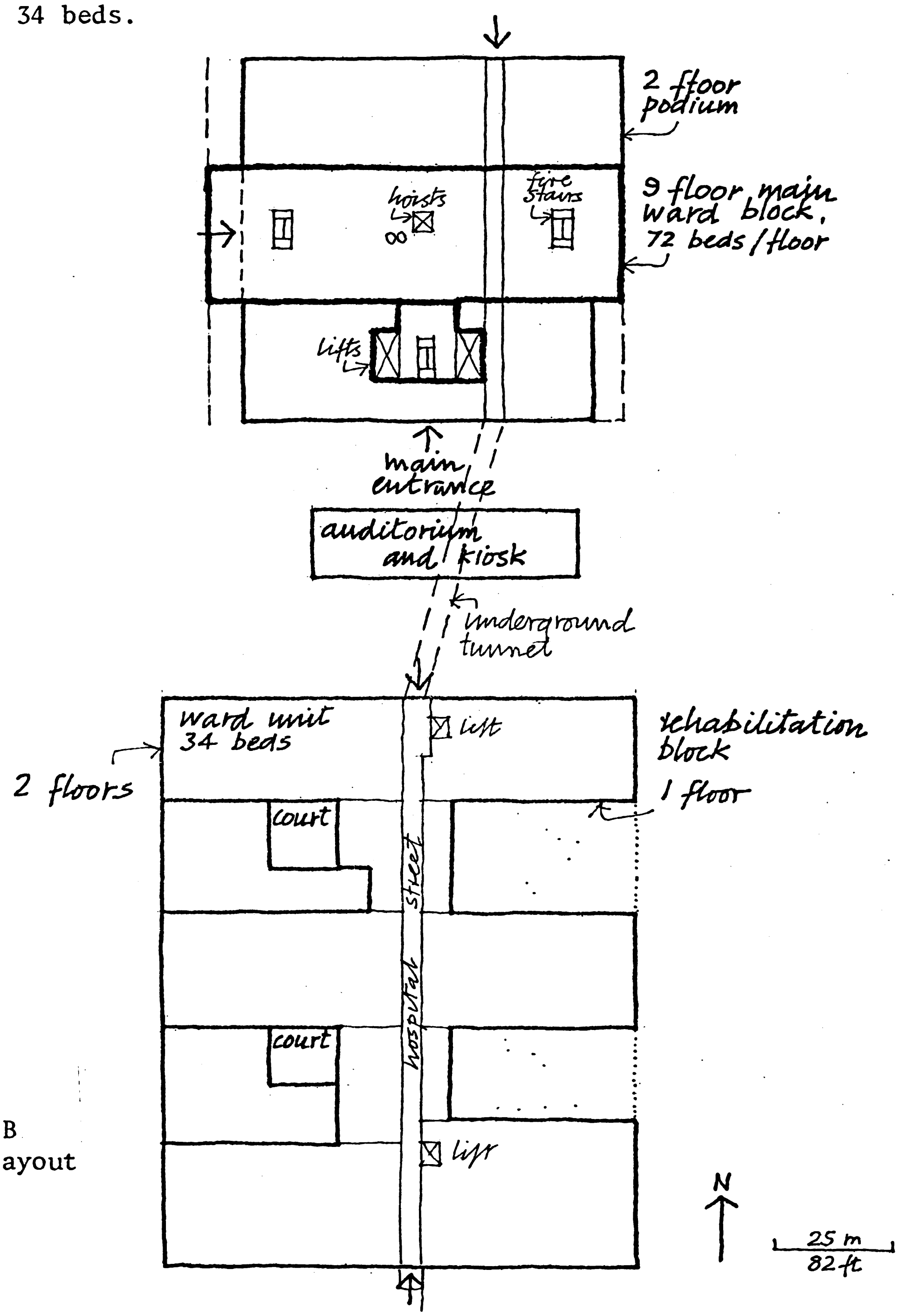


Fig.9.8
Hospital B
general layout

At hospital B the 11 storey tower block was served by six passenger/bed lifts, two goods hoists, a dumb-waiter, two chutes and a pneumatic tube system. The two storey block alongside the main ward block had two general purpose lifts, one at each end of the 'E' shaped building.

Each general ward floor in the main block of hospital B had four standard eighteen bed ward units, each of which contained two single bed rooms, four two bed rooms and two four bed rooms, all with ensuite toilets.

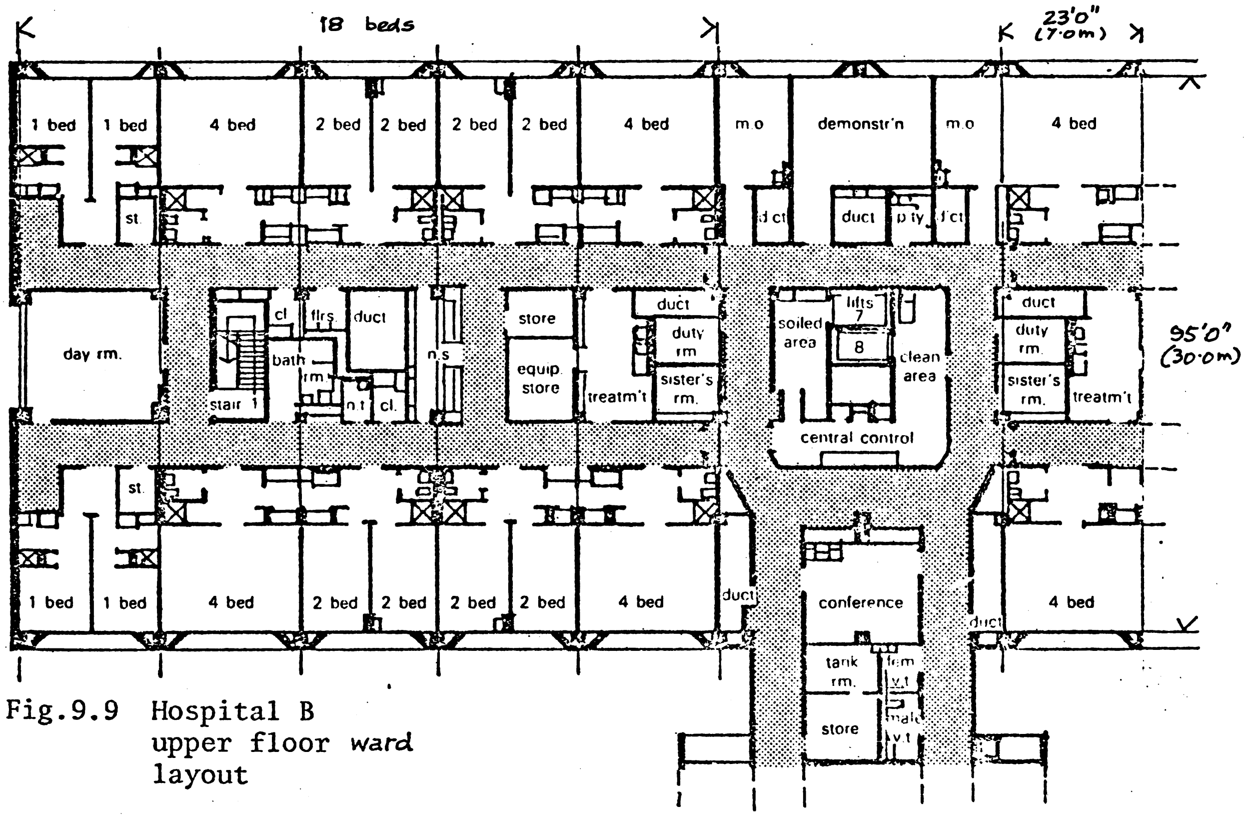


Fig.9.9 Hospital B upper floor ward layout

Each standard ward unit in the low block of hospital B had 34 beds in five six bed rooms and four single rooms all with ensuite toilets.

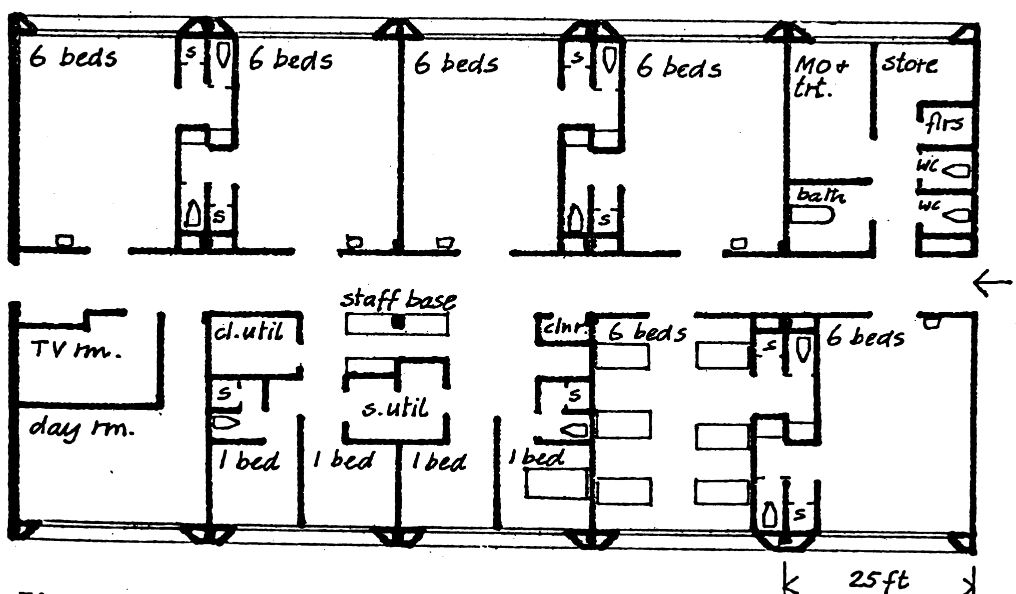


Fig 9.10 Hospital B, ground floor wards

In hospital B growth was originally provided for by leaving space for three additional tower blocks, one for laboratories, one for medical school facilities, and one for additional ward accommodation. In the event only the laboratory block (under construction at the time of the survey) is likely to be built in the foreseeable future.

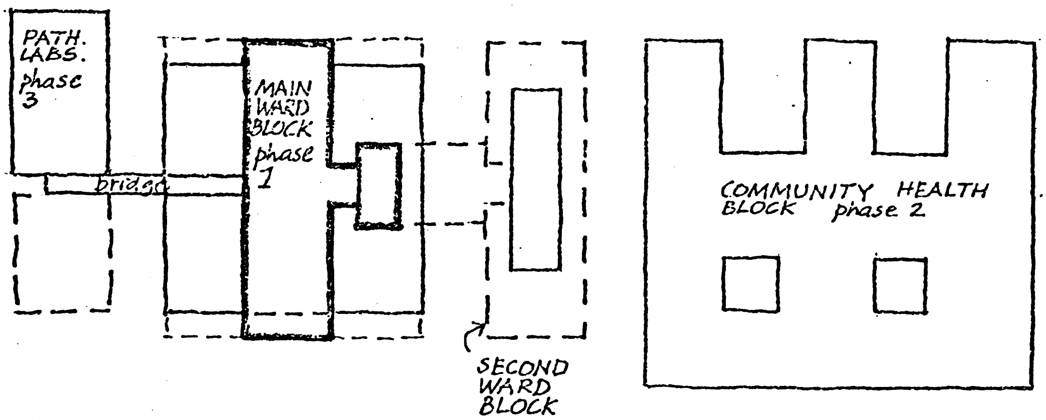


Fig.9.11 Hospital B, phasing

Change was provided for by a regular structural grid approximately 23 ft square, engineering services being distributed through numerous vertical shafts and ducts and above false ceilings.

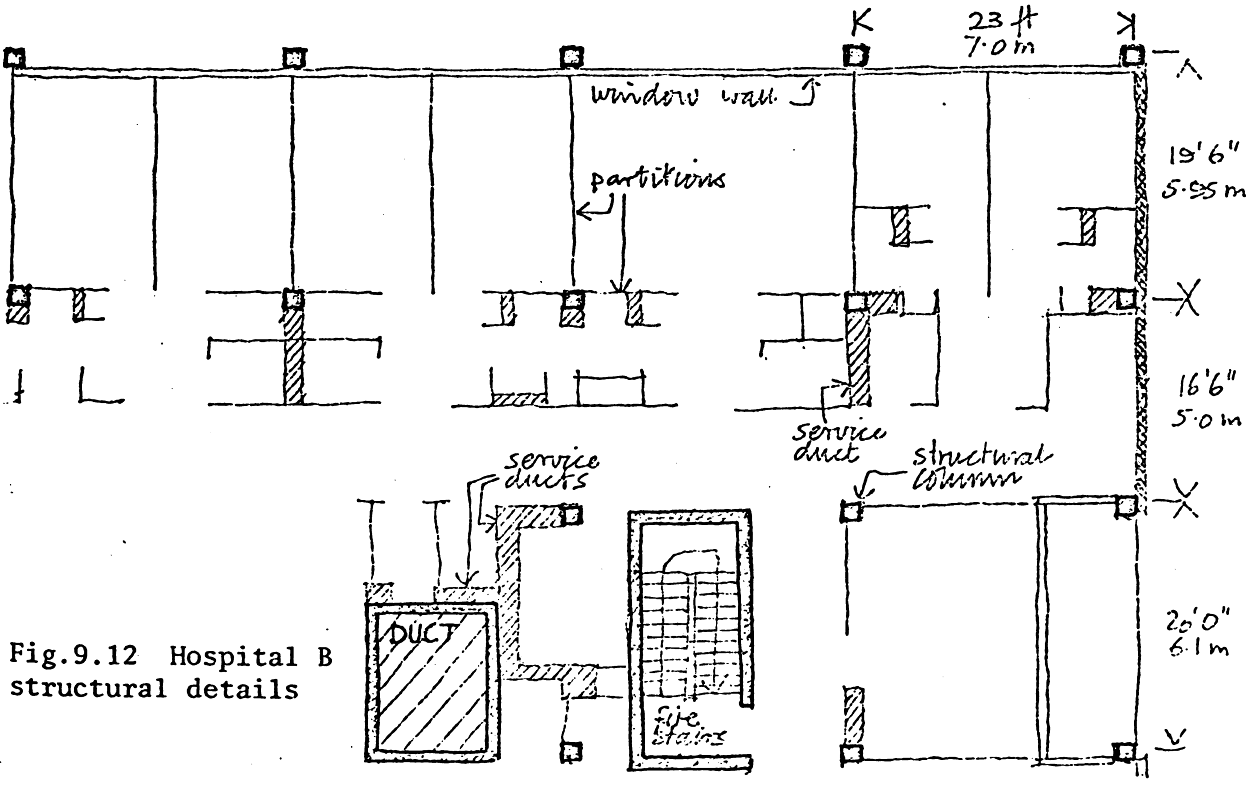


Fig.9.12 Hospital B structural details

In hospital C the wards were in a double corridor layout, each standard acute unit containing 28 beds. Three 28 bed acute ward units and a 16 bed high dependency unit made up a standard 'T' shape ward floor unit of 100 beds.

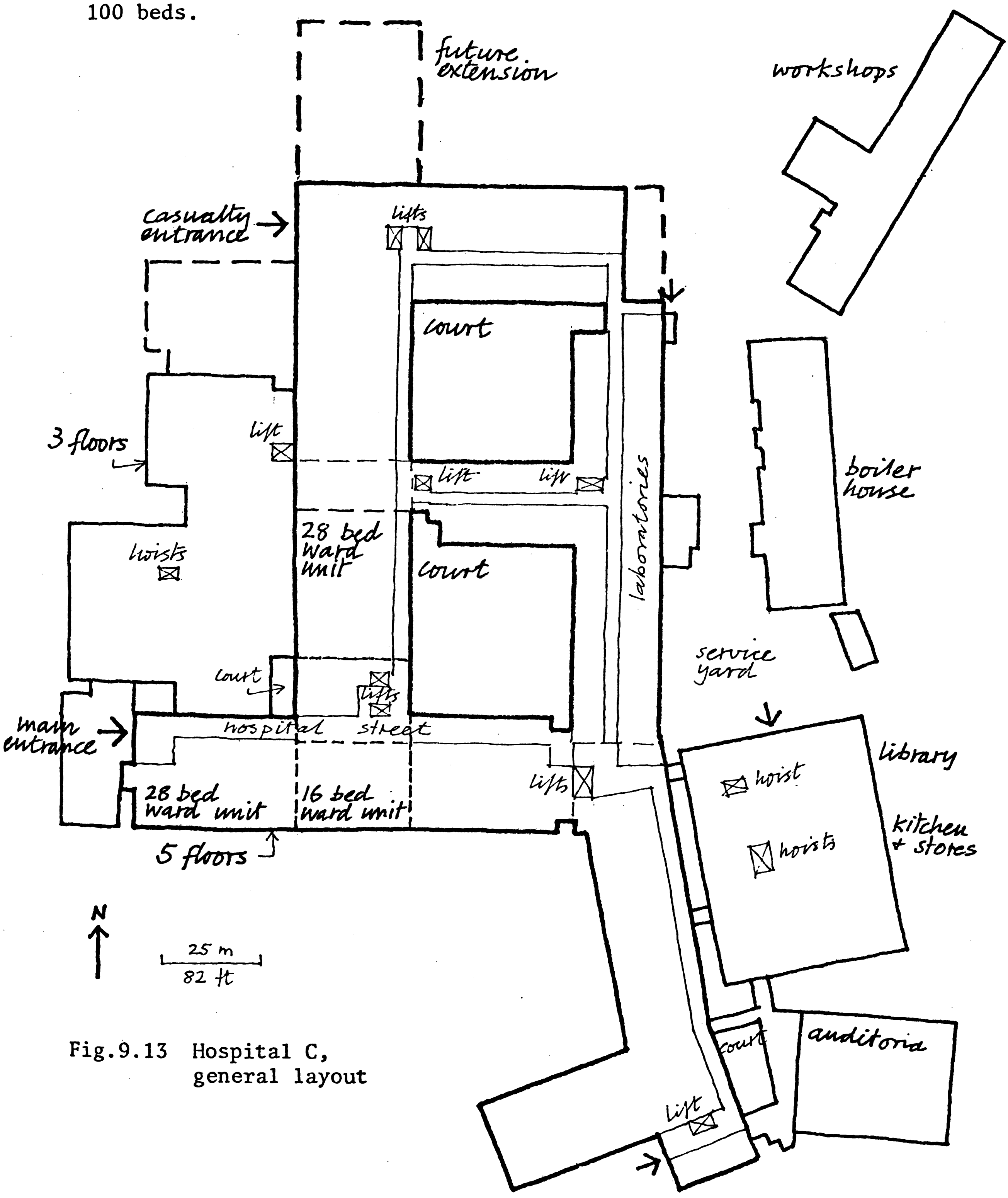


Fig.9.13 Hospital C, general layout

Hospital C had 17 lifts serving seven levels of accommodation although most traffic circulation was horizontal.

Each standard ward unit in hospital C had 28 beds in five four bed rooms and eight single rooms, all with ensuite toilets. The 16 bed high dependency ward had three four bed rooms and four single rooms. A shared area in the centre of the 'T' shaped ward floor linked the four units.

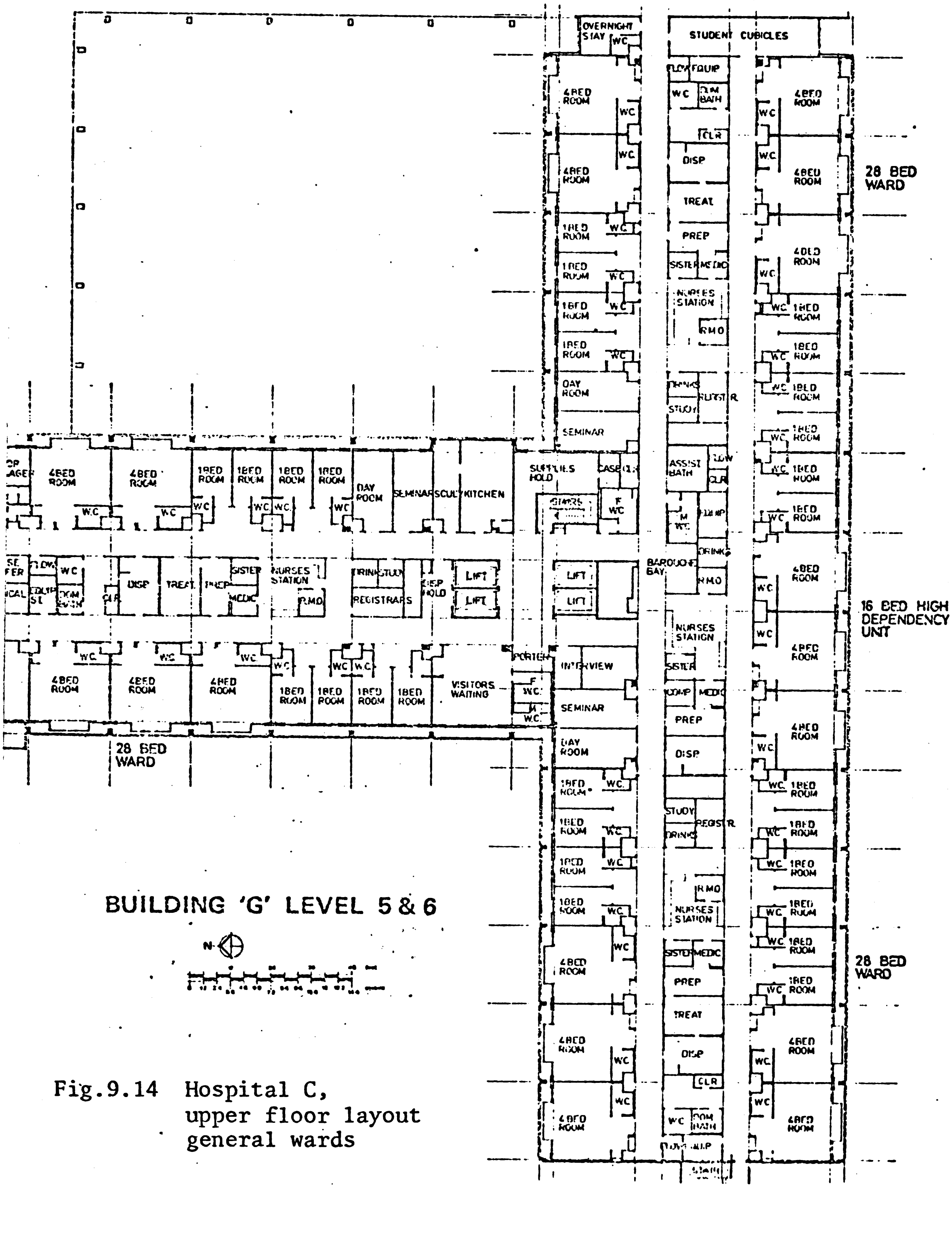


Fig.9.14 Hospital C, upper floor layout general wards

Hospital C was planned for phased horizontal extension following a predetermined grid-iron pattern.

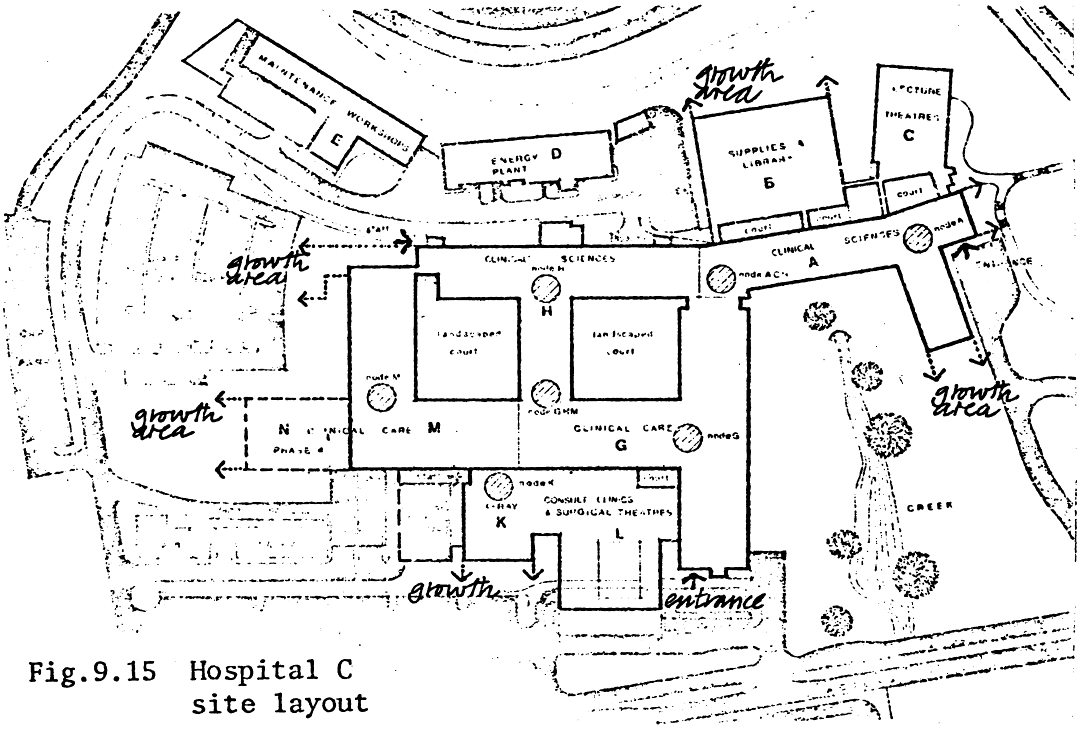


Fig.9.15 Hospital C site layout

Internal change was provided for by regular spacing of columns and service ducts in the various kinds of building, each of which housed a limited variety of department types.

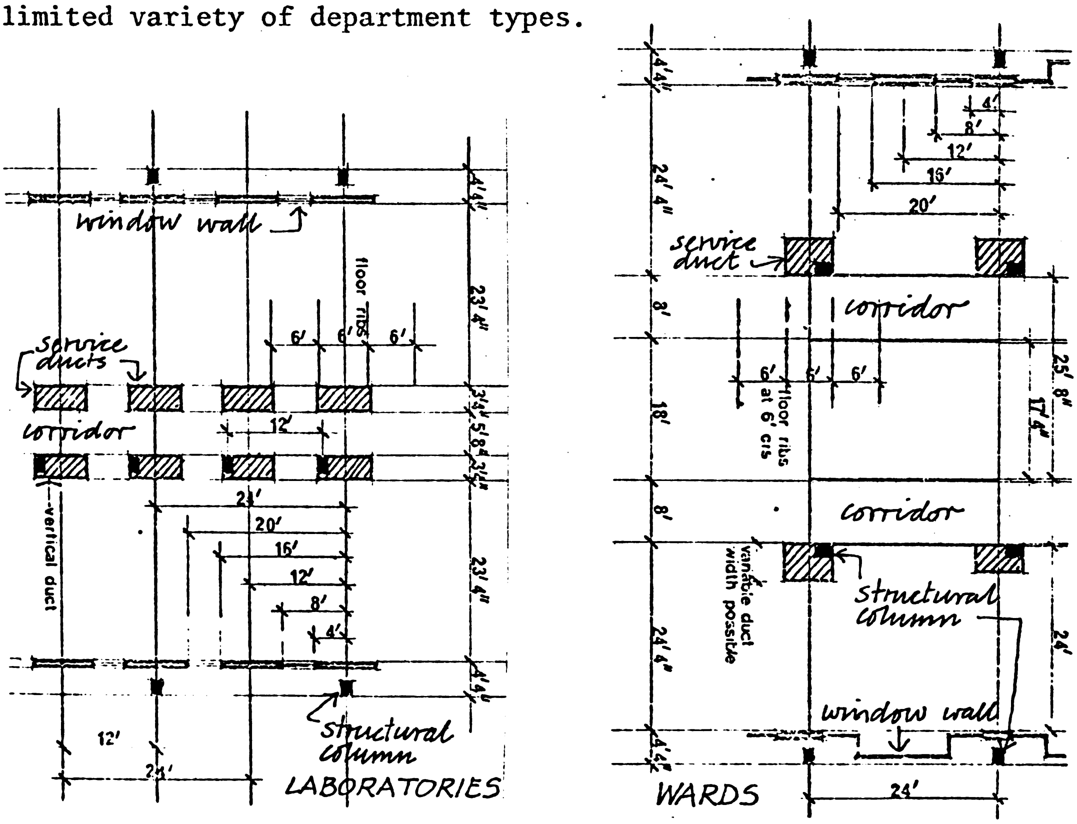


Fig.9.16 Hospital C, structural layout

The original idea for the shape of hospital A grew out of discussions between a number of hospital architects, engineers and administrators who had experience of designing or using various types of hospital buildings. The shape of hospital B represented a 'deterministic' approach to hospital planning which was both more restrictive in functional terms, and more monumental in visual terms than either of hospitals A or C. While hospital A represented the 'universal space' approach to provision for change, hospital C represented the 'multi-strategy' approach which, although more restrictive functionally, was less complex in terms of structural design and methods of engineering services distribution.

The three hospitals therefore differed from each other in a variety of ways which may have affected both objective and subjective measures of value. The main design features of each hospital are summarised below.

Table 9.1 Main design features

Feature	Hospital A	Hospital B	Hospital C
Completion date	1969-74	1972-73	1975-78
age when surveyed	4 to 9 yrs.	6 to 7 yrs.	1 to 4 yrs.
Building shape:	monoblock	tower & podium	double courtyard
height	medium	high & low	low & medium
compactness	very compact	extended	medium
cohesiveness	very cohesive	fragmented	medium
Overall floor area,000m^2	62	52	102*
Beds provided (approx)	760	630	500
Area/bed m^2 (overall)	82	83	204
Area/bed m^2 (in wards)	24	33	31.5

* included 12.5 allocated to teaching & research

All three hospitals contained a full range of clinical and supporting services, although hospital C contained additional teaching and research facilities making direct cost comparisons invalid.

Site conditions and methods of construction differed in all three examples: hospital A being built in four consecutive phases on a congested urban site; hospital B being built in two roughly concurrent phases on a large flat open site; and hospital C being built in five or six overlapping phases on a large but steeply sloping site with difficult ground conditions.

All three hospitals were fully airconditioned in the main clinical areas, although hospital B contained some naturally ventilated ward accommodation. Climatic conditions varied considerably between the localities of all three hospitals, although all hospitals required both heating and cooling at different seasons.

The standard of finishes and materials used in construction was generally better in the two Australian hospitals than in the British hospital which had been designed to provide a high degree of spatial flexibility lacking in hospital B, and only partially present in hospital C.

The form of construction of hospital A was designed to provide for easy accessibility for installation and maintenance of engineering services which added to the cost of the long-span pre-cast concrete and steel frame structure. Hospitals B and C were built in in-situ reinforced concrete with relatively short spans and conventional beam and slab floors. This had the effect of reducing structural costs compared with Hospital A, but added to the difficulty of engineering maintenance and installation.

9.3 SURVEY METHODS AND RESPONDENTS

The specific purposes of the design-in-use survey were:

1. to see how the original design objectives had been realised in practice,
2. to develop methods of comparing hospital designs in use,
3. to study the extent of changes in the use of space in the buildings since construction,
4. to determine how the buildings compared, in the opinions of their users, with two other hospitals of radically different design,
5. to study the general effects of building environment upon users,
6. to explore effects of ward design on feelings about supervision and privacy in nursing care.

Four approaches were used in the survey:

1. checking current uses of each room in comparison with 'as built' floor layout drawings,
2. unstructured interviews with hospital staff,
3. reference to publications, statistics and reports on design, use and costs of the hospitals,
4. structured interviews with patients, staff and visitors regarding their opinions of the hospital design.

The interview survey method was developed from two other previous evaluation studies of hospital ward design by Sears & Auld (1976), and by Noble & Dixon (1977) (see chapter 6).

In each of the three hospitals approximately eighty users were interviewed using a standard questionnaire (see appendix E^6). Details of respondents' environment were noted together with personal particulars such as their age, occupation, sex, previous hospital experience, educational background, and 'interests'. Each respondent was asked to nominate any design features they particularly liked or disliked in the hospital at each of four levels: the hospital generally, their department, their room, and 'equipment'. General comments on hospital design were also invited and in some instances were given in considerable detail.

'League tables' were compiled of the most frequently cited 'likes' and dislikes' in each hospital at each level, both for selected groups of respondents (such as female staff), and for special departments and types of rooms, such as 'wards' or 'bedrooms'.

The second part of the questionnaire asked respondents to give adequacy ratings at one or more levels for up to 22 listed design features. A rating of 4 was given for 'very adequate', 3 for 'adequate', 1 for 'inadequate' and 0 for 'very inadequate'. To simplify analysis a median score of 2 was given for 'don't knows'. In calculating percentages an equal number of 'adequates' and 'inadequates' would thus score 44 out of 88, or 50%, which represents 'just adequate'.

The range of features finally selected for adequacy rating in the survey was reduced from a short list of about 30 'possibles' which could apply selectively to the hospital exterior, the hospital interior, a department, a room or workspace, and a selected item of equipment. In the event, after initial trials, only the three middle 'levels' were used. In all up to 81 items could be answered for the value rated questions, but with the reduced number of levels this was brought down to 65; 22 for 'hospital generally' and for 'respondent's department', and 21 for 'room/workspace'.

In deciding the range of features for user evaluation, the aim was to select words which described characteristics which would have similar meanings to all respondents. The words also had to span a comprehensive range of design features in the three different hospital environments at each of the five levels originally intended for evaluation. The features were grouped to give a continuous sequence for each level in turn, but otherwise they were arranged in alphabetical order (see sample questionnaire at appendix E[6]). In selecting the final list of 22 topics a comparison was made between the user evaluation questionnaires developed by Ronco (1971), Sears & Auld (1976) and Noble & Dixon (1977). The evaluation topics used by these three authors and by the writer are compared in appendix E[5].

A last request to each respondent was to nominate two out of the 22 listed features as being 'most important' in an ideal hospital at each level which had been rated for adequacy.

Due to the limited amount of time and resources available for conducting the writer's surveys, for analysing results, and for writing up the findings, the decision was made to limit the survey questionnaire to two sides of an A4 sheet, and to aim at 20 minutes for its completion by respondents or interviewer. Simplicity and clarity were essential in case questionnaires were to be completed by respondents, but they also had to be suitable for filling in quickly and accurately by the interviewer while conducting the interviews. In the event virtually all responses were collected by interview, about 90% by the writer, the remaining 10% by an experienced assistant interviewer. The time required for each interview ranged from 15 to 45 minutes.

In analysing the results comparisons were made between rank orders of 'adequacy' ratings given for all features for each hospital at all three levels, and the corresponding rank orders for 'importance'. Features rated high in importance but low in adequacy were thus identified as being particularly in need of improvement. Features placed high in order of adequacy and high in importance could be regarded as good examples to follow. It was not considered feasible to 'weight' adequacy ratings according to importance without a more precise means of measuring respondents' attitudes.

Initially it was proposed to select about 100 respondents in each hospital to give a proportional representation of the different types of staff and patients 'in residence'. The aim was also to select a random sample so as to avoid undue bias due to respondents' occupation, age group, or level of education.

In the event it was not possible to take a random sample of patients using names or location as the basis for selection, firstly because patients could not 'officially' be identified by name (for reason of confidentiality), and secondly because many patients were unable to respond due to illness, language difficulty or ward routines. Inpatients were therefore mainly nominated by the ward sisters, or were invited to respond by the interviewer in those areas where the ward sisters allowed this approach. Outpatients and visitors were selected as opportunities arose in clinic, ward and canteen areas, and to make up a quota of appropriate respondent categories.

Staff were selected to give a representative cross section by seniority level, occupation, type of department where employed, and age group. Consideration was given to random sampling by selection from a list of names, but this was ruled out due to problems of ensuring staff availability at suitable times for interview, and so as not to interrupt their work routines. Staff were instead selected by nomination by the department head or deputy, who in many cases was also interviewed.

In the event the distribution of respondents gave a reasonably adequate cross section of occupational and age categories as shown in tables 9.2 to 9.4.

Table 9.2 Numbers of staff, beds & respondents in each hospital

Category		Hospital A	Hospital B	Hospital C
Full time staff (equivalent)		2124	1150	1885*
Beds in use at time of survey (approx)		700	370	370
Respondents:	all	80	89	82
	staff	50	57	60
	patients/visitors	30	32	22
Ratio $\frac{\text{patients}}{\text{staff}}$		0.60	0.56	0.35
Ratio $\frac{\text{beds}}{\text{staff}}$		0.32	0.32	0.20

* excluding students and teaching staff.

Table 9.3 Occupational distribution of respondents as percentage of number of full time staff in each hospital

Occupational category	Hospital A %	Hospital B %	Hospital C %
Administrative	4.0	5.0	4.3
Medical	3.5	10.0	2.5
Nursing	2.0	3.8	2.6
Technical	6.8	6.2	6.9
Other	1.3	4.6	1.8
All staff categories	2.4	5.0	3.2
Patients & visitors	1.4	2.8	1.2
All respondent categories	3.8	7.7	4.4

Table 9.4 Percentage of respondents by age group

Age group	Hospital A	Hospital B	Hospital C
	%	%	%
under 20	0	6.7	3.7
20 - 39	48.8	48.3	64.6
40 - 59	41.3	33.7	25.6
60+	10.0	11.2	6.1

9.4 INTERVIEW SURVEY RESULTS

Likes and dislikes

Almost all respondents mentioned at least one or two things they particularly liked or disliked in the hospitals generally, or in their own room or department. The following tables show the number of likes and dislikes mentioned ten times or more in at least one of the three hospitals. The features are arranged in descending order of frequency of 'times mentioned' in any one of the hospitals (highest value underlined):

Table 9.5 Features liked most

	Hospital		
	A	B	C
liked generally	9	21	10
ensuite toilets in wards	2	20	16
6 bed rooms (cf open wards)	20	NA*	NA
4 bed rooms	NA	18	18
colours, decor, brightness	6	5	17
courtyards	3	NA	16
spaciousness, open	15	13	8
new, modern	13	11	6
relationship between departments	13	6	7
carpets	5	NA	13
gardens, trees, grass, surroundings	2	2	13
ward layout	5	12	9
entrance foyer	12	-	3
view from bedrooms	8	9	11
cleanliness, clean looking	10	5	5
hi/lo beds	10	5	3
equipment generally	10	3	3
single bedrooms	2	4	10

*Most wards in hospital B had mainly four or two bed rooms. There were also some six bedded rooms in wards for longer stay patients.

Table 9.6 Features liked least

Features	Hospital A	Hospital B	Hospital C
finding the way	10	13	34
excessive walking between departments	13	22	34
cramped department	6	8	26
airconditioning hot/cold/variable	21	19	22
noise in wards	2	22	8
parking arrangements	4	13	21
cramped workspace, lack of space	12	20	13
no outside access from wards/depts	1	19	2
noise generally	5	17	11
poor supervision in wards	7	16	10
bed head lighting in wards	-	16	11
lack of view from internal rooms	15	15	13
airconditioning smells/stuffy	12	7	15
wasted space	15	5	7
drab, lacked colour, boring	14	13	5
small bedrooms (prefer open ward)	13	12	3
departments too accessible to public	-	8	13
lift size/waiting time	4	13	3
stains on carpets	-	NA	13
poor department location	7	12	11
lighting too glaring	12	-	3
can't open windows	11	11	9
equipment inconvenient/unsuitable	10	11	6
poor department layout	5	10	11
single bed rooms remote from n.stn.	-	10	-
obstruction to view (pathology block)	NA	10	NA

The analysis of respondents' likes and dislikes was somewhat tedious owing to the variable wording used by respondents to express their views on particular features. The degree of understanding it gave of users' views on hospital environments nevertheless made this task well worthwhile. The highlighting of well-liked features such as en-suite toilets in wards in hospitals B and C, and the attention to colour design in hospital C, tallied well with design differences between the three hospitals concerned.

Even more revealing were frequently mentioned 'dislikes', such as 'finding the way' in hospital C, which were corroborated by adequacy ratings given for the 22 listed features in the second part of the interview (see below). A few features such as finding the way, artificial lighting and noise, which rated poorly in both the 'dislikes' section of the questionnaire and in the adequacy ratings, were analysed further for reasons for dislike. Staff and patients' responses were also differentiated.

Examples of analyses of reasons for likes and dislikes regarding lighting and noise in hospital C are tabulated below. Ideally a larger number of responses would be needed to indicate clearly the nature and degree of the problem, but the identification of 'glare' as a problem by six staff, and of 'disturbance at night' by five patients, suggests that there is a need to investigate these aspects in more detail (see section 8 of this chapter).

Table 9.7 Reasons for likes and dislikes in Hospital C

Lighting (Hospital C)

	Reasons given	staff	patients	all respondents
dislike:	glare	6	2	8
	disturbance at night	2	5	7
	inaccessible controls	2	4	6
	not adjustable	0	4	4
	affects eyes	4	0	4
	unspecified	4	0	4
	poor in workspace	3	0	3
	too even	0	1	1
	too bright at night	1	0	1
like:	generally	3	1	4
	artificial light in workspace	3	0	3
	daylight in workspace	2	0	2
	daylight in dept. generally	2	0	2
	in wards generally	1	0	1
	in bed room generally	0	1	1

Noise (Hospital C)

	Reasons given	staff	patients	all respondents
dislike:	noise in dept. generally	9	2	11
	wards noisy at night	5	3	8
	noise in workspace	7	0	7
	noisy equipment	5	1	6
	noise of other patients in bed rooms	0	3	3
	noise disturbance generally	1	2	3
	airconditioning noise	2	1	3
	noise from ward kitchens	1	0	1
	'musac'	0	1	1
like:	quietness in hospital generally	5	1	6
	in wards generally	2	2	4
	in workspace	3	0	3
	'musac'	2	0	2

Adequacy ratings

The following table gives the overall rank order of respondents' adequacy ratings for all 22 features for 'interior in all three hospitals compared with the rank orders in each hospital.

Table 9.8 Rank orders of adequacy of hospital 'interior'

Feature	all three	Hospital A (N=37)	Hospital B (N=39)	Hospital C (N=53)
cleanliness	1	6	1	1
spaciousness	2	1	3	5
tidiness	3	2	2	2
safety	4	5	4	10
sociability	5	11	8	6
quietness	6	3	16	4
view	7	7	5	16
surface finishes	8	14	9	7=
reliability	9	16	6	14
privacy	10	13	13	9
adaptability	11	4	18	13
artificial lighting	12	15	7	15
stimulation	13	12	15	7=
convenience	14	8	11	17
daylight	15	17	10	11=
colour	16	18	21	3
supervision	17	9	12	18
homeliness	18	19	19	11=
finding the way	19	10	17	20
ventilation	20	20	14	19
temperature	21	21	20	21
security	22	22	22	22

*rank order determined from percentage mean scores for all three hospitals

N = no. of respondents in each hospital voting for 'interior'

The rank order of adequacy of design features highlights those features which were considered markedly better or worse than the norm. It says little however about opinions on degree of adequacy. The percentage adequacy ratings from which the rank orders were derived are therefore shown below for all 22 listed design features in the three hospital interiors (highest and lowest rated features underlined).

Table 9.9 Percentage adequacy ratings for 'hospital interior'

Features (in listed order on questionnaire)	Hospital A	Hospital B	Hospital C
a finding the way	63	57	42
b stimulation	61	57	76
c cleanliness	70	86	86
d colour	51	53	82
e homeliness	49	55	72
f tidiness	72	80	82
g adaptability	70	56	72
h convenience	64	66	66
i quietness	70	57	78
j reliability	57	70	72
k safety	70	74	75
l security	36	52	40
m artificial light	57	70	71
n daylight	53	68	72
o privacy	60	63	75
p sociability	62	70	77
q spaciousness	83	75	77
r supervision	63	63	63
s surface finishes	59	68	76
t temperature	45	53	41
u ventilation	47	59	51
v view	65	72	70

The three lowest rated features for adequacy were 'security' in hospitals A & C, and 'temperature' and 'finding the way' in hospital C. 'Cleanliness' was rated the most adequate feature in hospitals B & C followed by 'spaciousness' in hospital A.

Expressing adequacy ratings in the form of bar charts for each hospital gives a profile of respondent opinion on overall adequacy, and on particular features:

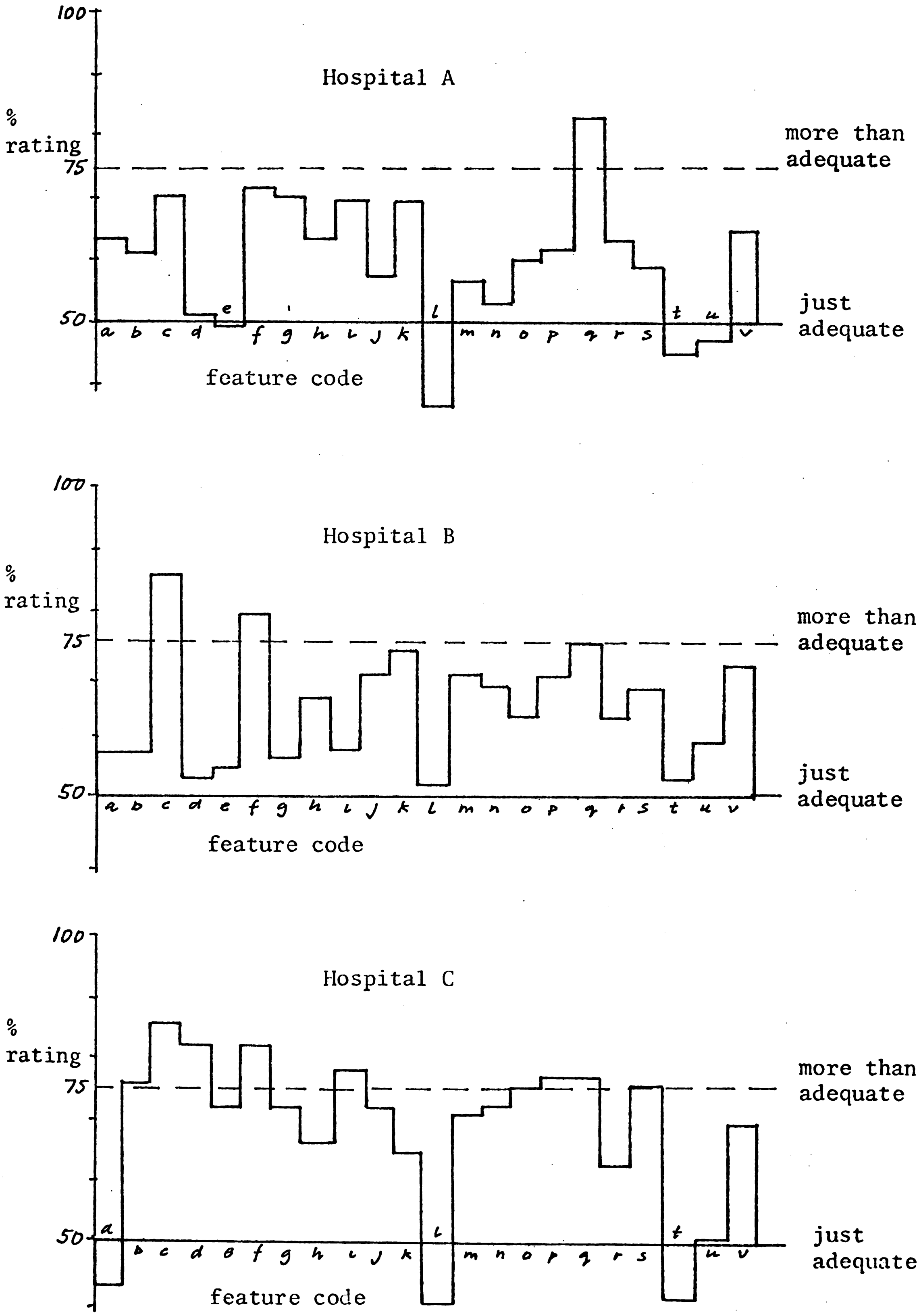


Fig.9.17 'Adequacy profiles' for each hospital

Percentage rating levels for adequacy in each hospital were compared with respondents' age group, sex, occupational group and educational status. Higher adequacy ratings tended to be given by patients rather than by staff (see table 9.10). Sex, age and educational status appeared not to influence respondents' adequacy rating levels. The respective data for hospital A, for example, are given below for 61 respondents who provided adequacy ratings (tables 9.10, 9.11 and 9.12).

Table 9.10 Comparison between staff and patients' mean percentage ratings for each hospital.

	Hospital		
Group	A	B	C
Staff	54.6 (N=39)	62.1 (N=39)	65.7 (N=48)
Patients	67.9 (N=22)	72.1 (N=17)	68.2 (N=19)

Table 9.11 Mean percentage adequacy ratings (all levels) by sex

Sex	mean % rating	(Hospital A)
Male	61.7	N = 14 (23%)
Female	58.8	N = 47 (77%)
Both sexes	59.3	61

Table 9.12 Mean percentage adequacy ratings (all levels) by age group

Age group	mean % rating	(Hospital A)
20 - 39	60.8	N = 30 (49%)
40 - 64	56.2	N = 28 (46%)
65+	74.7	N = 3 (5%)
All groups	59.3	61

Table 9.13 Mean percentage adequacy ratings (all levels) by education level

Education level	mean % rating	(Hospital A)
Primary/secondary only	57.7	N = 27 (44%)
Secondary/technical	60.5	N = 23 (38%)
Tertiary/professional	61.4	N = 11 (18%)
All groups	59.3	61

Importance ratings

The rank order of the two most important design features as voted for by respondents is given in the following table. All levels of the hospitals for which respondents gave adequacy ratings are included.

Table 9.14 Rank order of importance (all levels)

		Hospital		
Feature	all three	A	B	C
cleanliness	1	1	1	15
safety	2	2	5=	2=
convenience	3	13=	7	1
supervision	4	4	3=	4
finding the way	5	3	2	8=
adaptability	6	7	3=	5=
security	7	5	5=	8=
spaciousness	8	20	10=	2=
stimulation	9	9=	8	10=
quietness	10	15	9	7
privacy	11	18=	10=	5
temperature	12	9=	10=	10=
reliability	13	8	13=	18=
colour	14	9=	13=	20
homeliness	15=	6	20	16=
ventilation	15=	12	16	16=
sociability	17	13=	19	13
view	18	22=	15	12
daylight	19	18=	17=	14
artificial light	20	16=	21	18=
tidiness	21	16=	17=	21
surface finishes	22	21=	22	22

Comparing the overall rank order of adequacy ratings with the voted order of importance for the 22 listed features highlights those features which were considered generally to be markedly worse than the ideal in all three hospitals combined.

Table 9.15 Comparative order of adequacy and importance (all levels) in all three hospitals

Features (in listed order)	adequacy	importance	difference importance - adequacy
finding the way	19	5	-14
stimulation	13	9	- 4
cleanliness	1	1	0
colour	16	14	- 2
homeliness	18	15	- 2.5
tidiness	3	21	+18
adaptability	11	6	- 5
convenience	14	3	-11
quietness	6	10	+ 4
reliability	9	13	+ 4
safety	4	2	- 2
security	22	7	-15
artificial light	12	20	+ 8
daylight	15	19	+ 4
privacy	10	11	+ 1
sociability	5	17	+12
spaciousness	2	8	+ 6
supervision	17	4	-13
surface finishes	8	22	+14
temperature	21	12	- 9
ventilation	20	15.5	- 4.5
view	7	18	+11

'Security', 'finding the way' and 'supervision' were the three features which most respondents felt were well below their expectations in the three hospitals surveyed. 'Tidiness', 'surface finishes' and 'sociability' were, however, ranked markedly better in order of adequacy than in order of importance.

9.5 COST AND STAFFING COMPARISONS

Cost analyses of buildings constructed at about the same time show how differences in detail design affect both the proportional and actual costs of the various building elements. Although these data are widely used in building cost planning there is often inadequate feedback to designers on maintenance or running cost consequences. Decisions on amounts to spend on, say, superstructure compared to engineering services may be influenced by considerations having little relevance to longer term operating costs.

In the comparative evaluation of the three hospitals an attempt was made to obtain detailed construction costs analyses of each hospital as a whole, as well as for each phase or type of building included. This task was relatively easy for hospitals B and C as a detailed comparative cost analysis had been carried out on both hospitals for the Australian Hospitals and Health Services Commission in 1975 by Rider Hunt & Partners, Quantity Surveyors. Equivalent information was not readily obtainable for hospital A, although the quantity surveyors responsible for the project provided detailed cost data for the first two phases of construction, and overall costs for the completed hospital at 1977 valuations.

Precise cost and area comparisons between the British and Australian hospitals could not be made due to differences in methods of categorizing building elements and departments. The British hospital costs were converted to equivalent Australian prices taking into account exchange rates at the times of construction, differences in average materials and labour costs, and levels of average wages in each country. Comparative costs for structural frame and floors are shown below.

Table 9.16 Percentages of net building cost* for structural elements

Building element	Hospital A	Hospital B	Hospital C
frame	8.9	1.2	2.1
upper floor	9.3	6.1	13.3
total frame and upper floors	18.2	7.3	15.4

*net building cost = construction costs exluding fees, external works and equipment

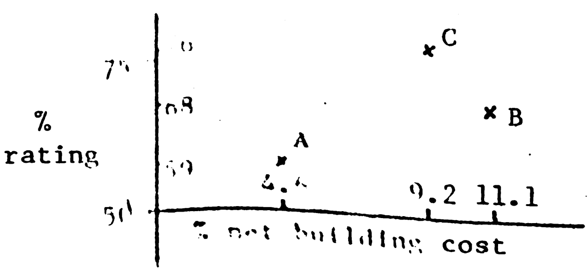
A comparison between percentage costs for main groups of building elements in the main ward block (or its equivalent) in each hospital shows that a considerably larger proportion of costs was expended on engineering services in hospital A, and considerably less was spent on its finishes and fittings compared with both hospitals B and C.

Table 9.17 Percentages of net building cost: 'building and services'

Element group	Hospital A phases 1 & 2		Hospital B blocks 1 & 2		Hospital C ward block G	
substructure	3.2	34.8	2.6	34.3	3.8	42.8
superstructure	31.6		31.7		39.0	
finishes	4.6	8.1	11.1	20.6	9.2	15.6
fittings	3.5		9.5		6:4	
building	43.9		54.9		58.4	
services	57.1		45.1		41.6	
net building cost	100		100		100	

The lower percentage cost of 'finishes' in hospital A is reflected in the lower adequacy rating for 'surface finishes' in the hospital interior.

Fig. 9.18
Percentage cost of finishes related to adequcy rating for 'surface finishes' in hospital A.



A more detailed comparison between selected building elements in each hospital shows similar variations in percentage costs which reflect the types of structure, services and materials used.

Table 9.18 Percentage of net building cost : selected elements

Element	Hospital A phases 1 & 2	Hospital B blocks 1 & 2	Hospital C 'ward block G'
external walls	3.7	5.7	3.2
windows	0.2	1.6	2.6
internal walls	4.4	6.7	5.9
floor finishes	2.4	3.4	2.1
mechanical services incl. airconditioning	37.4	9.9	15.2
transportation (lifts etc)	2.5	4.0	4.5

The total construction costs of each hospital were obtained as accurately as possible on a comparable basis from the cost analyses. The following table shows approximate overall costs related to nominal bed capacity and to total floor areas for each hospital.

Table 9.19 Overall cost comparisons

Feature	Hospital (and year of completion) A (69/74)	B (72/73)	C (75/78)
total building cost (approximate)	£8.7 ($45m) (a)(b)	$36m (b)	$47m (b)
planned bed capacity (approximate)	760	630	500
notional cost per bed	$59,000	$57,000	$94,000
total floor area	62,000m^2	52,000m^2	102,000m^2
cost/m^2	$730	$692	$460

a) approximate costs based on conversion factor of 5.152, derived from:

1) average exchange rate in 1972 £1 = A$2.00
2) building cost differential UK to Australia 1975, 1:1.6
3) rise in building costs 1972 to 1975 x 1.61

(Sources: Reserve Bank of Australia
International Labour Organisation Yearbook, 1978
United Nations Yearbook of Construction Statistics,1967-76
Australian Bureau of Statistics, Building Statistics
Australian National Accounts No.46, 1977)

b) all building costs adjusted to 1975 values.

Capital cost per bed for the whole hospital does not accurately reflect the different construction or space standards in wards, nor the number of beds in each ward unit. The following table therefore shows how the three hospitals compare for space per bed in ward accommodation.

Table 9.20 Capital cost & area comparisons

Feature	Hospital A	Hospital B	Hospital C
area per bed for whole hospital	$82m^2$	$83m^2$	$204m^2$
number of beds per standard ward unit	33	36	28
area per ward unit	$792m^2$	$1200m^2$	$881m^2$
area per bed in ward units	$24m^2$	$33m^2$	$31.5m^2$

Running cost data for the three hospitals were obtained from the hospital accounts departments but were difficult to compare due to the different categories used for expenditure items in British and Australian hospitals.

Table 9.21 Total costs per bed day in each hospital in 1976/77 and 1977/78

	Financial year 76/77	77/78
Hospital A	£36.56	£39.7 ($120 equiv. approx.*)
Hospital B	$145	$168
Hospital C	$155	$209

* The equivalent cost per bed day for hospital A is based on an exchange rate of A$1.54=£1 and an average cost differential between Australia and Britain of 1.98 : 1 in 1977.

(Sources: Reserve Bank of Australia
International Labour Organisation Yearbook)

Running costs of some other hospitals in Britain were also obtained for comparison with hospital A.

Table 9.22 Running cost comparisons (other hospitals in Britain)

		cost/inpatient day 1977/78
Hospital A	new 770 bed general acute	£39.71
Hospital D	new 400 bed general acute	£35.78
Hospital E	old 600 bed general and special	£45.33
Hospital F	new 500 bed general acute	£36.20

(Source: Greenwich and Bexley Area Health Authority, Accounts Dept.)

Percentage running costs for hospital A were compared with another large new hospital built nearby at about the same time (hospital D). The following expenditure categories, including staff salaries, were used.

Table 9.23 Percentages of total running costs (hospitals A & D)

	hospital A		hospital D	
Expenditure category	1976/77	1977/78	1976/77	1977/78
maintenance				
engineering	7.06	5.36*	3.82	4.08
building	2.11	1.91	1.2	1.54
energy and utility	2.71	5.44	4.26	4.36
catering	11.84	11.28*	7.69	7.99
domestic and cleaning	11.65	10.95	11.30	11.54
other general services	15.32	15.89	17.11	18.11
patient care	43.65	45.15	50.51	48.13
medical and paramedical services	5.66	4.00	4.11	4.28

*The higher percentage engineering maintenance costs in hospital A are attributed to airconditioning and more complex engineering services generally. The higher catering costs are due to the three floor kitchens in hospital A. Other costs are fairly closely related.

Running costs for hospitals B and C were set out in a directly comparable form to each other and are given below as percentages of 1977-78 costs excluding salaries:

Table 9.24 Running cost percentages (hospitals B & C)

Expenditure item	Hospital B	Hospital C
food	9.96%	8.59%
energy	11.32	6.75
maintenance	5.69	10.25*
supplies (m & s)	36.35	47.26
domestic	29.52	10.95
administration	9.17	15.38

*includes renovations and replacements.

Staff salary percentage costs were obtained for hospitals B and C, but detailed analyses by staff categories was obtainable only for hospital C and are therefore not included here.

Table 9.25 Salary percentage costs (hospitals B & C)

Category	Hospital B	Hospital C
all staff salaries as percentage of total running costs	73.85%	75% approx
nursing salaries as percentage of all salaries	48%	36%

Comparing nursing costs between hospitals is relatively meaningless without more detailed data for analysis. The very different distribution of building and engineering costs between the three hospitals is however reflected in the appearance and standard of materials used, and in engineering services provision.

Staffing and bed occupancy statistics were obtained for each hospital, but owing to different means of classification the staffing figures are not directly comparable.

Table 9.26 Staffing statistics

Staff category	Hospital (and year) A(77)		B(77/78)	C(77/78)	
medical	87		73	200	
trained nurses	369	773	545	760	
trainee nurses	204			-	
technical/professional	188		214	263	
administrative/clerical	175		201	209	
ward orderlies	180		-(1)	-(1)	
domestic	282		133(2)		384
catering	234		NA		
porters	120		- (1)		
cooks	86		NA	62	
TOTAL	2125		1166	1877	

NOTES: (1) included in nursing and/or domestic
(2) includes 'auxiliary', but excludes contract cleaning staff
NA = not available as separate item
(Sources: Hospital personnel departments)

Table 9.27 . Bed occupancy statistics

Item	Hospital (and year) A(77)	B(77/78)	C(77/78)
occupied beds	702(a)	360	369
daily average occupied beds	555(b)	290	270
occupancy percentage	79%	80%	73%
admissions	(15,414)(c)	14,224	17,107
average length of stay	13.15(d)	7.26	5.76

(a) available beds, daily average
(b) occupied beds, daily average
(c) discharges and deaths (no figures given for admissions on SH3)
(d) due to high proportion of geriatric beds

(Sources: Hospital A - SH3 form for year ended 31.12.77

Hospital B & C - Hospital Finance Departments and Australian Hospitals Yearbook 1979/80)

Staff to bed ratios give an indication of the 'efficiency' of the hospital, but other factors such as case mix, dependency of patients and size of ward units affect the number of staff required to provide an acceptable level of service.

Table 9.28 Staff and bed numbers

Item	A(77)	Hospital (and year) B(77/78)	C(77/78)
no. of staff (WTE)	2125	1296	1922
no. of nursing staff (WTE)	773	588	720
no. of occupied beds	702	360	414
total staff/bed ratio	3.02	3.60	4.64
nursing staff/bed ratio	1.10	1.63	1.74

The higher ratios of staff to beds in hospital C are at least partly attributable to its teaching and research role. The difference between nursing staff/bed ratios in hospital A and B may reflect different standards of nursing in Britain and Australia as well as the effect of different sizes of ward unit. More detailed investigations would be necessary to form any conclusions regarding effects of design on efficiency.

Statistics for other clinical services were obtainable in varying degrees of detail. The main items are summarised below:

Table 9.29 Outpatient attendance and operations statistics

Item	A(77)	Hospital (and year) B(77/78)	C(77/78)
outpatient attendances	159,542	171,799	148,436
operations	NA*	9,187	8,512

* number of operations not included in SH3 forms.

9.6 DEPARTMENTAL AREAS AND USE OF SPACE

Detailed schedules of accommodation were available for hospitals B and C from the cost and area analyses by Rider Hunt (1975). These schedules were however for proposed departmental areas and did not necessarily accord with what was built. There was some difficulty therefore in establishing the actual space allocation when the hospitals were completed, and in tracing how the use of space had changed since that time.

Space allocation to departments is often used as a starting point for building planning, both to obtain an approximate building cost estimate, and also to explore possible sizes and shapes of building in relation to the site. Hospital A was planned to be as compact as possible, not only to fit an 800 bed hospital into a 7½ acre (3 ha) site, but also to keep costs within the limits established by the DHSS cost allowances. Hospital B was planned as something of a 'showpiece', but was also based on an anticipated growth in the population served which did not eventuate. Hospital C was planned and built in a relatively short space of time, the departmental space allocations being based largely on the accumulated experience of the planning consultants in the design of other similar teaching hospitals overseas.

Although the space standards for each of the three hospitals were derived in different ways, there are nevertheless similarities in departmental area allocations in each hospital, mainly because the initial space budgets were based on similar precepts.

Comparisons of departmental floor areas, and their percentages of the total floor area of each hospital, are given in the following tables.

Table 9.30 Space allocation in square metres for some key departments in each hospital, including percentage of the whole hospital floor area

	Hospital					
	A		B		C	
Department	m²	%	m²	%	m²	%
general wards	8200	18.8	9590	21.17	14406	14.16
outpatients	2850	6.54	923	2.09	3197	3.14
operating dept.	1730	3.97	1165	2.63	3027	2.98
pathology labs	1460	3.35	1000	2.26	2967	2.92
physiotherapy/rehab.	870	2.00	497	1.12[1]	1221	1.20
pharmacy	520	1.19	312	0.70[1]	1101	1.08
intensive care unit	270	.60	368	0.83	1138	1.12
administration	2440	5.6	1784	4.03	5087	5.00
catering	1260	2.89	1379	3.12	1951	1.92[2]

NOTES: (1) department expanded later

(2) food prepared in off-site food factory

Table 9.31 The amount and proportion of floor space allocated to all types of wards

	Hospital					
	A		B		C	
Category	m²	%	m²	%	m²	%
all wards (excl.obstetrics)	13110		19087		20493	
wards/total usable floor area		30.1		46.2		20.1

The substantial difference between the proportion of floor space allocated to wards between the three hospitals is only partly accountable to the teaching and research role of hospital C. The large outpatient department in hospital A is one reason for the lower proportion of ward space compared with hospital B.

Another way in which space allocation can be analysed is by comparing the ratio of usable floor space to non-usable space, ie circulation areas, structure and engineering plant rooms. Proportional areas of usable and non-usable floor space are given below for hospitals B and C.*

Table 9.32 Floor space allocation (usable/non usable).

	Hospital			
	B		C	
Area category	m²	%	m²	%
total usable floor area	28485	53.2	55108	51.7
circulation (within depts)	8858	16.5	20654	19.4
travel (between depts)	3947	7.4	7536	7.1
plant space (in depts)	6678	12.5	12543	11.8
ducts	incl. below		3319	3.1
'shell' areas	2653	5.0	2777	2.6
non-habitable (walls etc)	2964	5.5	4651	4.4
Gross floor area	53585	100	106588	100

* No comparable data were available for hospital A

Differences in shape between hospitals B and C would not appear to have materially affected the amount of space allocated to communication between departments. The type of department has a greater effect on the percentage of departmental area allocated to circulation (see table 9.33 below).

In both hospitals B and C just over half the gross floor area (GFA) is available as usable space, while approximately 14% of the GFA is attributable to plant spaces and ducts within departments.

Within one hospital there are considerable differences in utilisation of space within particular departments. The following table compares the ratio of usable floor area (UFA) to GFA in selected departments.

Table 9.33 Space utilisation ratios compared

	Hospital	
	B	C
Department	UFA/GFA %	UFA/GFA %
general wards	63.3	62.9
outpatients	57.5	64.9
operating department	62.9	69.4
pathology laboratories	70.4	70.4
physiotherapy	74.1	67.1
pharmacy	69.4	78.1
intensive care	95.2	68.9
administration	69.9	64.5
catering	83.3	65.4

(source Rider Hunt 1975)

The low space utilisation percentage of the outpatient clinic in hospital B is attributed to its relatively small size and large waiting area. The high utilisation percentage of the intensive care ward in hospital B is a result of its small size and open planning. Pathology laboratories are remarkable for their apparent consistency.

The following two tables (9.34 and 9.35) show various ways in which space utilisation differed between various parts of hospital B, and how the three hospitals compared in terms of floor space per unit of provision for selected departments.

Table 9.34 Hospital B : selected differences in percentage utilisation of floor space in the tower block compared with the low block.

Category of space use	percentage of GFA tower & podium block 1	 low finger plan block 3
usable floor area (UFA)	51.2%	57.8%
circulation (in depts)	15.9	17.9
travel (between depts)	8.2	5.2
engineering plant	13.8	8.7
non-habitable & shell	5.1	5.2
external walls	5.6	5.2
GFA	100	100

Table 9.35 Space utilisation comparisons between selected departments in each hospital

Department type	Hospital A	 B	 C
maternity wards m^2/bed	25.7	43.96	35.75
operating dept. m^2/op.th.	288	214	305.2
outpatients m^2/cons.rm.	81.5	117.3	79.76
radiology m^2/rm	155.4	155.6	232.5

The higher areas per maternity bed and consulting room in hospital B are due partly to the small size of the departments. Larger areas per theatre and consulting room in hospital C are mainly due to its teaching role. The differences between these floor area ratios are better appreciated graphically (see fig.9.19).

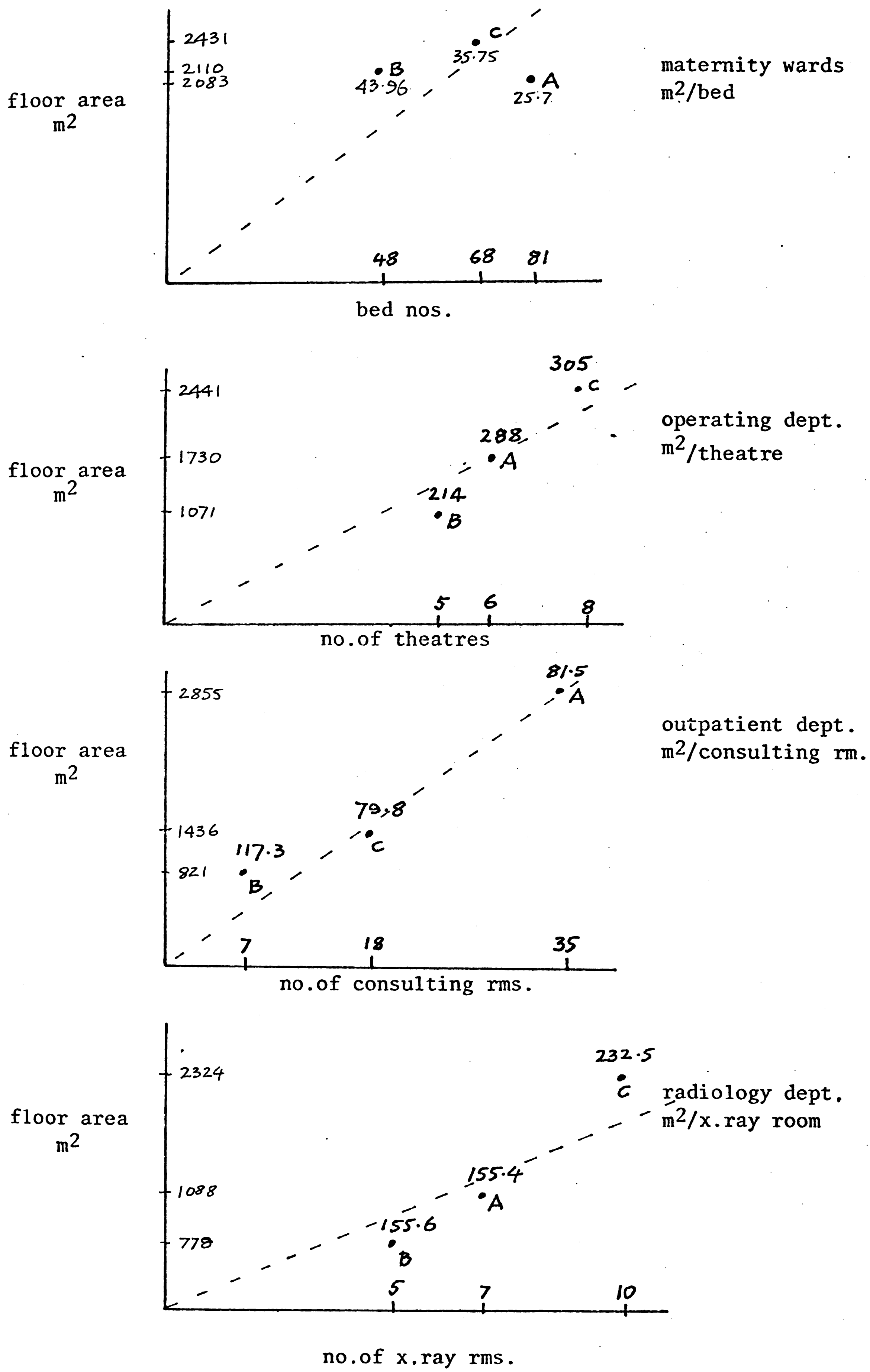


Fig.9.19 Floor area ratios for four departments in each hospital

Similarity in allocation of floor areas to hospital departments may be due firstly to the tendency for the design of one hospital to follow a pattern previously established in hospitals of a similar kind and functional content. Floor areas of departments in a wide variety of new hospitals have been shown to bear a close proportionate relationship to one another (England 1971). This may be because some hospital planners start by producing a schedule of accommodation for a new hospital based on approximate numbers of beds and medical students. This was the practice adopted on hospitals B and C to a certain extent. In hospital A, however, the planning team worked from fundamental principles in producing department designs; and 'schedules of accommodation' were not drawn up until the layout of each department had been settled in principle.

Variations from the 'normal' size for a hospital department may be due to a variety of causes, eg pressure for more space by an 'empire building' department head, or a legitimate need for extra facilities because of anticipated demand. Some departments, such as the pharmacy in hospital B, were significantly smaller proportionately than the pharmacy departments in hospitals A and C. That this was an 'error' was made evident by the pharmacist in hospital B who had increased the size of his department substantially since it first opened.

Differences in space allocation in wards in each of the three hospitals are attributable to a variety of factors - numbers of beds in standard ward units, size of multi-bed rooms, numbers of single bed rooms, provision of toilet facilities, and so on. Hospital B, with the highest proportional space allocation to general wards, also had the smallest number of beds in a standard ward unit (18), and the most generous provision of toilet facilities and utility areas. Hospital C, being a teaching hospital, had proportionately much more space devoted to laboratories and teaching facilities. The significantly lower proportion of space allocated to 'catering' in hospital C was due to the use of an 'off-site' food factory which obviated the need for a conventional hospital kitchen.

Despite arguments in favour of basing department space allocations on previous 'good' designs, there are benefits in being able to adjust new designs to meet local needs and changing circumstances. Each of the three hospitals therefore had made provision for some changes in design during the planning, and also after completion.

One of the purposes of the evaluation study was to investigate how the three hospital building designs had affected their adaptability in use. A detailed room-by-room survey was therefore made with the aid of 'as-built' drawings on which any detected changes in room use and consequent building or engineering alterations were recorded. These drawings were then analysed to establish the total number of rooms, and the number and type of alterations in room use in each department. The departments with the highest proportionate number of alterations since completion were thus identified.

Detailed data on the reasons for (and costs of) building alterations involved in room use changes were not readily available, except in hospital C where the writer was able to analyse works records for all building and engineering work since the hospital opened.

Departments which had changed most in <u>use</u> of rooms in the three hospitals are listed below in rank order of their combined frequency of changes in all three hospitals. Percentages are expressed as numbers of room changes in each department in relation to the total number of room changes recorded in each hospital.

Table 9.36 Percentage number of changes in use

	Hospital		
Department	A	B	C
wards	22.2%	13.1%	11.2%
pathology and mortuary	7.2	22.3	7.7
administration	8.7	10.3	15.5
stores, supply	9.6	3.9	4.3
laboratories (teaching & research)	-	-	15.8 (2)
physiotherapy	2.9	8.0	4.3
outpatient clinics	4.8	8.7	1.2
education (medical/nursing)	1.9	0.9	9.1 (4)
maternity and delivery	7.7	3.0	1.2
day hospital	2.4	NA	6.0
psychiatry	1.4	6.4	- (3)
accident and emergency	3.7	2.6	0.9 (1)
Total of above departments (12)	72.5	79.2	77.2
Other departments (16 to 24)	27.5	20.8	22.8

NOTES: (1) most recent department to be completed
(2) excluding pathology laboratories
(3) recently opened when survey made
(4) university teaching hospital

Widely differing proportions of changes had occured in each hospital with respect to the twelve departments which had changed most often. About three quarters of changes in room use had occurred in these twelve departments.

The above analysis appears to contradict a generally held belief that wards are low in the order of departments which are likely to change often. But if the proportion of changes is expressed as a ratio of the total number of rooms in the department then the position is reversed. The relatively high position of administration in the above table reflects a tendency to rearrange offices in accordance with organisational changes in early years of a new hospital's existence. The relatively large numbers of changes in pathology (and in laboratories in hospital C) is to be expected, although the low proportion of changes in laboratories in hospital A is accounted for by the policy of providing an easily adjustable benching system in this department (see Moss 1971).

An analysis was also carried out on the number and types of building alterations associated with changes in room use. The most frequent types of building work are shown below in rank order of frequency.

Table 9.37 Number of building alterations

	Hospital		
Change made	A	B	C
wall added	38	40	42
door(way) added	9	20	38
wall removed	31	8	23
internal window added	13	6	4
door(way) removed	-	6	16
sanitary equipment removed*	12	1	6
electrical work*	1	2	12
finishes changed/improved	2	1	12
shelving/cupboards added*	-	3	10

Note: *building work solely due to changes in room use

Table 9.38 Most frequent reasons for building alterations ascertained from works records in hospital C

Reason	Frequency
improve security	14 times
improve privacy/quietness	14
convert store to office etc.	11
combine spaces for convenience	10
subdivide spaces for convenience	10
improve cleanliness/hygiene	9
change of use from planned use	9
improve drainage	8
safety	8

A total of 26 reasons were given altogether for the 165 building alterations, only some of which were due to changes of use during the period March 1975 to May 1979.

As the three hospitals had been in use for varying lengths of time when the surveys were made, the number of changes made per year since the completion date of each main phase of building was determined.

Table 9.39 Changes in use per annum

Item	Hospital A	Hospital B	Hospital C
completion dates of main phases	phase 1 1969 phase 2 1971 phase 3 1974	phase 1 1971/2 phase 2 1972/3	phase 1 1975 phase 2 1976 phase 3 1978
mean no.of years between completion and survey	6	6	2.5
total no. of rooms in hospital (approx)	1640	1500	2210
total no. of changes in room use	204	279	230
changes : total rooms	12.4%	18.6%	10.4%
% changes/year	2.1	3.1	4.2

Hospital C appears to have had twice as many changes in room use per year since completion as hospital A, and half as many again as hospital B. Reasons for changes in room use, and for consequent building alterations, are seldom clear-cut. The following list illustrates the range of possible reasons:

planned change due to phasing of construction
changes in policy since completion
changes in senior personnel in department
changes of demand (increase/decrease)
new techniques developed since completion
design incorrect (for various reasons)
design inadequate eg cramped space
design incorrectly constructed
building work defective
design not adaptable/versatile enough
new safety regulations enforced since completion

In addition there are factors which determine whether desired changes are actually put into effect:

eg. availability of finance
ease of construction/modification
cost of alteration work
disruption caused by alterations
'power' of the department head
political implications if change not made
cost of <u>not</u> doing alteration work
effect on staff morale/recruitment/turnover

In the three hospitals surveyed it was evident that most if not all these reasons and factors had influenced the frequency with which changes in use and consequent building alterations had been made. Suitability of the building design to facilitate changes was not apparently a particularly important factor. If money was not made available, changes were not made. Priorities for change depended on the ability of a department head to acquire sufficient resources to have desired changes implemented. Cost of alteration work was however affected by the suitability of the building design to accommodate changes, but even where the building had been designed to facilitate change, there were often problems in re-routing engineering services to correspond with changes in room use or arrangement.

If changes to construction are easy to make, there may still be a complex procedure to draw up a request, get it designed, costed and approved. It then has to be fitted into the minor works program. Finally, several building trades are likely to be involved and disruption to hospital activities may be caused while the alterations are proceeding.

If a building is designed to avoid the need to make physical alterations due to changes in use, it will be cheaper, quicker and less disruptive. The design of hospital A facilitated changes in design prior to construction, as also did hospital C to a lesser extent. Hospital B was more constraining in its physical design and this may have been a factor inhibiting necessary or desired changes. Some changes were planned or anticipated as a consequence of phasing and decanting; such as the change in use of the temporary accident and emergency department in hospital C, and the phase 1 physiotherapy department in hospital B. Other major 'changes' in use were 'non-use' of some areas, or their conversion to totally different functions from those intended. For example, two ward units in hospital B were used temporarily as pathology laboratories and an accounting department. Other areas were not used due to shortage of funds to staff them or to complete their construction and equipping. In hospital C an area left 'in shell' was put into temporary use as a children's occupational therapy department pending allocation of funds to complete the fitting out of the area.

The relatively small number of changes in some departments in hospital A were attributed (by the staff) to the suitability of the design for its purpose. This was particularly evident in those departments where users were involved in discussions on requirements and proposals, eg pathology laboratory, operating department, outpatient clinics and radiology department (see Green et al 1971). This was aided in hospital A by having existing hospital staff 'on-tap' during the briefing, design and construction period. In hospitals B and C there were no existing hospital staff to consult, all design decisions were therefore made on behalf of other people.

9.7 ACCIDENT STATISTICS AND SAFETY

Statistics of accidents to patients and staff were studied by looking through accident reports relating to notified accidents to patients, and through forms completed by staff who reported an accident and who sought medical advice. The extent of unreported accidents is not known, but staff were usually advised that failure to report an accident to themselves could result in loss of rights to claim compensation for injury received while on duty.

Staff accident statistics over a three month period immediately prior to the surveys were analysed in terms of causes and parts of body affected. Categories of analysis differed somewhat in each hospital, but an approximate correlation showed that the most common cause of staff injuries in hospitals A and B was 'action by or involving patients', including lifting. In hospital C it was the second most common cause after 'slipped on floor'. In hospital A a high proportion of incidents to staff occurred in kitchens or while involved in cleaning. The predominating part of the body affected in hospitals B and C was 'back' or 'trunk', while in hospital A it was the second most common part affected after 'fingers'.

The total number of staff incidents reported in the survey period included both major and minor injuries. The following tables show the main causes and body parts affected. The higher number of incidents in hospital A is attributable to the larger number of staff and patients, and also to the high proportion of geriatric inpatients and day patients.

Table 9.40 Number of reported incidents : staff/part of body

Part of body affected	Hospital A	B	C	Total
finger	24	2	-	26
back	13	12	-	25 } 42
trunk	-	-	17	17 }
neck	8	3	6	17
face/head	9	-	7	16
shoulder/arm	-	2	13	15
knee/leg	6	-	8	14
wrist/hand	10	-	2	12
eye	3	1	3	7
ankle/foot	4	1	1	6
chest	-	2	-	2
stomach	1	1	-	2
not specified	-	-	2	2
Total	77 major & minor	24 major	24 major 29 minor 53	156

Table 9.41 Number of reported incidents : staff/causes

'Causes' of incidents	Hospital A	B	C	Total
patient (incl.lifting)	13	6	5	24
slip on floor	6	6	7	19
cleaning	13	-	4	17
kitchen	13	2	-	15
equipment	10	2	-	12
engineering	8	-	-	8
door/cupboard	8	-	-	8
hit by/moved	-	2	5	7
lifting load	-	4	2	6
wall/window etc.	4	-	-	4
other	2	2	1	5
Total	77 major & minor	24 major	24 major	

Causes of accidents to patients were recorded for periods of six weeks prior to the survey in hospitals A and B and for eight weeks prior to the survey in hospital C. The most common 'causes' were 'tripped and fell', 'found on floor' and 'fell from bed'. Falls from chair/wheelchair and from toilet or bedpan were also common causes in hospitals A and B. Details are given in the following table:

Table 9.42 Number of incidents reported : patients/causes

'Causes' period	Hospital A	Hospital B (6 weeks)	Hospital C (8 weeks)	Total
tripped/fell	24	12	21	57
found on floor	30	9	4	43
fell from bed	22	9	11	42
fell from chair/w'chair	21	9	2	32
fell from toilet/bedpan	18	10	-	28
bruised head	4	-	-	4
fit/fainted	2	1	1	4
bruised face	2	-	-	2
slipped	2	-	-	2
slipped from hoise	2	-	-	2
others	5	3	9	17
Total	131	52	48	232

Caution should be exercised in drawing any conclusions from these raw data as they are not based on comparable categories nor are they related to staff hours worked or to patient bed days. Nevertheless there is a high proportion of falls associated with beds in all three hospitals, and with chairs, wheelchairs and toilets in hospital A. The use of carpet in corridors in hospital C does not seem to have significantly lowered the proportion of falls involving staff or patients.

Location of toilets in wards may account for the higher number of patient falls in hospital A where toilets are mainly across a corridor from the bed areas. In hospitals B and C toilets are ensuite with patients' bed rooms.

Variation in methods of collecting accident statistics makes comparisons between hospitals not only difficult but also unhelpful in linking design features to causes of accidents. More consistent categories and more precision in stating causes would assist in improving design safety.

The following comments relate to specific safety features in each of the three hospitals.

In hospital A the relatively large number of accidents which involved falls probably reflected the high proportion of geriatric patients in the hospital. It may also be an indication of inadequacies in supervision due to staff shortages and/or ward layout. Another factor may have been the height at which beds were fixed when patients tried to get out of bed on their own. Several respondents commented on the need for wheel brakes on lockers to prevent them moving when used as support.

Seventeen accidents occurred in toilets, some of which may have been attributable to design factors such as inadequate or unsuitable hand grips.

In hospital B the most significant features about 'accidents affecting staff' were the high proportion of injuries to the back and neck (62.5%), and the relatively large number caused by 'lifting' (37.5%). Personal experience of the writer while working as a wardsman, and comments from other members of staff, identified this as a major problem, especially with helpless and heavy patients. Lifting aids, if available, appeared seldom to be used, either because they were considered awkward in use, or because it was quicker to do without them. (This problem is currently being followed up in a separate research project.)

Many accidents to patients in hospital B occurred either in the toilet (19.2%), or on the way to or from the toilet (9.6%). Including accidents in the shower, the total percentage of accidents in toilet areas was 32.7%, while 34.6% of incidents were associated with beds, chairs or wheelchairs. Comments by members of staff regarding problems of lifting patients in toilets, and in and out of beds and wheelchairs, identified this as an area where considerable design improvement is needed, not only in relation to design of equipment, but also regarding provision of adequate space and grab rails in toilets. Another factor commented upon was inadequate instruction in how to lift patients without causing strain to the lifter or harm to the patient.

In hospital C a quarter of the incidents caused injuries (mainly minor bruising). More than half the incidents affected patients over 65 years of age, and just over three-quarters happened in wards, either in bedrooms or bathrooms (toilets). In well over half the cases reported the patient was 'normal' at the time (ie not senile, agitated, disorientated or affected by drugs), and in just under a quarter of the cases staff were in attendance. In the eleven incidents for which restraints, straps or cot sides could have been used, they were not used in four.

In commenting on the above accident statistics, the Hospital Safety Officer in hospital C said that many falls from bed occurred at night or when patients were awake and tried to get out of bed. Cot sides did not appear to prevent injury as patients clambered over them and increased the risk of falls. The nurse call system did not appear to have been used in many instances of falls from bed. Tile and vinyl floor coverings appeared to contribute to many falls, particularly if the floor was wet. Carpets are considered to be safer, both in preventing falls and in providing a softer landing.

9.8 BUILDING SHAPE, VIEW AND LIGHTING

The third spatial characteristic to be analysed in the three hospitals was the effect of building shape on the number of internal and external rooms. These were counted in each hospital as a whole, and within department 'zones', from floor layout drawings as at the time of construction with later modifications marked. Internal rooms were defined as those which had no direct view of the outside or the sky.

Table 9.43 Total number of rooms in each hospital related to number of internal rooms

Rooms in hospital	Hospital A	Hospital B	Hospital C
total number (approx)	1560	1480	2307
number internal	1136	1061	1532
% internal	73%	72%	66%

Because each hospital is made up of departments or zones with different spatial characteristics, the proportion of internal rooms in each zone in each hospital were also analysed.

Table 9.44 Percentage of internal rooms in general wards

Rooms in wards	Hospital A		Hospital B		Hospital C	
% internal (in each zone)	2nd floor	67%	block 1	67%	level 4	66%
			block 3	62%	level 5 & 6	67%

Despite the very different building shapes of the three hospitals it is perhaps surprising that the percentages of internal rooms in their wards are so similar. There were, however, greater differences in the proportional numbers of internal rooms in other zones of the hospitals.

Table 9.45 Proportion of internal rooms in various zones in each hospital

Floor/zone/department	no. of rooms internal	no. of rooms external	% internal
Hospital A (levels)			
lower ground	64	21	75
ground	420	125	77
1st	315	136	70
2nd	337	140	71
Hospital B (zones)			
block 1 LG & G	306	49	86
fl. 1-8	465	233	67
block 2	7	1	87
block 3 LG	132	44	75
G	151	93	62
Hospital C (selected dept.zones)			
plant & stores level 1	16	0	100
operating theatres ITU, x-ray level 3	142	70	88
outpatients clinics & x-ray level 2	168	27	84
administration level 2	47	30	61
laboratories levels 3-6	160	174	31
nurses training school level 7	15	33	31

A comparison was also made between the three hospitals with respect to their external 'window wall' area (perimeter length of each floor x approx. floor to ceiling height) expressed as a percentage of their 'effective' floor area (gross floor area excluding rooftop plant rooms). Floor areas were based on figures supplied by the quantity surveyors in the cost and area analyses of hospital B and C, and from the final cost analysis by the quantity surveyors for hospital A. Perimeter wall lengths were measured from scale drawings and a standard floor to ceiling height of 3m (10 ft) was used to derive a nominal external window wall area. There were some discrepancies between floor areas provided by the quantity surveyors and approximate areas calculated by the writer, due partly to converting imperial drawings to metric and differences in methods of computation. These differences were not considered sufficient to invalidate the data.

Table 9.46 Relationship between proportion of external rooms and window-wall/floor ratio area

Item		Hospital A	Hospital B	Hospital C
gross floor area as provided by QSs	A	61,621m^2	52,235m^2	101,743m^2
'effective' floor area measured from drawings	B	54,900m^2	48,390m^2	94,659m^2
'discrepancy ratio'	$\frac{B}{A}$	.89	.93	.93
perimeter length of external walls measured from drawings	C	3,359m	4,109m	7,688m
external window-wall area (C x 3)	D	10,077m^2	12,327m^2	23,064m^2
$\frac{\text{window-wall area}}{\text{effective floor area}}$ %	$\frac{D}{B}$	18.36%	25.47%	24.37%
$\frac{\text{no. external rooms}}{\text{no. total rooms}}$ %	E	27%	28%	34%
ratio	E: $\frac{D}{B}$	1.47	1.10	1.40

Not unexpectedly there is a degree of association between E and $\frac{D}{B}$ in all three hospitals, although hospitals A and C make more effective use of the external wall in providing a higher proportion of rooms with an outside view and daylight (see fig.9.20).

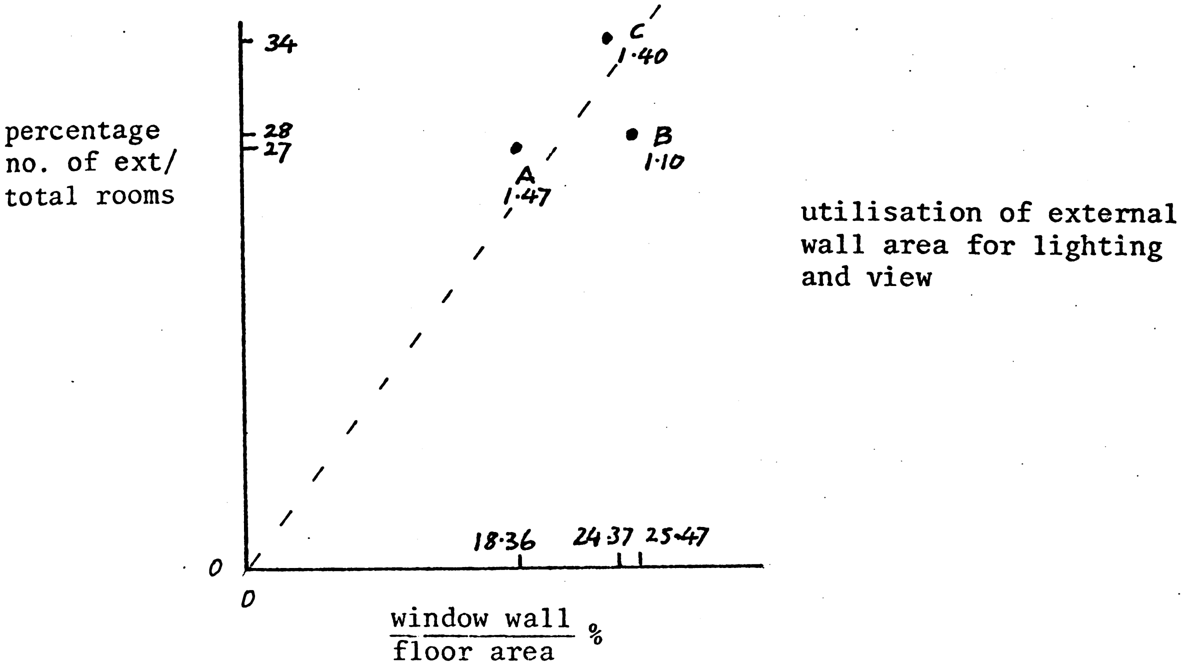


Fig.9.20 Association between number of external rooms and window wall : floor area ratio.

The relative utilisation of external wall area in the three hospitals can now be compared with respondents' adequacy ratings for view and daylight. These might be expected to correlate with the proportion of external rooms and/or the external window wall/floor area ratios, although the differences between the three hospitals in respect of these ratios are relatively slight.

A generally higher level of adequacy ratings for both view and daylight at most levels was evident in hospital C. This suggests that the percentage of external rooms rather than the window wall/floor area ratio is more significant in affecting users' feelings about adequacy of view and daylighting.

Comparisons between adequacy ratings for 'view' and 'daylight' at various 'levels' in the three hospitals are given below.

Table 9.47 Percentage adequacy ratings for view and daylight

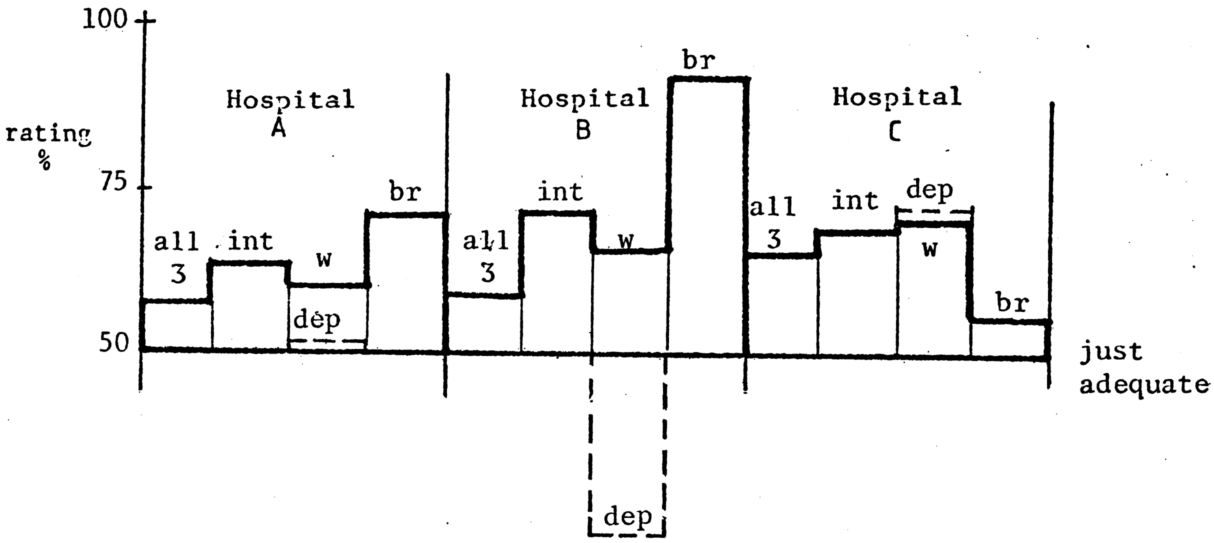
Levels	Features	Hospital A	Hospital B	Hospital C
		(N=117)	(N=67)	(N=74)
all 3 levels (all responses)	view	56.8	59.6	65.8*
	daylight	56.0	60.7	62.2
		(N=37)	(N=39)	(N=53)
hospital interior (all responses)	view	64	71.7	69.8
	daylight	53	67.8	71.7
		(N=44)	(N=22)	(N=34)
department (excl. wards for B & C) (all responses)	view	52	24	72.8
	daylight	55	38	55.9
		(N=22)	(N=37)	(N=23)
wards (staff and patients)	view	60	66.2	70.7
	daylight	73	68.9	67.4
		(N=12)	(N=12)	(N=14)
bedrooms (patients only)	view	71	92	55.4
	daylight	85	75	67.9

*Highest percentages for each level/aspect underlined

Hospital B was rated generally better than hospital A for both view and daylight, particularly so in the hospital interior. Hospital A was, however, rated better than hospital B for daylighting in wards and in patients' bedrooms. Hospital B scored well for view from patients' bedrooms, while hospital C scored surprisingly poorly in this respect with a low rating of 55.4%. Hospital B rated very poorly with respect to view and daylight in hospital departments other than wards. These data are shown in the bar charts below for a clearer comparison:

Key: interior = int, ward = w,
department = dep, bedroom = br

VIEW, adequacy rating %age



DAYLIGHT, adequacy rating %age

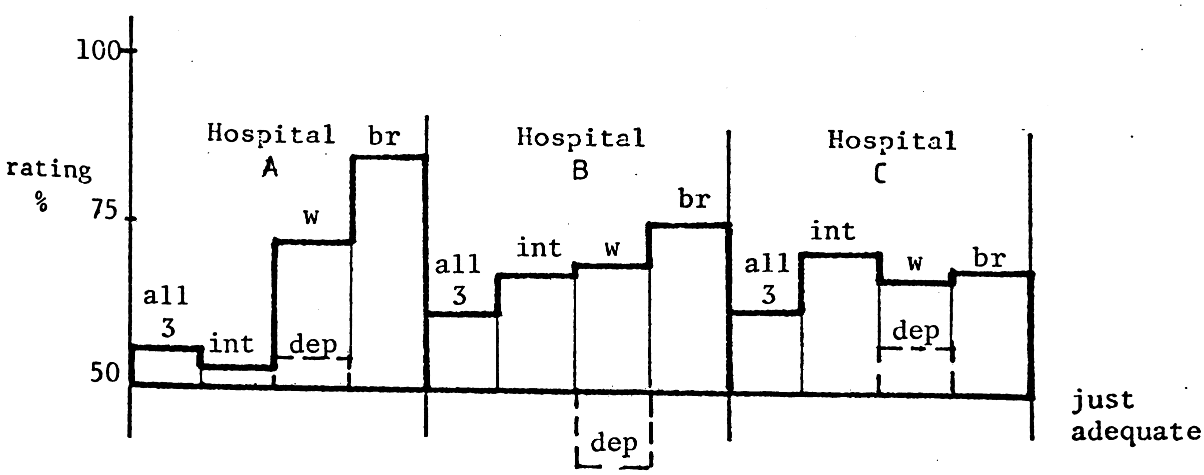


Fig.9.21 Comparison of adequacy ratings for view and daylight

The low rating for view in bedrooms in hospital C is explained by the use of double glazed windows with tinted glass and integral venetian blinds which obscured the pleasant views otherwise obtained from most patient bedrooms.

The exceptionally low ratings for view and daylight in departments in hospital B are due to the internal environment of many clinical departments in the main block podium and the lower ground floor of the rehabilitation block.

The low ratings for view and daylight in 'interior' and in departments in hospital A are also explained by the high proportion of rooms with no windows. The somewhat depressing urban environment of hospital A compared with the open landscape setting of hospital B may explain the rather higher level of adequacy in hospital A.

There appeared to be justification for claims of 'eye strain' by some staff, particularly at hospitals A and C. These mainly occurred in areas away from natural light, and with ceiling mounted fluorescent lighting as the only source of illumination of work surfaces. Use of adjustable desk lighting by some staff appeared to give better lighting for continuous close work. Glare is a major cause of eye fatigue and discomfort, and is due to a combination of factors including light sources insufficiently shielded from direct sight, too great a contrast in tones in the field of view, and over-bright lighting generally (Duke-Elder 1970).

The ribbed translucent diffusers used for 'surface mounted' fluorescent lights in hospital A appeared to be associated with complaints of 'eye-strain' and glare from fittings. In one office (in the mortuary) this type of fitting had been replaced with one having a prismatic semi-transparent bottom panel with less transparent grooved side panels.

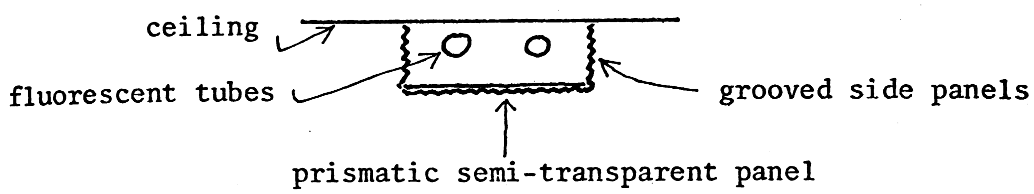


Fig.9.22 Ceiling mounted light fitting in hospital A

The mortuary office had recently been re-decorated with a green patterned wallpaper and a green carpet had been installed. Previous problems of headaches, claustrophobia and 'eye-strain' were claimed to have 'disappeared overnight' as a result of the change. The prismatic bottom panel of the fluorescent light enclosure was less bright to look at than the ribbed diffusers, and gave a more sparkling and sharper light on the work plane.

Comparing the level of complaints about lighting and vision in other hospitals suggests that the type of translucent diffusers used for fluorescent lights is only partly to blame. The other factors involved are:

1. the colour emission characteristics of the tube,
2. the size and location of light sources in relation to the worker and the task,
3. the decor of the room or workspace
4. the colour and degree of contrast between the task and the background (especially the desk top),
5. the existence of reflective glare from the task or near surroundings,
6. the outlook from the room including the view, and the extent of daylight penetration,

7. the level of job satisfaction of the worker,
8. the age and state of physical and mental health of the worker,
9. knowledge by the worker concerning lighting and vision, and the means of producing comfortable working conditions for him/herself,
10. the type of visual task, its frequency and duration,
11. the age of the fluorescent tube and the cleanliness of the light fitting enclosure (Taylor 1977).

Some or all of the factors above may cause actual or imagined visual deficiencies and can result in complaints, job dissatisfaction, poor work performance, and possibly eyesight deterioration. The suggestion has been made that fluorescent lighting causes a breakdown in the ability of the body to absorb certain vitamins from food, or actually destroys the vitamin content of food, but this does not yet appear to be adequately substantiated (Rand 1979). A factor causing visual difficulties to people working under large translucent fluorescent light fittings is that they give virtually no shadow or surface modelling. Exposed fluorescent tubes, while being brighter to look at and thereby causing more contrast glare, provide a smaller light source and therefore increase sharpness of shadows and reveal more surface modelling and textures. Tungsten filament lamps, being even smaller in size, are often preferred for this reason alone.

Evidence from all three hospitals in the comparative study suggests that fluorescent light fittings of certain types in internal rooms add to problems of glare, eye-fatigue, and feelings of discomfort. But these problems were not confined to internal rooms, nor did all staff in internal rooms which were lit by this type of fluorescent light fitting have eyesight problems. The colour of worktops also appeared to be a factor affecting discomfort felt by some staff. Desks with white or black tops were sometimes associated with visual problems of staff in offices and laboratories.

Use of supplementary tungsten filament desk lights had been found by some staff to give better lighting for continuous close work, and the writer's own experience strongly supports this. For certain kinds of laboratory work, eg examination of media plates, such lighting is essential. In other types of laboratories the general fluorescent lighting was said to be quite satisfactory.

In corridors in hospitals A and B the combination of overbright ceiling mounted fluorescent lights, and the pale undifferentiated colours of walls, floors and ceilings, gave an appearance which was both boring and disorientating. Some variation in lighting intensities and colours is essential for our eyes to be able to see shapes accurately and to distinguish colours and patterns (Gregory 1972). The tendency of some lighting engineers to aim for uniform brightness everywhere may therefore be counter-productive to good vision.

Table 9.48 List of the most frequent dislikes regarding lighting

Reason for 'dislikes'	Hospital A	Hospital B	Hospital C
unsuitable lighting in bedrooms		16	
lack of daylight	9		2
glare from lighting			8
poor lighting in workspace		4	3
lighting affects eyes			4
bedhead lights not adjustable			4
unsuitable lighting generally			4
lack of windows	4		

Respondents' ratings for adequacy and importance of artificial lighting are perhaps more revealing than their stated dislikes as many people tend not to consider lighting until their attention is drawn to it. The table below shows respondents' adequacy ratings at various levels in each hospital (highest ratings underlined):

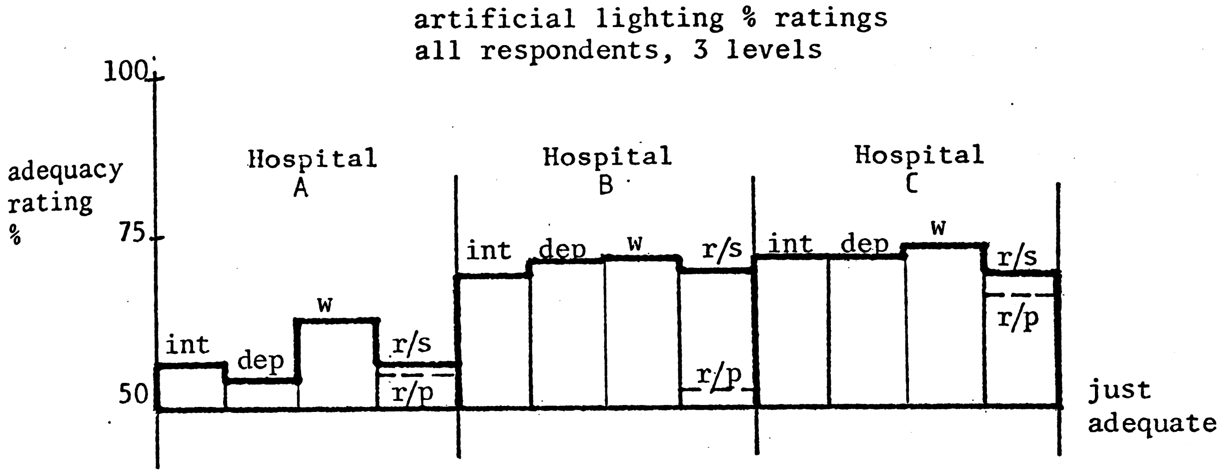
Table 9.49 Percentage adequacy ratings for artificial lighting

Level and respondent type		Hospital A		Hospital B		Hospital C	
all 3 levels,	all respondents	56%	(N=117)	69	(67)	70	(74)
interior,	all respondents	57	(37)	70	(39)	71	(53)
	staff	49	(21)	70	(29)	NA *	
	patients	69	(16)	67	(10)	NA *	
departments,	all respondents	55	(44)	72	(22) staff	71	(34)
wards,	all respondents	64	(22)	72	(37)	73	(23)
	staff	55	(10)	75	(17)	71	(15)
	patients	71	(12)	70	(20)	75	(8)
workspaces,	staff	55	(19)	70	(19)	69	(31)
bedrooms,	patients	56	(12)	52	(12)	66	(15)

* Not analysed separately.

Differences between hospitals, levels and respondent groups show up more clearly in bar chart form:

Key: Room = r staff = s patients = p
other abbreviations as for fig 9.21



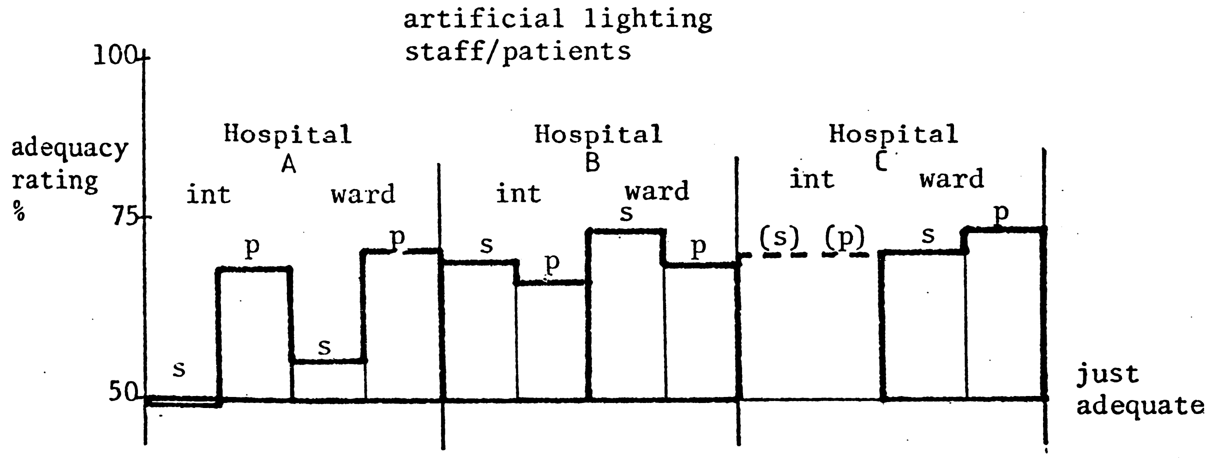


Fig.9.23 Percentage adequacy ratings for artificial lighting

The above analyses indicate that hospital A was rated poorly overall for artificial lighting by all respondents, staff rating the interior generally at 49%. Patients, however, rated artificial lighting in wards fairly highly at 71%, largely due to the 'angle-poise' bedhead lighting fittings.

Hospitals B and C were rated equally well for adequacy of artificial lighting at about 70% for most levels. Both patients and staff gave similar adequacy ratings. The only exception was a low rating of 52% by patients for bedrooms in hospital B due to the fixed ceiling mounted bedhead lights.

Few respondents thought artificial lighting was important enough to complain about, greater concern was expressed about the internal environment generally than about the ability to see properly. Complaints of eye fatigue came mainly from staff in internal areas relying wholly on artificial light, although in some instances the gradation of lighting levels in deep rooms with both daylighting and artificial lighting gave rise to problems of visual adaptation.

The following table shows how respondents voted for the importance of artificial lighting at different levels. Many respondents indicated that artificial lighting was higher on their list of priorities at room/ workspace level than in the hospital generally where it was less likely to affect working conditions. There seemed to be general agreement on the relative priority placings by respondents in each hospital.

Table 9.50 Priority placings for artificial lighting

Level and respondent type		Hospital A	B	C
for all 3 levels, all respondents		16= (N=48)	20 (67)	18= (50)
interior		NA*	17 (39)	21= (52)
departments, wards		NA*	21 (60)	9= (31)
rooms		3= (38)	6= (33)	10= (17)
all levels	staff	11= (38)	20=(18)	21= (41)
(or interior)	patients	21= (10)	14=(21)	21= (5)

* NA = Not analysed separately

9.9 SIGNPOSTING AND FINDING THE WAY

'Finding the way' was one of the 22 design features which was evaluated in each hospital generally, and in departments, but not in rooms.

The low adequacy rating for 'finding the way' in all three hospitals suggests there is a serious need to improve design in this respect. Reasons given by respondents for difficulties in finding the way are examined below, and suggestions given for improving direction finding in large complex buildings such as hospitals.

Consultant designers had been employed in all three hospitals for the signposting system, including direction signs and room labels. In none of the hospitals, however, had floor maps or 'directories' been included in the initial signposting scheme, although in all cases floor directories had been added later.

The most compact of the three hospitals was rated the easiest for finding the way. It was also the simplest in concept, the main corridor layout being based on a cross enclosed by a square. The hospital with the largest floor area proved to be the most difficult for finding the way, and it was the most complex in layout.

The three buildings also differed in terms of number of floor levels, degree of fragmentation horizontally and vertically, horizontal extent, and ground coverage. The main corridor layout in two of the hospitals (A and C) was based on a square grid, and in the third (B) it was in the form of a spine with lateral branches (see fig.9.24 and table 9.51).

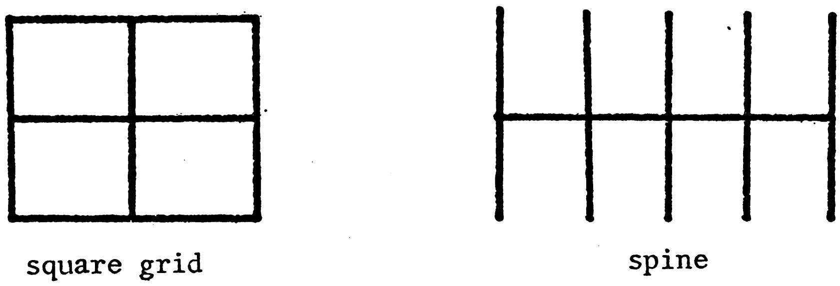


Fig.9.24 Corridor layouts compared

Vertical transport routes in hospital C were dispersed, whereas in hospital A and B they were concentrated in only two or three locations.

Table 9.51 Characteristics of the three hospitals

Feature	Hospital A	Hospital B	Hospital C
height	3-4 storeys	10 storey tower 2 storey podium	on 7 levels (mostly 4-6 storeys)
ground coverage (approx)	32,000m^2	26,000m^2	47,000m^2
horizontal distance between furthest points in building (straight line)	235m	280m	305m

One important factor influencing personal attitudes to finding the way in buildings is the proportion of rooms which have an external view and daylight compared with those which do not (Keep 1977).

Table 9.52 Percentage number of internal rooms in each hospital

Feature	Hospital A	Hospital B	Hospital C
total number of rooms	1558	1481	2380
number of internal rooms	1136	1061	1575
%age of internal rooms	73%	72%	66%

In hospital C an analysis was made of reasons for likes and dislikes concerning finding the way. Out of the 34 respondents who complained about direction finding 31 were staff and three were patients (which dispels the idea that it is only patients and visitors who get lost). Several staff also said they were sometimes asked to assist patients and visitors who had difficulty in finding their way to particular departments.

Specific reasons given for difficulties finding the way in hospital C are given below. Some respondents gave several reasons:

Table 9.53 Reasons for difficulties finding the way (hospital C)

Reason	staff	patients	total
finding the way generally	20	3	23
signs confusing	10	1	11
lack of signs	9	1	10
layout complex/confusing	3	0	3
entrances	3	0	3
difficulty finding people	2	0	2
access to emergency dept. confusing	1	1	2
ward layout	1	1	2
Total	49	7	56

Six staff and one patient commented on 'ease of orientation' in hospital C and one staff member commended the 'location maps'. The complex grid layout of corridors was, however, said to cause problems for both patients and staff in getting to departments from main entrances, although a large courtyard visible from the main corridor helped people to get orientated. Location maps placed at strategic points were not considered helpful, nor were the code letters which were used to identify lifts. Numbers to identify floor levels were preferred. Floor directories in lifts were suggested. Some signs were poorly placed for easy visibility, and some were in shadow. Other suggested improvements were larger and clearer signs for the emergency department, to mark main entrances, and to indicate lifts. The use of colours to denote horizontal zones (rather than floor levels) was also proposed.

In hospital B some signs were difficult to read or hard to see due to poor location in relation to light fittings and glare from windows. Some signs were ambiguous in showing the direction to go, or in the words used. 'Ad hoc' signs were sometimes put up by staff in an attempt to be helpful, but these looked untidy and were often too small, badly placed or illegible. The main sign system was effective in giving directions at critical points, although most people preferred to ask the way rather than to work out which way to go from a floor directory.

In hospital A visitors sometimes had difficulty in finding their way to wards. This was partly due to a dual system of names and alpha-numeric codes for wards not readily understood by 'outsiders'. Some staff even said they got confused despite the letter codes progressing clockwise alphabetically round the hospital perimeter. The three courtyards helped people to establish a reference point and provided a relief from the internal environment, although a more distinctive character to each courtyard would have been welcomed. Lack of floor directories in lifts was again criticised, while the large floor directories in each main lift lobby (added after commissioning) were helpful although difficult to follow due to non-alphabetical listing of department names.

Several suggestions for improvement were made by respondents. Enquiry desk staff at two of the hospitals, for instance, suggested that it would be easier to give directions to enquirers if they were provided with small cards printed with a simple map of the hospital. 'You are here' could then be marked on the map together with the desired destination and the simplest route to follow.

'Vertical' hospitals were considered by some respondents to be easier to find the way around than horizontal hospitals. The main problem was waiting for lifts and remembering to get off at the right floor.

A point made by several staff in all three hospitals concerned difficulty in orientating themselves within suites of rooms in ward units which were similar (but not identical) in layout to other ward units in the hospital. Handed or 'mirrored' room layouts were felt to be particularly disorientating.

Doors which were not distinctive in labelling or colour gave no indication what was behind them. Door labels were frequently invisible until one was directly opposite the door. It would be easier to identify rooms if door labels could be seen as one approached from either side along the corridor.

Departments with double corridor or race-track layouts caused problems for staff trying to find other staff members. Corridors which looked the same everywhere were disorientating in two of the hospitals.

Colours could be used to give an individual character to a department or hospital zone, and enabled people easily to recognise where they were. The large number of internal rooms with no direct window to the outside or into a courtyard added to disorientation caused by complex layouts in deep-planned departments. All patients' bed rooms in general wards in all three hospitals, however, had a direct view of the outside, but most of the ward ancillary rooms were entirely internal. In hospital A a part-glazed partition divided the ward corridor from the multi-bed bedrooms and provided a view to the outside from the ancillary rooms. In hospital B a large proportion of the main out-patient department was internal and generated some adverse comments that it was like a 'rabbet warren'. In hospital C the internal intensive care and admission wards were criticised by both staff and patients.

Comments from respondents concerning disorientation in internal areas in the three hospitals were mainly about feeling detached from the outside world and not knowing the time of day. Adequacy ratings for finding the way were therefore compared with the relative proportion of external rooms in each hospital.

Table 9.54 Percentage of numbers of external rooms in hospitals & wards

	Hospital		
Level	A	B	C
	%	%	%
hospital generally	27	28	34
wards	33	33 acute 38 rehab.	34

The percentage of rooms with an outside view did not appear to improve ease of finding the way.

Table 9.55 Adequacy ratings for finding the way (highest percentages underlined):

Feature/level	Hospital A	Hospital B	Hospital C
	%	%	%
finding way, all levels	63	58	55
finding way, interior	63	57	42

Other features which might help people to find the way are 'colour' and visual interest or 'stimulation'. Respondents' adequacy ratings for these features were compared with ratings for finding the way, but no obvious relationship was evident.

Table 9.56 Adequacy rating comparisons (highest percentage underlined)

Feature (all levels)	Hospital A	Hospital B	Hospital C
	%	%	%
finding the way	63	58	55
colour	56	54	74
stimulation	59	58	68

Signposting intended to help people find their way round hospitals is often ineffective and confusing. Complex building layouts with many corners and no clear pattern of main streets and side streets adds to the disorientating effect caused by deep buildings with many rooms lacking external view and daylight. Monotonous colour schemes and poorly lit signs also add to confusion.

9.10 DISCUSSION ON COMPARATIVE EVALUATION OF HOSPITAL DESIGN IN USE

The three hospitals surveyed represented different approaches to design. The comparative survey sought to find out if these differences in design or in methodology had had any significant effect on how the hospitals were used or what their users thought about them.

In the first hospital (A), the planning of which started in 1963, the aim was to develop a method of functional briefing suitable for an innovatory design where many existing management and construction ideas were questioned and tested. It was planned by the authority which was also responsible for funding and approval, so that some of the planning constraints were untypical. The project was the redevelopment of an existing hospital so that it was possible to involve hospital staff in briefing, and this was exploited to an unusual extent (Green et al 1971, Keep 1972).

The second hospital (B) was planned in the period 1967 to 1970. It was a new hospital on a virgin site and there was no functional brief. Instead the consultant architects were given a schedule of accommodation by the government department concerned and requested to produce a detail building design and to supervise its construction. There was little involvement of user advisers in detail planning or in the development of operational policies (Bishop 1979).

Planning for the third hospital (C) was commenced in 1971 and proceeded very quickly using the combined experience of an overseas hospital planning consultant, a local firm of architects, and the state government public works architects. The previous experience of the overseas consultants was utilised to a considerable extent, and much of the detail design was the result of ideas which had been tested in other projects (Blandford 1975, Weeks 1973).

Due to the long time gap between briefing and evaluation in use, it was only possible to make a superficial comparison between the briefing methods used and user satisfaction in the form of opinions expressed by respondents. Since the hospitals were planned at different times in different countries, and in different political and social contexts, this also made such a comparison of doubtful value.

Perhaps the most important difference between approaches to briefing and design in the three hospitals (and in planning generally) is the degree to which information on problems, as distinct from solutions, influenced the decision process on which the outcomes depended.

In all three hospitals there were considerable differences in the degree of involvement of users in decision making, both in the initial planning, and later in detail design and commissioning. The differences in constructional design between the three hospitals also meant that there were varying degrees of provision for change, and thus more or less opportunity for users to modify their workspaces as a result of experience in use.

At hospital A a few senior staff were in the hospital at the time of the survey who were also involved in the original planning. These were: the head of the pathology department, the consultant obstetrician, the chief orthopaedic surgeon, several assistant matrons and senior sisters, and the domestic staff supervisor. Interviews with several staff who had been involved in the planning gave the impression of a higher level of satisfaction with the design than comments made by staff from the old hospital on the same site who had <u>not</u> been involved. New staff from 'outside', who had opted to come to the hospital because of its innovatory ideas or other attractions, seemed generally to be satisfied with the design.

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Selecting an appropriate range and number of specific topics for user evaluation of building environments is also a matter on which there are wide divergences of opinion. The following table shows the numbers of topics and scale intervals used in various hospital surveys of patients and staff over a ten year period 1969 - 1979. The rank order is determined by the number of items used in the questionnaires:

Table 9.57 Topics & interval scales used in nine hospital surveys

author	date	no. of items in Q	no.of scale intervals	respondent types
CURTIS	1979	13	2(yes/no)	patients (wards)
RAPHAEL	1969/77	26	2(yes/no)	patients (wards)
HOSPLAN	1979	47	3	patients (wards)
NOBLE*	1977	48	2 to 4	nurses (wards)
"		55	2 to 4	patients (wards)
RONCO	1971	58	7 & 11	patients (wards)
HUGHES	1978	58	2(yes/no)	patients (wards)
SEARS & AULD	1976	71	5	patients & staff (wards)
CANTER	1978	99	7	nurses (wards)
"		105	7	patients (wards)
HOSPLAN	1979	189	3	staff (whole hospital)

*interview survey

The survey questionnaires by Hughes, Sears & Auld, and Hosplan, included questions on the hospital as a whole; while those by Curtis, Raphael, and Hughes, included some aspects of management. The above surveys varied considerably in scope, methods, form of presentation, and usefulness of results, but the writer's view is that the simpler survey questionnaires were both better conceived in relation to their objectives, and produced more meaningful results which could be acted upon to improve effectiveness of design and management.

Analysing the questionnaire responses presented few problems in practice. The feature items which presented most uncertainty for patients were 'adaptability' and 'supervision', the former because patients had little experience of what this meant in practical terms, and the latter because this was not a matter which patients could see from the staff viewpoint. When asked to rate the items for importance, the items which scored highest for all three hospitals combined were 'cleanliness', 'safety' and 'convenience'.

The choice of four degrees of adequacy in the three hospital survey again presented few problems, the only difficulty being when different parts of the hospital or department were rated differently. The numbers 0 to 4 for the value scales were easily summed by inspection and kept the totals to manageable values for converting to percentage ratings. This also helped to maintain reliability.

Many kinds of comparisons and cross tabulations of data on user opinion would be both possible and perhaps informative in revealing areas of need for improvement in hospital planning or design. The data collected in all three hospitals nevertheless revealed a remarkable similarity in many respects despite the very different hospital designs, the different distribution of capital and running costs, and the different social and climatic contexts. They also revealed much about the kind of evaluative comments hospital users tend to make anywhere, and about the personalities of the respondents.

The simple survey and analytical methods described, and some of the data collected, show that both general problems as well as particular areas of dissatisfaction not otherwise apparent can be revealed. In open-ended questions it is important to the designer to get responses regarding satisfaction (or likes) as well as dissatisfaction (or dislikes). There will, however, usually be more adverse responses than complimentary ones, particularly from staff.

The considerable difference in adequacy ratings for some design features at different levels in the three hospitals appeared to justify making a distinction between levels whenever possible, despite the occasional difficulty of differentiating between 'hospital interior generally' and 'your department', or between 'ward generally' and 'your bedroom'.

Apart from comparing statistical data on capital and running costs, floor areas, utilisation, accidents, staffing, and workloads, the best way to make a comparative evaluation of the effects of hospital designs on their users appeared to be by interview surveys of the kind used in the three hospital study. Comparisons of statistical data on costs, areas and utilisation has shed relatively little light on interactions between function and design.

One of the difficulties associated with making comparative evaluations based on user comments and value ratings is that different people are evaluating different things in different contexts at different times. But even among controlled groups of people one can get very different comments and value ratings about the <u>same</u> things at different times. Nevertheless the results of the comparative studies indicated a relationship between some design characteristics in the three hospitals surveyed, and the responses of specific groups of respondents such as 'patients' and 'staff'. This information could be used by hospital planners and designers in making their designs more human and more responsive to changing needs.

An impression resulting from the survey is that many comments echoed those of staff and patients in new hospitals generally, even though there were considerable differences in the design of the three hospitals studied. There were, however, many differences in respondents' comments and value ratings for different parts of each hospital, and between staff at different levels in the hierarchy, particularly in hospital A. Further analysis of value ratings of respondents in each hospital could possibly shed more light on whether respondent's age, sex, occupation, status, education or hospital experience influenced their responses to any significant extent.

As the writer was involved in the briefing and design for Hospital A, some of the views expressed may be considered biased. Yet is is only by being personally involved in several projects where different methods of briefing and design have been adopted that any direct comparisons can be made between them.

CHAPTER TEN

WARD DESIGN EVALUATIONS - synopsis

This chapter describes three surveys of ward design. Two were carried out in hospitals in which there were two distinct types of ward layout: older open wards with poor provision of utility and toilet facilities, and more modern wards with beds arranged in rooms containing between one and six beds.

These two surveys sought opinions of patients and staff on aspects concerning privacy, supervision and convenience. Each ward was evaluated in terms of users' opinions concerning requirements such as patients' access to toilets, and quietness at night. Comparisons were made between staff and patients' ratings for adequacy of each ward, and between adequacy ratings and votes for the two most important features in an ideal ward.

A third survey was conducted by interviewing nursing and medical staff concerning their opinions on policies and trends in patient care affecting design of acute general wards. Suggestions were sought on aspects needing further investigation, particularly concerning the effects of design on nursing efficiency.

The survey findings confirm a desire of many nurses to return to the more open type of ward layout, but with more convenient facilities for patients and staff, and a means of providing for privacy for patients when needed.

10.1 EVALUATION OF WARD DESIGN

As reviewed in an earlier chapter, ward design has evolved in different parts of the world and in different hospitals as a result of a variety of influences such as climate, technical developments, social changes and economic pressures. Two of the most important factors which have influenced ward design are provision for patient privacy and means of ensuring adequate supervision of patients by staff.

Privacy for patients is concerned not only with visual seclusion for activities such as undressing, and using the toilet or bedpan, but also with choosing whether to enter into social intercourse with one's neighbour, or how much one can see, hear or smell a patient in an adjacent bed undergoing a clinical examination.

Supervision on the other hand is not just a matter of nursing staff being able to see what is going on in the ward by day and at night, but is also aided by ability to hear and smell what is happening to patients. Absence of sound may be an important warning in an unconscious patient, and smell may be the first sign that a patient has vomited or set fire to the bed-clothes.

One of the most frequent complaints by patients in hospital wards is disturbance from causes such as rattling trolleys, noisy cleaning machines, or other patients' TV sets and radios being used without earphones. The noisiness of a ward is also affected by the type of flooring used and whether the building is air-conditioned.

Comfort and convenience are two other conflicting requirements influencing ward design, both in terms of general layout, and in respect of details of fittings and finishes. Easy access to toilets, appropriate lighting to read by in bed, and convenient storage for personal belongings are matters which greatly concern patients. Staff, on the other hand, require easy access to patients' bed areas, a minimal amount of unnecessary movement, and temperature conditions which are unlikely to coincide with patients' preferences.

Many open wards built in the mid or late 19th century are still in use today, either in virtually their original form, or in a modified layout such as subdivided four bed bays. More modern wards, particularly those designed since World War II, provide the bulk of their accommodation in four or six bed rooms as well as a proportion in single or private rooms. Higher expectations of comfort and convenience in hospital have influenced the move towards 'hotel' style bedroom accommodation with ensuite toilets. Some argue that 'public' ward accommodation is an anachronism in an advanced society and that all patients should be accommodated in private single bedrooms if they so desire (Burrough 1976). It has also been suggested that wards with all-single-rooms are more efficient in terms of greater flexibility in allocation of beds, and that they provide better control of hospital acquired infection.

A number of studies of patients' and staff opinions of ward design conducted in recent years, particularly in Britain (Noble & Dixon 1977, Raphael 1977, Sears & Auld 1976), have suggested that the older more open types of ward possess qualities not provided by newer wards with 'higher' standards of comfort and convenience. Reasons given for preferring open wards were better supervision, easier access to patients, better social atmosphere (especially cooperation between patients and staff), and, perhaps surprisingly, more privacy. The last point is explained by the masking effect of background noise in the open ward. It is also easier to avoid unwanted contact with others in a crowd than in a room shared with three other people.

Few evaluation surveys of the functional effects of ward design have been conducted in Australia, exceptions being an extensive general survey of inpatient opinions at Flinders Medical Centre by Hughes in 1978, and a comparative survey of nurses' opinions of ward design at Flinders Medical Centre and Modbury Hospital by Shinnick in 1978. The NSW Hospital Planning Advisory Centre has conducted some evaluation surveys in selected new hospitals in Sydney and elsewhere, but these have not been published for reasons of legal liability for any implied criticism of the professional consultants or commercial products involved.

Because the results of these evaluation studies, and those mentioned earlier, were somewhat inconclusive, and because most were conducted outside Australia, it was felt worthwhile to conduct some comparative surveys in a number of Australian wards of differing design. The purpose was to test the applicability of the earlier findings, and to establish general principles on which ward design development could be based, particularly as it affects costs and staffing levels.

Guidance on ward design from sources such as the British Department of Health and Social Security (1968), the New Zealand Department of Health (1972), and the New South Wales Hospital Planning Advisory Centre (1977), all show a preference for a mix of single and multi bed rooms in units of about 30 beds, with a staff base located fairly centrally, and with limited direct observation of some beds in one or two of the multi-bedded rooms.

Some recent innovative designs have varied this pattern somewhat, particularly in respect of the arrangement of toilet facilities, and in the grouping of bedrooms around the staff base and utility areas. Some of these designs have shown a tendency to return to the older more open type of ward layout (Curry 1980).

The two design-in-use surveys described below were intended to develop a simple method by which ward designs could be described, and their users' opinions sought on issues such as privacy and supervision. A further stage of research was to seek the opinions of senior nurses and medical staff on design features which they considered contributed most to efficiency in operation and to explore how ward design could be made more adaptable to new methods of nursing education and practice.

10.2 THE TWO PILOT SURVEYS

Introduction

The St. Thomas' Hospital ward evaluation (see chapter 6) showed that some modern ward designs were considered by patients and staff to be less satisfactory than older more open types of ward. Was this also true for Australian hospitals? The type of detailed survey conducted at St. Thomas' could not be undertaken with the limited resources available, so a simple survey method was developed based on that used in the comparative surveys described in the previous chapter.

Aims and methods

In November 1979 and March 1980 two pilot surveys of user opinions on ward design were conducted at a major teaching hospital in Sydney and at a smaller country hospital outside Sydney.

The aim of the surveys was two-fold:

1) to develop a self-administered questionnaire which could be used with minimal hospital staff involvement and which could be analysed using simple manual or computer techniques

and 2) to use the pilot survey results to explore differences in patients' and staff opinions on suitability of 'open' versus 'subdivided' or 'separate room' ward designs with respect to privacy, supervision, and other features such as comfort and convenience.

The two hospitals were selected because:a) each contained two basic types of ward which were radically different in layout and design, b) one hospital was a large teaching hospital and the other a smaller country hospital, c) one hospital was conveniently located for the survey team, and d) senior staff in the other hospital were interested in the results of the survey findings as a basis for renovation proposals.

Survey procedures

The survey visits were preceded by discussions with senior medical, nursing and administrative staff in the hospitals to explain the purpose of the survey and the form of questionnaire proposed. Permission to interview patients in the teaching hospital was approved by the hospital board and the relevant committees.

Briefing sessions were held with senior ward nursing staff immediately prior to visits to the wards. Details of the questionnaires were explained, and arrangements worked out for distributing questionnaires and for staff to be relieved temporarily to complete their questionnaires.

Staff needed about 10 to 15 minutes to fill in a questionnaire, one of the two members of the survey team being available to answer any queries. The other survey team member visited patients in turn in each ward, inviting them to participate in the survey, explaining its purpose, answering questions, and collecting completed questionnaires. Some patients preferred to complete their questionnaire while a survey team member was in attendance, others preferred to think about it and complete it at leisure. Addressed envelopes were supplied for the completed questionnaires in order to maintain confidentiality and to facilitate the return of questionnaires completed after the survey team had left the hospital.

The surveys were intended to cover as complete a sample of respondents as possible in each of the wards surveyed. Problems were, however, experienced in obtaining responses from a proportion of patients for a variety of reasons:- too ill, in pain or discomfort, sleeping, not able to write, or not able to understand English sufficiently.

A high proportion of nursing staff completed questionnaires satisfactorily, but only a few responses were obtained from ancillary, clerical, cleaning, medical and para-medical staff who worked in the wards. There was some apparent distrust concerning confidentiality of the responses, particularly by some migrant domestic staff at one hospital. A few responses were also obtained from patients' visitors.

Due to staff working hours, questionnaires had to be left for the night shift to fill in and were collected the next day. Several medical and para-medical staff were invited to complete the questionnaire and in some cases did so in considerable detail.

Details of each ward were recorded by one of the research team on a proforma (see appendix E.7). Most of the details were obtained by observation (eg the number of beds which could be seen easily from the nurses' station). Other details concerning staffing and policy (eg use of treatment rooms) were obtained from the sister in charge of the ward. Colour photographs were taken of each ward from a variety of positions to record the appearance of the ward at the time of the survey, and to act as an aide memoire on design details. Floor layouts of each ward were also obtained, although in two cases these were only rough sketch drawings as no accurate scale drawings were available. A detailed measured survey of these wards was not attempted due to lack of time.

The questionnaires

The first (teaching hospital) ward survey questionnaire was developed from one used previously by the writer in the comparative survey of design of three new hospitals (see chapter 9). The ward survey questionnaires consisted of five main sections:

1) a brief description of the ward or room occupied by the respondent,
2) details of the respondent including age, sex, education, country of birth and previous hospital experience,
3) statements on likes and dislikes concerning the ward design and suggestions for improvement,
4) opinions on adequacy of specified design features such as visual and auditory supervision and personal privacy,
5) opinions on the relative importance of the specified design features in an 'ideal' ward.

The first questionnaire (see appendix E8) asked similar questions concerning both patient and staff respondents. All respondents were asked to rate each of 25 specified design features (such as 'privacy when using bed pan/urinal'), firstly for importance, and secondly for adequacy. Comments were also invited.

A five point scoring system was used whereby respondents wrote '4' for very important/adequate, '3' for important/adequate, '1' for important/inadequate, and '0' for very unimportant/very inadequate. A '2' was used for don't know. This scoring system allowed the total scores for each group of respondents to be simply converted to percentage mean scores for each feature.

Problems with the first version of the questionnaire suggested that some respondents, particularly patients, had difficulty in distinguishing between 'importance' and 'adequacy'. In some cases respondents only rated for the first of these two aspects, with the probability that they were rating for 'adequacy' rather than for 'importance'. For the second survey a revised questionnaire was produced (see appendix E9). This was simplified, firstly in terms of the description and range of features to be rated, and secondly so that patients were only asked to say whether they thought a feature such as privacy was sufficiently good or not, and if not in what way it could be improved. Patients were then asked to nominate three out of fourteen features as being the 'most important' in an ideal ward.

While the response to the simplified questionnaire was much better in terms of reliability, it did not give a sufficient degree of detail in respect of the components of a feature such as privacy. Nor did it provide a basis for comparison between the importance and adequacy ratings by staff and patients.

The scoring method for the staff respondents' adequacy rating question was also modified to a tick in one of four columns for very good, good, poor, very poor. No option was given for don't know. The ticks were subsequently converted to scores of 3, 2 1 and 0.

An additional feature in the patients' version of the second questionnaire was a request for information concerning their insurance classification. This was to establish whether patients classified as privately insured differed in their attitudes to privacy.

10.3 TEACHING HOSPITAL SURVEY

Description of wards

Three modern wards in the teaching hospital were surveyed. All were of similar layout - a single corridor with separate bedrooms and ancillary rooms on each side. In the older section of the teaching hospital three 'mostly open' wards were surveyed, one of which contained an experimental area originally used as a mock-up for the new wards.

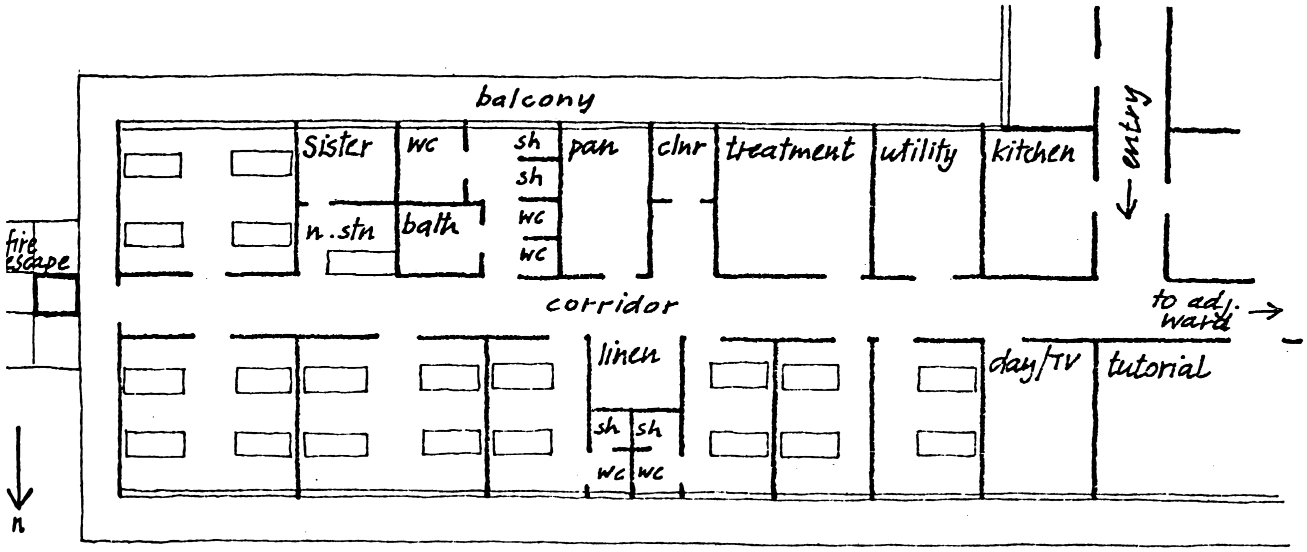


Fig. 10.1 Teaching hospital - new wards
approx area/bed 260 sq ft (24 m²)

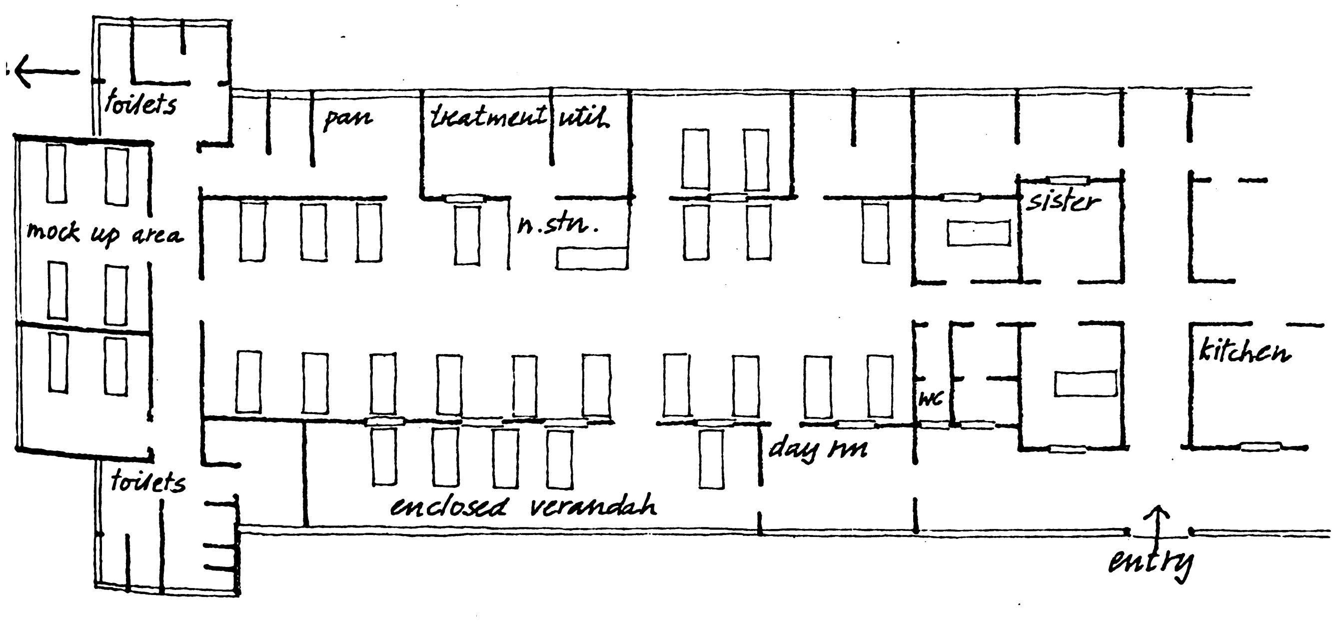


Fig. 10.2 Teaching hospital - old wards
approx area/bed 210 to 270 sq ft (19.5 to 25.0 m²)

The allocation of beds in the new and old wards is tabulated below:

Table 10.1 Bed allocation

Item	new wards 4	6E	6W	old wards 2M	2F	3
specialty	gastro-enterology	med.	med.	med.	med.	cardio-thoracic
sex	m/f	m/f	f	m	f	m/f
beds in rooms:						
1				3		
2	16	8	12	4	6	5
4	16	12	8	4		4
5				5		
7+				17	7	16
Total	32	20	20	33	13	25

Nurses' stations in the newer wards were located in a bay off the corridor and opposite a four-bed room (or a pair of two-bed rooms). Only one or two patients in bed could be seen from the nurses' station. In the older wards the nurses' stations were in the open ward area. Most of the beds in the open area were visible from the nurses' stations. One of the nurses' stations (in ward 2M) was partly enclosed by glazed partitioning.

The degree of observation in the two types of ward is compared below.

Table 10.2 Beds visible from various locations in ward.

Total number of patients seen from:	new ward 4	6E	6W	old ward 2M	2F	3
nurses stn. - sitting	-	2	-	9	7	14
nurses stn. - standing	-	-	-	9	7	15
from corridor/aisle	-	-	-	20	7	16
from bedroom/bay doorway	16	10	10	31	9	25
Total beds in ward	32	20	20	33	13	25
Percentage seen/total	50%	60%	50%	94%	69%	100%

A push button buzzer call system was in use in all wards except in the mock-up area of ward 2M which also had a two-way talk system.

Toilets in the new wards were located in a toilet area across the corridor from the bedrooms. Two two-bed rooms had access to ensuite toilets. Toilets in the older wards were located in rather cramped accommodation at the outer corners of the wards (see figs. 10.1 & 10.2)

A treatment room was provided for one pair of the new wards but it was only used for difficult or unpleasant procedures. The other new ward did not have use of a treatment room. Only one of the older wards had a treatment room which was located behind the nurses' station. It also was only used for more difficult procedures.

All wards had a day/TV room except one of the older wards which had only a waiting room which could be used as a sitting space.

View from patients' beds in the new wards depended to some extent on the floor level, and on which side of the building the bed rooms were sited. All the patients had a view of sky, trees and rooftops, but only those patients near the windows could see activity on the ground or in the street. Because the older wards were at ground level a majority of patients had a view of some outside activity, and patients in all beds had at least a peep of the sky.

Floor finishes in the new wards were terrazzo throughout. In the older wards a composition flooring was used in wards 2M and 3, but ward 2F was carpeted throughout except in the workroom and toilets.

Privacy screening to beds was by means of semi-opaque curtains in the new wards, and by opaque curtains in the old wards.

Bedhead lighting in new wards was by a fixed-focus recessed ceiling fitting over the head of the bed. In the old wards a wall mounted louvred light fitting was provided over the beds.

Wardrobes in the new wards were built-in and located on the corridor wall side of bedrooms. No wardrobes were provided in the older wards. All bedside lockers were the standard contract metal 3-drawer type.

Ward management and staffing

Nursing was by job assignment in the new wards by day and by night. In the old wards team nursing or patient assignment was adopted by day and job assignment at night.

The numbers of senior and junior nursing staff allocated for duty for each shift in each ward are tabulated below:

Table 10.3 Staff allocations in new and old wards

	new wards					
	4		6F		6W	
Shift	sen.	jun.	sen.	jun.	sen.	jun.
morning	2	4	1	2	2	2
afternoon	2	4	1	2	1	2
night	1	3	1	1	1	1
Total	5	11	3	5	4	5

	old wards					
	2M		2F		3	
Shift	sen.	jun.	sen.	jun.	sen.	jun.
morning	2	1+1	1	1	3-4	3
afternoon	1	1	1	1	2-3	3
night	1	½	1	½	1-2	1
Total	4	3½	3	2½	6-9	7

The total 'beds to nursing staff' ratio in each ward was calculated (see table 10.4). General medical wards had higher bed/staff ratios than special wards. The 32 bed gastro-enterology ward (4) was in fact two 16 bed sub-units end to end and this may have partly accounted for its lower bed/staff ratio. The 33 bed older type medical ward had the highest bed/staff ratio, due possibly to its larger number of beds and more open layout.

Table 10.4 Bed/staff ratios in new and old wards

	new wards		
	4	6E	6W
beds/n.staff	32:16	20:8	20:9
factor	2	2.5	2.2

	old wards		
	2M	2F	3
beds/n.staff	33:7.5	13:5.5	25:14.5
factor	4.4	2.4	1.7

The respondents

The questionnaires were given to all available respondents in the teaching hospital, of whom 59 were in new wards and 56 in older wards. There were 30 patients and 1 visitor who responded in the new wards and 22 patients and 2 visitors in old wards. Males and females were approximately equally balanced in new wards, but nearly three-quarters of the patients in the old wards were male. Only patients who were too ill or unable to respond were excluded. All nursing staff on duty were included. Sixty staff responded altogether, of whom 28 were from new wards and 32 from old wards. Nearly one fifth of staff in both types of ward were male.

Respondents' age groups were recorded and are tabulated below in relation to the type of ward occupied and occupational group. A rather higher proportion of older staff in older wards is evident.

Table 10.5 Percentage of respondents by age and occupation

	patients		staff			
Age groups	new wards	old wards	new wards		old wards	
under 25	-	-	48	} 96	40	} 72
26-40	7	17	48		32	
41-64	73	75	4		28	
65+	20	8	-		-	
	100	100	100		100	

A similar number of staff in each occupational category were asked to complete questionnaires in each type of ward.

Table 10.6 Staff respondent occupational categories

	ward type			
category	new	old	both	%age
medical	6	5	11	18
nursing	17	19	36	60
clerical	3	1	4	7
technical	-	2	2	3
domestic	2	5	7	12
Total	28	32	60	100

Due to incorrect completion of questionnaires by some respondents, only 61% of patients' responses and 82% of staff responses could be included in the analysis of adequacy ratings. Although this was disappointing it was not considered sufficiently serious to invalidate the general conclusions concerning attitudes to privacy and supervision. The reason for failure to complete the questionnaire correctly related to the value rating questions on 'importance' and 'adequacy' which a proportion of respondents appeared to confuse. The importance rating column appeared first on the questionnaire and this was the only column completed by some respondents. Where this occurred the values were treated as adequacy ratings.

Patients' preferences

Patients were asked the size of bedrooms they preferred in relation to the size of bedroom they occupied:

51% said number of beds in room occupied was preferred
22% said too many beds in room occupied
11% said too few beds in room occupied
16% gave no response
100

Patients were also asked to say what they thought was the ideal number of beds in a room:

39% said 4 beds
37% said 2 beds
13% said 6 beds
4% said 10 beds
4% said 1 bed
2% said 7 beds
100

Patients were asked to state what type of bedroom they preferred.

Table 10.7 Patients' bedroom preferences

Preferences	no. of patients from: old wards	new wards
54% preferred sub-divided wards(1)	15	15
22% preferred open wards(2)	5	7
11% preferred separate rooms(1)	6	-
13% did not respond	5	2
100		

NB (1) As the question only gave as examples 'open' or 'sub-divided' the responses were likely to be biased in favour of sub-divided rather than separate rooms.

(2) Some patients giving a preference for open wards also stated that their ideal room size was 4 beds, suggesting that they considered an open ward should either be in 4-bed bays or that they regarded a 4-bed room as an open ward.

Reasons given by patients for preferring sub-divided wards were that they provided for privacy (12 patients) and for quietness needs (6 patients). Four patients liked open wards for their companionship, and five patients said they were friendly; one patient gave 'better attention' as the reason. Two patients said they preferred 2-bed rooms as being quiet and less boring than single rooms, and two other patients said they preferred 4-bed rooms but gave no reason.

Patients were asked to provide a brief history of their previous inpatient experience to see if this bore any relationship to their expressed preference for type of ward accommodation. No such relationship was detectable.

Table 10.8 Patients' previous experience of ward types

Type of wards	no. of respondents		
	new	old	total
open and sub-divided or open and separate rooms	8	10	18
sub-divided and/or separate rooms	5	7	12
open wards only	7	4	11
open, sub-divided and separate rooms	4	2	6
no previous experience	7	1	8
	31	24	55

Patients with experience of all types of ward accommodation almost invariably recorded a preference for the type of ward they were currently occupying. Patients with no previous experience gave a similar preference.

Patients were asked to say what features they liked most in the ward they occupied. Seventy eight percent of patients responded and a total of 27 features were listed. The nine most frequently cited are listed below.

Table 10.9 Features liked by patients

Feature	ward new (n=31)	old (n=24)	total (n=55)
airy	4	7	11
spacious	5	5	10
ensuite toilet	9	-	9
light	4	5	9
view	3	2	5
open	1	4	5
quietness	1	3	4
carpet	-	3	3
privacy	1	2	3

Both new and old wards appeared to be liked almost equally on account of their airiness, spaciousness, lightness and view. The new wards were preferred for their ensuite toilets, and the old wards for their openness, quietness and carpeting.

Forty five percent of patients specified their least liked design features.

Table 10.10 Features disliked by patients

Feature	wards new (n=31)	old (n=24)	total (n=55)
colourless decor	2	3	5
too small/overcrowded	4		4
floors cold	3		3
no view	3		3
external noise	2		2
large open ward		2	2
swinging door	2		2
other features (mentioned only once)	4	6	10
	20	11	31

The new wards attracted nearly twice as many adverse comments as the old wards from only 23% more patients. The comment about rooms being too small in the new wards was due to the fact that the two-bed rooms were originally intended as single rooms. All floors in the new wards were terrazzo, hence the complaints about 'cold floors'.

Only 9% of patients made a response to the invitation to make general comments on ward design. Their comments added little to the previous answers on likes and dislikes. Among the points mentioned were the need for single rooms, a solarium, and handrails in the corridor of the new wards. In the old wards the need for privacy, quietness and good artificial lighting was emphasised.

Staff preferences

Staff were asked to say what they thought was the ideal number of beds in an 'adult acute ward unit' and to give reasons. The answers appeared to vary according to the interpretation of 'ward unit' as some respondents seemed to think that 'unit' referred to a room. The preferences ranged from 2 to 40 beds with a higher proportion of respondents preferring 10 to 16 rather than 20 to 26 beds.

Table 10.11 Staff preferences for ward unit size

Size range	new (n=28)	old (n=32)	total (n=60)	%
2-8 beds	7		11	18
10-16	9	5	14	23
20-26	4	10	14	23
30+	-	2	2	4
Total	20	21	41	68
nil or evasive response	8	11	19	32

The reasons given for preferences of 'wards' of 8 beds or less were quietness, privacy, companionship, better nursing care and 'more manageable'.

Wards of 10 to 16 beds were considered ideal for delivery of adequate care, individual patient contact, easy accessibility and observation, appropriateness for team nursing, and socially manageable for patients.

Wards of 20 to 26 beds were considered ideal for similar reasons to the 10-16 bed group, but in addition allowed for efficient use of staff while providing for good access from a single nurses' station.

Two respondents (both doctors) said they considered that 30-40 beds was ideal for 'good' patient care and 'convenient' medical care, with 40 beds as the upper limit.

Staff were also asked about their preferences in ward design. To establish whether experience in working in different kinds of ward design affected staff respondents' opinions, the respondents were grouped according to experience of open or sub-divided/separate room wards.

Table 10.12 Staff preferences for ward design type

		preference for			
	no. of	open		sub-divided	
past experience	respondents	no.	%	no.	%
open + bays + rooms	26	15	58	11	42
open + bays or rooms	5	3	60	2	40
bays and/or rooms	8	5	63	3	37
open only	2	2	100	0	0
no previous experience	6	4	67	2	33
all types of experience	47	29	(62%)	18	(38%)

Five respondents in older wards suggested that a combination of ward design types was preferred. Although the question only gave 'open' and 'sub-divided' as examples of ward types, the preference of staff for open wards was significant regardless of experience.

Open wards were preferred for observation, better patient care, friendliness, greater efficiency in use of staff, less likelihood of tasks or patients being forgotten, and convenience. Observation was given as a reason for preferring open wards by 21 respondents, seven from the new wards, and 14 from the old open wards.

Staff who preferred sub-divided wards said they allowed easy observation of patients and staff, yet catered for patients' privacy needs and quietness Open wards were preferred for nursing high dependency patients, whereas sub-divided wards were more appropriate for lower dependency patients. Staff likes and dislikes are shown in the following tables.

Table 10.13 Staff likes

Feature	wards new (n = 28)	old (n = 32)	total (n = 60)
easy observation		19	19
open ward		10	10
privacy	10		10
central nurses station		6	6
large rooms	4	2	6
clean/tidy	4		4
modern	3		3
ensuite toilets	3		3
nothing liked	5		5
other features (mentioned once or twice)	6	5	11
no response	2	6	8

Table 10.14 Staff dislikes

Feature	wards new (n = 28)	old (n = 32)	total (n = 60)
poor observation	15		15
excessive walking	10		10
lack of privacy	1	10	11
lack of toilets/basins	5	3	8
not enough space in emergency	5	2	7
noise	2	5	7
only one treatment room	5		5
doors on 2 bed rooms	5		5
separate rooms		4	4
waste of space	3		3
no single rooms	3		3
light disturbs patients		3	3
other features (mentioned once or twice	8	17	25
no response	4	4	8

About half of the staff respondents made further comments on ward design, either in relation to the ward they worked in or suggestions for improving ward design generally. The following were the main additional points made by staff respondents in both new and old types of ward:

work areas for medical and nursing staff should adjoin

all wards should have separate rooms for noisy, dying or unconscious patients

emergency equipment should be easily visible and accessible

there should be a 'retiring' room for staff to get away from the ward periodically

window cills should be lower to enable patients to see out

blackout facilities are needed

more space needed at sides and ends of beds (relates to 2-bed rooms)

wider doors on showers (for access by sanichairs)

provide motel accommodation for relatives.

Ratings for adequacy

Patients and staff were asked to rate their wards for adequacy in respect of 25 specified design features affecting privacy, supervision and convenience. Ratings for adequacy were converted to percentages of the highest possible scores for each feature and 'league tables' compiled in descending order of votes by respondents in the new wards. These data are presented separately for patients and staff.

a) Patients' adequacy ratings

The patients' percentage adequacy ratings are shown in the following three tables together with the differences in percentage ratings between new and old wards (see footnote below table 10.24).

Table 10.15 Patients' percentage adequacy ratings for privacy

Feature	wards new (n=17)	wards old (n=16)	difference new-old
privacy for treatments	79	87	-8
belongings	72	66	6
bed pan	68	75	-7
toilet	68	64	4
visitors	68	75	-7
sleep	68	69	-1
space	66	78	-12
washing	66	78	-12
dressing	66	69	-3
TV	57	48	9
being alone	54	40	14
radio	47	47	0
overall for privacy	64.9	66.3	-1.4

Patients rated 'privacy for being alone' and 'watching TV' as markedly better in the new wards than in the old wards, while 'privacy for personal space' and 'washing' were markedly better in the old wards.

Table 10.16 Patients' percentage adequacy ratings for supervision

Feature	wards new	wards old	difference new-old
patient attract nurse	84	70	14
patient call nurse	81	72	9
nurses help nurses	74	88	-14
nurses move easily	74	88	-14
nurse hear patients	68	73	-5
nurse see patients	65	56	9
patients help patients	65	67	2
patients talk to nurse	38	20	18
overall for supervision	68.6	66.75	1.9

New wards were rated much better than old wards for 'patients' ability to talk to the nurse by call system' and for 'patients' ability to attract the nurse'. Old wards fared better than new wards for 'nurses' ability to help each other' and 'ability to move around the ward easily'. 'Patients' ability to talk to nurses' was poorly rated in both new and old wards.

Table 10.17 Patients' percentage adequacy ratings for convenience

Feature	wards new	wards old	difference new-old
call system	83	63	20
toilet	73	72	1
locker	70	83	-13
wardrobe	76	42	34
day room	64	55	9
overall for convenience	73.2	63.0	10.2

New wards were markedly better than old wards for convenience of access to wardrobes and in use of the call system.

b) Staff adequacy ratings

Table 10.18 Staff percentage adequacy ratings for privacy

Feature	wards new (n=24)	wards old (n=26)	difference
dressing	71	71	0
treatments	69	64	3
TV	68	60	8
toilets	67	60	7
space	65	57	8
belongings	65	68	-3
bed pan	65	66	-1
washing	65	69	-4
visitors	63	67	-4
being alone	53	27	26
radio	51	62	-11
sleep	47	49	-2
overall for privacy	62.4	60.0	2.4

Staff rated 'privacy for being alone' as markedly better in the new wards than the old open wards.

Table 10.19 Staff percentage adequacy ratings for supervision

Feature	wards new	old	difference
patient summon nurse	74	71	3
nurse help nurse	57	82	-25
nurse move easily	50	78	-28
patients help patients	49	68	-19
patients attract nurse	37	76	-39
nurse hear patients	33	80	-47
patient talk to nurse	24	19	5
nurse see patients	15	80	-65
overall for supervision	42.4	69.25	-26.9

For all but two of the eight supervision features staff rated the old open wards as very much better than the new wards, the greatest differences being for 'nurse able to see patients' and 'nurse able to hear patients'.

Table 10.20 Staff percentage adequacy ratings for convenience

Feature	wards new	old	difference new-old
call system	78	79	-1
day room	72	72	0
locker	70	49	21
toilets	70	39	31
wardrobe	62	32	30
overall for convenience	70.4	54.2	16.2

Convenience for access to lockers, toilets and wardrobes was considered by staff as greatly superior in the new wards compared with the old wards.

Staff clearly assessed the new wards as deficient in respect of supervision, three of the eight features being rated as inadequate, and two as very inadequate. Only one feature in the old wards ('patients able to talk to nurse by call system') was rated as very inadequate because the call system was mainly 'buzzer only'.

The old wards were rated as inadequate for privacy for 'patients able to be alone', and both wards as just less than adequate for 'undisturbed sleep and rest'.

Staff rated three convenience features in the old wards as inadequate - 'access to locker', 'toilets' and 'wardrobes'.

'Ease of access to call system' in both ward types was rated highest for adequacy by staff, followed by 'patients ability to summon nurse by call system'.

Patients' and staff importance ratings

Patients and staff were also asked to rate each of the 25 listed features for importance in an ideal ward (see appendix E[10]). Percentage ratings above 90% and below 50% are summarised in the tables below:

Table 10.21 Patients' four most important features in an ideal ward.

	Feature	% mean rating
S*	patients able to attract nurses' attention	95
S	patients able to summon nurse by call system	95
S	nurses' ability to move round the ward easily	94
P	patients able to sleep/rest undisturbed	92

*P = privacy
S = supervision
C = convenience

Table 10.22 Patients' three least important features in an ideal ward

Feature		% mean rating
p	privacy when listening to radio	46
p	privacy for being alone	46
p	privacy when watching TV	38

Table 10.23 Staff's six most important features in an ideal ward

Feature		% mean rating
s	nurses able to see patients	97
p	patients able to sleep/rest undisturbed	95
s	nurses able to help each other	94
s	nurses able to hear patients	93
s	nurses able to move round ward easily	93
s	patients able to attract nurses' attention	92

The feature which staff rated as least important was 'patients able to talk with nurse by call system' (48%).

Comparisons were made between patients' and staff ratings for importance. The largest differences in ratings are shown below.

Table 10.24 Greatest differences between patients' and staff mean ratings for importance

Respondent category and feature	difference
1) Patients' ratings more than 6% higher than staff:	p-s %
patients able to talk to nurse by call system	9*
patients able to summon nurse by call system	7
privacy of personal belongings	7
2) Staff ratings more than 10% higher than patients':	p-s %
privacy for patients being alone	-20
privacy when watching TV	-18
privacy of patients' personal space	-14
nurses able to help each other	-11

Key p = patients s = staff

* Footnote: Quite large percentage differences in adequacy ratings can arise from small variations in the number of responses in each category. Small percentage differences should therefore be ignored in interpreting results.

Comparison of adequacy and importance ratings

The relative percentage ratings for importance and adequacy by each group of respondents in both types of wards are compared below. The full data for each respondent group are shown in appendix E.[10]

Nearly all features in both ward types were rated by patients as considerably less adequate than the equivalent ratings for importance.

Table 10.25 Greatest differences between importance & adequacy (patients)

	Features for new wards	% difference i-a
P	patients able to sleep and rest undisturbed	22
S	nurses able to help each other	22
S	nurses ability to move around the ward easily	22
S	patients able to talk to nurse by call system	21
	for old wards	
S	nurses able to see patients	35
S	patients able to talk to nurses by call system	35
C	convenient use of call system	31
P	patients able to sleep/rest undisturbed	25
S	patients able to attract nurses' attention	25
S	patients able to summon nurse by call system	23

Table 10.26 Features patients rated higher for adequacy than importance

	Features in new wards	% difference i-a
P	privacy when watching TV	-14
C	convenient access to wardrobe	-6
P	privacy for patients' belongings	-1
	in old wards	
P	privacy when watching TV	-15
P	privacy when listening to radio	-11
C	convenient access to locker	-5
P	privacy when washing	-1

Nearly all features in both ward types were rated by staff as considerably less adequate than their equivalent ratings for importance.

Table 10.27 Greatest differences between importance & adequacy (staff)

Features for new wards		% difference i-a
S	nurses able to see patients	84
S	nurses able to hear patients	61
S	patients able to attract nurses attention	53
P	patients able to sleep/rest undisturbed	51
S	nurses able to move around ward easily	44
S	nurses able to help each other	37
for old wards		
P	patients able to sleep/rest undisturbed	43
P	patients able to be alone	37
C	easy access to toilet	37
C	easy access to wardrobe	31
P	patients personal space	30

Table 10.28 Features staff rated higher for adequacy than importance

Features in new wards	% difference i-a
privacy for watching TV	-4
in old wards	
privacy when listening to radio	-19
privacy when watching TV	-13
patients able to help each other	-3

Comparisons between patients' and staff ratings

Comparisons between overall percentage adequacy ratings by patients and by staff for privacy, supervision and convenience are summarised below.

Table 10.29 Differences in adequacy ratings between old and new wards

Main feature	difference in adequacy ratings (old - new)	
	by patients	by staff
privacy	-1.4%*	2.4%
supervision	1.9%	-26.9%*
convenience	10.2%	16.2%

(*minus %ages = new wards less adequate than old wards)

Staff rated the new wards as very much less adequate than the old wards for supervision generally. Both staff and patients rated the new wards as considerably more adequate than old wards for convenience.

Comparisons were also made between overall importance and adequacy ratings for the three main features in the two types of ward by each group of respondents.

Table 10.30 Difference in percentage ratings between importance and adequacy.

	by patients		by staff	
Main feature	new wards	old wards	new wards	old wards
privacy	7.9	5.7	19.4	17.3
supervision	16.1	17.8	37.9	14.0
convenience	6.2	10.2	13.0	23.4

By far the greatest difference between overall importance and adequacy ratings was for staff rating of supervision in the new wards.

Staff were generally more critical of the wards they worked in, compared with their ideal, than were patients.

Table 10.31 Difference between importance and adequacy ratings for all features (patients and staff)

patients (n=33)		staff (n=50)	
new wards (n=17)	old wards (n=16)	new wards (n=24)	old wards (n=26)
10.4	10.1	25.5	17.6

Staff appeared generally more critical in the new wards than in the old wards judging by the difference between their overall percentage ratings for adequacy and importance.

Statistical comparisons

Spearman's test for rank order correlation was applied to comparisons between importance and adequacy ratings of staff and patients.

Table 10.32 Summary of rank order correlation tests

Privacy n=12 features rated

	Values	
Importance		
patient/staff - new wards	0.948	significant at 1%
patient/staff - old wards	0.794	" at 1%
staff: old wards/new wards	0.937	" at 1%
patients: old wards/new wards	0.841	" at 1%
Adequacy		
patients/staff - new wards	0.131	not significant
patients/staff - old wards	0.374	"
staff: old/new wards	0.371	"
patients: old wards/new wards	0.477	"

(see over for continuation of table)

Supervision n=8 features rated

	Values	
Importance		
patients/staff - new wards	0.488	not significant
patients/staff - old wards	0.363	"
staff: new/old wards	0.815	significant at 5%
patients: new/old wards	0.554	not significant
Adequacy		
patients/staff - new wards	0.631	not significant
patients/staff - old wards	0.607	"
staff: new/old wards	0.054	"
patients: new/old wards	0.592	"

Convenience n=5 features

	Values	
Importance		
patients/staff - new wards	0.5	not significant
patients/staff - old wards	0.6	"
staff: new/old wards	0.95	significant at 5%
patients: new/old wards	0.8	not significant
Adequacy		
patients/staff - new wards	0.35	not significant
patients/staff - old wards	0.9	significant at 5%
staff: new/old wards	0.4	not significant
patients: new/old wards	0.5	"

Possible relationships were explored between personal characteristics of respondents and their attitudes to features of ward design. Respondents' age, level of education, previous hospital experience, and patients' length of stay and degree of ambulation were correlated with their ratings for importance and adequacy.

For patients there was a significant correlation between age and overall adequacy rating. There was no correlation between length of stay and overall adequacy ratings, but there was some correlation between adequacy ratings for privacy and length of stay. There was a negative correlation between adequacy of <u>supervision</u> and length of stay. These results suggest that privacy needs may decrease with length of stay, and feelings of dependence may increase.

For <u>staff</u> there was a significant negative correlation between age and <u>overall</u> adequacy ratings in the new wards, and a weak positive correlation in the old wards. There were more trained staff in the old wards and their average length of service was three times that of staff in the new wards. Staff perceptions of adequacy and importance would therefore appear to be related to their age, status and length of service.

The above results generally do not show a highly significant degree of correlation between patients' and staff ratings, or between ratings in old and new wards. Nevertheless the more highly significant correlation between all respondents' ratings for importance of privacy features suggests that for this attribute at least there is general agreement between respondents' opinions on the order of priorities.

The low level of significance between respondent group's ratings for adequacy generally suggests that people's stated opinions should not be taken as a reliable guide to evaluation of particular environments.

The generally higher levels of significance for rank order of <u>staff</u> ratings for <u>importance</u> between old and new wards for all three groups of features suggests that this parameter could be used as a means of weighting adequacy ratings in future evaluation studies. Patients' opinions on importance are likely to be less reliable for this purpose.

Summary of the teaching hospital survey findings

Nearly all patients said that the size of bedroom they currently occupied was satisfactory. More than a third thought the ideal size of a bedroom was 4 beds, and a smaller proportion preferred 2-bed rooms. Only 4% preferred single-bed rooms. More than three times as many patients preferred sub-divided or separate room wards to open wards.

Patients' previous hospital experience did not appear to affect their preferences for type of bedroom accommodation.

Features liked most by patients in the wards they occupied were airiness, spaciousness, ensuite toilets and lightness. Features liked least were drab decor and cramped 2-bed rooms.

Nearly a quarter of the staff preferred ward units of 10 to 16 beds, while an equal number preferred units of 20 to 26 beds. Nearly a third had no particular preferences. The remainder preferred smaller or larger units.

Nearly two-thirds of staff said they preferred open wards rather than sub-divided or separate room wards, although some suggested a combination of ward types would be the ideal.

Easy observation in open wards was liked by many staff from the old wards. Privacy for patients was liked by a smaller number of staff from the new wards. The main features disliked by staff from new wards were poor observation and excessive walking, while staff from old wards disliked lack of privacy for patients.

Adequacy ratings by patients and staff for 25 listed design features in both types of ward showed that patients considered the open wards slightly better for privacy and slightly worse for supervision than the new wards with separate bed rooms.

Staff however gave slightly better adequacy ratings for patients' privacy in the new wards, but much better ratings for supervision in the old open wards. The new wards were rated by both patients and staff as superior for convenience.

Patients considered that ability to summon a nurse when needed is the most important requirement in an ideal ward, while staff considered that ability to see patients was the most important requirement.

All wards fell well below respondents' ideals in respect of all three main features, but particularly so in respect of staff requirements for supervision in the new wards and convenience in the old wards. Patients regarded design for supervision as about equally short of the ideal in both new and old wards, and design for privacy more deficient in new wards than in old wards.

10.4 COUNTRY HOSPITAL SURVEY

Description of wards

Three wards were studied in the second survey: 1) a modern 31 bed double corridor ward for male and female patients on the second floor of a four storey block (referred to hereafter as 'new'), 2) a 24 bed open ward for female patients, and 3) a 23 bed part open and part separate rooms type ward for male patients on the ground floor in the old part of the hospital (see floor layouts overleaf, figs 10.3 & 10.4).

The distribution of beds in the three wards is shown below.

Table 10.33 Bed distribution by size of bedroom

Beds in room	new wards	old wards male	old wards female
1	2	4	-
2	10	4	-
3	1	-	-
4	16	-	-
5 - 6	-	6	-
7+	-	9 verandah	16 main 8 verandah
available	31	23	24
no. occupied when surveyed	31	22	21

The extent of observation of beds in each ward was analysed.

Table 10.34 Visibility of patients' heads

Observation point	no. of patients heads visible: new wards	old wards male	old wards female
nurses' stn.sitting	2	3	1
nurses' stn.standing	2	5	1
walking along corridor/aisle	13	21	24
standing in entrance of rooms/bays	24	23	24
total beds	31	23	24
% visible from room entrance	77%	100%	100%

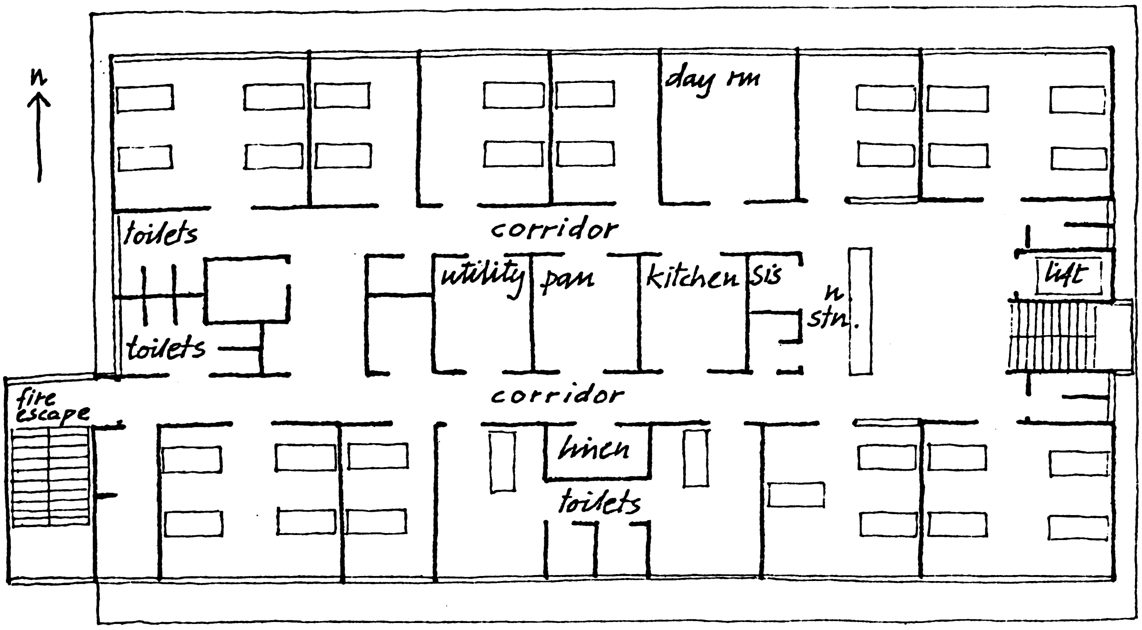


Fig 10.3 Country hospital - new wards
approx. area/bed 136 sq ft (12.6 m^2)

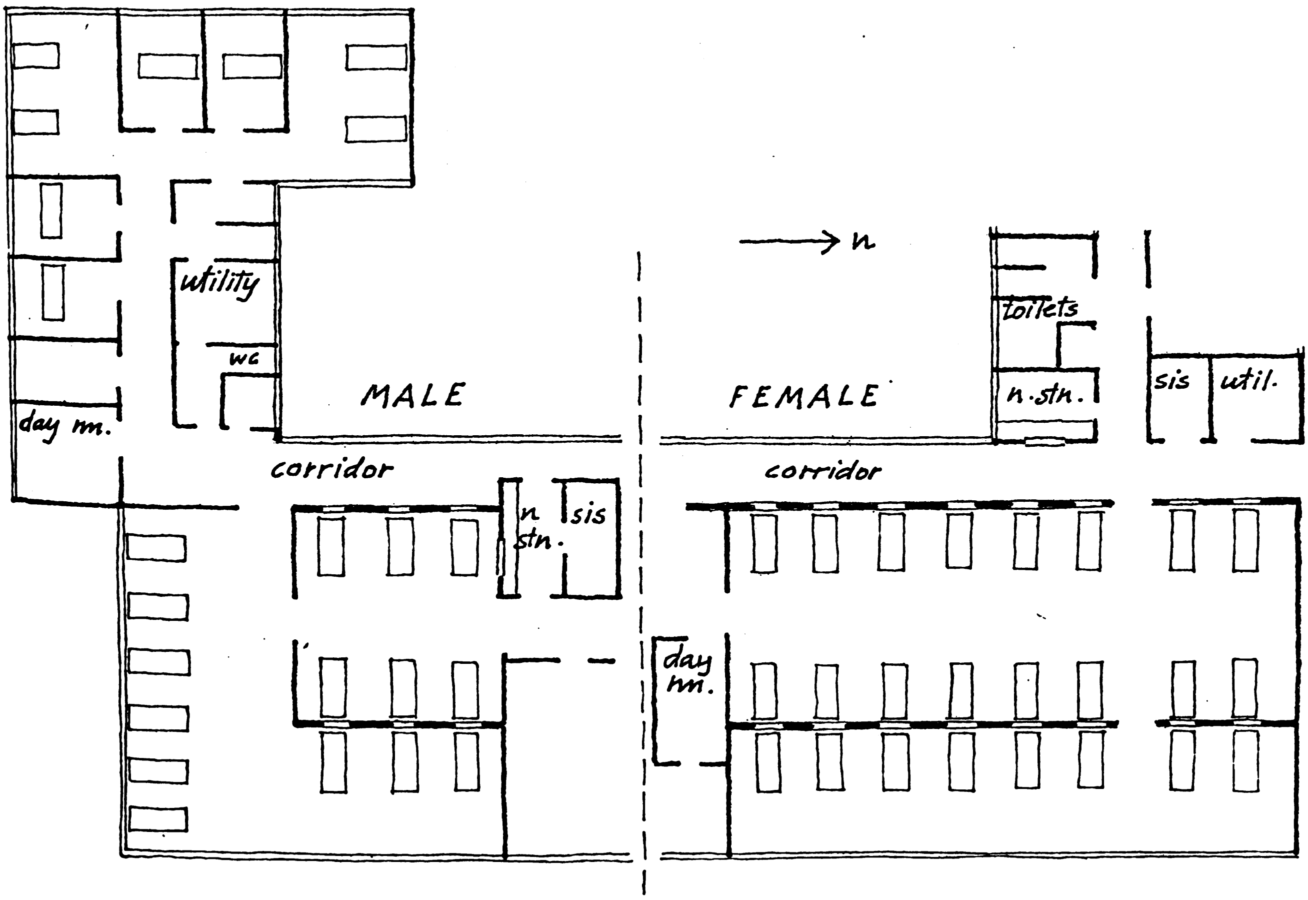


Fig 10.4 Country hospital - old wards
approx. area/bed F 136 sq ft (12.6 m^2)
M 189 sq ft (17.6 m^2)

A call system was installed in all three wards. In the new ward the 'talk' facility was used one way only (patient to nurse) although 2-way talk was possible. In the old male ward a buzzer system only was installed in the main ward area although a 1-way talk system was provided for single rooms. In the old female ward all beds had a 1-way talk facility but it was said to be "lousy".

In the new ward the open nurses' station commanded a view of the lifts and stairs and entrance lobby to the ward. In the female ward the nurses' station was in an enclosed room across the corridor from the main ward area; in the male ward the nurses' station was in a small crowded room adjoining the 6 bed open ward.

In the new ward the toilets and bathroom were accessible only from the corridor, although the two single rooms had a shared ensuite toilet between them. In the old female ward there were two WCs and a bathroom accessible along a corridor outside the main ward. In the old male ward there were a WC and 2 bathrooms along the corridor from the main ward, but fairly close to the single and 2-bed rooms. The general provision of toilet facilities for the old wards was well below the standard of the new ward.

No treatment room was provided in any of the wards surveyed, although it appeared that some procedures on patients in the new ward were carried out in the clean utility room.

A sitting room was provided on the north side of the new ward. Day rooms were not available for the old wards, although they had existed previously.

Vinyl sheet or tiles were used for floor coverings in all three wards, although the male old ward had carpet to the corridor serving the single and 2-bed rooms, and the new ward had rubber sheet for the corridors and tiles for utility rooms and toilet areas.

The wards were compared for their extent of internal and external view.

Table 10.35 View from beds

Extent of view	no.of patients able to see new	old M	old F
nurses station	4	6	1
sky	all 31	15	9
other buildings nearby	all 31	13	9
people outside	20	11	8

All wards were equipped with the old type standard metal frame bedsteads. Cubicle curtains were provided for all beds in multi-bed rooms in all wards.

In the new wards a wooden combined wardrobe/locker unit was used. This had been specially designed for the hospital when the new ward unit was built. The standard metal 3 drawer cupboard unit was used in the old wards for storage of patients' belongings. No wardrobes were provided in these wards.

An 'angle poise' light was provided for all beds in the new wards plus an upward pointing wall lamp. Small wall bracket lights were provided in the female ground floor ward, and strip lights on the walls in the main ward area of the male ward.

Ward management and staffing

The following tables give the allocation of senior and junior nurses on duty in all three wards for the three shifts, and the bed/staff ratios.

Table 10.36 Staffing allocations

	new		old M		old F	
Shift	sen.	jun.	sen.	jun.	sen.	jun.
morning	3	4	2	3	5	-
afternoon	3	2	2	1+	4	-
night	1	2	1	1	1	1½*
total	7	8	5	5+	10	1½

*1 shared with children's ward.

Table 10.37 Beds/staff ratios

Item	new	old M	old F
beds available	32	23	24
staff total	15	10+	11½
ratio beds/staff	2.1	2.2	2.1

Patient assignment was practised in all wards.

The Respondents

A total of 71 respondents completed questionnaires in the second survey at the country hospital, of whom 40 were patients and 31 staff. Forty three respondents were from the new ward and 28 from the old wards. Male and female patient respondents were approximately equally balanced in the new wards, but female respondents were in the majority in the old wards.

Almost all staff respondents in both wards were female. About two thirds of patients in new wards were under 35 years of age, while the reverse applied in old wards. Over two thirds of staff in all wards were under 30. All occupants of the wards who could respond did so.

As described earlier the survey method for the country hospital was simplified in respect of the patients' questionnaire (see appendix E^9). It was thus not possible to compare staff and patients' responses for adequacy or importance as in the teaching hospital survey. Patients' and staff opinions are analysed separately in the following sections.

Patients' opinions

Patients' previous hospital experience was related to their expressed preference for different types of ward, ie open, sub-divided bays, separate rooms or other.

The distribution of patients' previous experience is given below.

Table 10.38 Patients' previous ward accommodation

Type(s) of ward experienced	%age of respondents
open + bays + rooms	2
open + bays or rooms	20
bays &/or rooms	45
open only	20
no previous experience	13
	100

Only 16% of patients expressed a preference for ward accommodation of a different type to that which they currently occupied. Fifty-two percent of the respondents gave reasons as follows:

company	10 patients
privacy	8
quietness	6

Patients' previous ward experience did not appear to influence strongly their preference for type of ward accommodation. Quietness was given as the reason by two patients who preferred bays or rooms rather than open wards.

Patients were next asked to nominate the type of ward they thought ideal. Sixty percent responded, but only 10% gave reasons.

The three most commonly cited reasons for an ideal ward type were:

size of bedroom/number of beds
location of toilet facilities
nurse call system

Preferences for ideal bed room size were:

4 beds	12
2	7
2-4	5
1	3
open ward	1

Preferences regarding toilet facilities were

toilets close by/within view	9
ensuite toilets	5
more toilets	4 (from open ward)

Preferences concerning nurse call system were:

2-way conversation	5
easily reached buzzer	2

Features liked most and least about ward

Ninety two percent of patients answered the question on likes.

Table 10.39 Features most liked by patients

	no.of responses in each ward type		
Total	new (n=28)	old (n=12)	total (n=40)
windows/view	13	2	15
light/airy	9	1	10
spacious	2	3	5
privacy (separate rooms)	4	1	5
quietness	3	-	3
size of separate rooms	2	-	2
other features	3	2	5
'nothing'	1	-	1
total features mentioned	37	9	46
no response	-	3	3

Thirty seven percent of patients answered the question on dislikes.

Table 10.40 Features most disliked by patients

Features	no.of responses in each ward type new (n=28)	old (n=12)	total (n=40)
drab decor	3	1	4
insufficient toilets	1	1	2
2 bed room too small	2	-	2
lack of storage	2	-	2
other features	3	4	7
total features mentioned	11	6	17
no response	17	8	25

Ratings for privacy by patients in each ward type were:

	new wards	old wards
sufficient	27	5
unsufficient	1	5
no response	-	2

Means of improving privacy were suggested as follows:

	patients
compulsory use of earphones for TVs and radio	2
no smoking in ward	1
less beds in ward	1

Ratings for supervision by patients were:

	new	old
adequate	21	8
inadequate	7	2
no response	-	2

Several ways of improving supervision were suggested:

less patients in ward	2 patients
more staff (in separate rooms wards)	1
intercom system	1
nurses' station should have view into each room	1

Ratings for <u>convenience</u> by patients were:

	new	old
sufficient	22	7
insufficient	6	2
no response	-	3

Suggested aids to convenience

plenty of room to move	4 (2 from old wards)
good lockers	2

Suggested hindrances to convenience:

toilets not close enough	5 (3 from old wards)
lack of storage	2 (new wards)
'drip patients' can't reach buzzer	1
need washbasin in bedroom	1

Ratings for <u>comfort</u> by patients were:

	new	old
sufficient	25	8
insufficient	1	3
no response	2	1

Comments on comfortable features:

airy/large windows	4 patients
good light	2
beds comfortable	2
table & locker handy	1
toilets handy	1
openness	1 (old ward)

Comments on uncomfortable features:

too hot	1
uncomfortable beds	1

Lastly patients were asked to select three features from a list of 14 which they regarded as most important in an ideal ward.

Table 10.41 Most important features as ranked by patients

Features	no. no. of nominations
privacy for clinical administration	20
easy access to toilet	19
undisturbed sleep/quietness at night	14
good view of the outside	11
nurse able to see patients	9
sufficient space round beds	8
able to talk to nurse on call system	7
adequate storage for belongings	7
conversation with visitors not overheard	6
nurse able to hear patient call out	6
call system easy to use	6
able to converse with other patients	5
not overlooked when undressing	1
personal seclusion from other patients	1

Staff opinions

Staff were asked to say what design features they liked most about their ward. Eighty seven percent of respondents nominated one or more features, about 20% being in the negative ("there is nothing I like about this ward").

A total of 12 design features were mentioned, eight from the new wards and four from the old wards.

Table 10.42 Features most liked by staff

	no. of nominations		
Feature	new wards	old wards	total
openness		4	4
easy supervision		4	4
central facilities	4		4
views	3		3
spaciousness	3		3
other features	4	2	6

Staff were also asked to say what features they liked least.

Table 10.43 Features most disliked by staff

Features	no. of nominations new wards	old wards	total
poor supervision	6		6
beds too close	4	2	6
insufficient showers	2	2	4
lack of privacy		4	4
location of pan room		3	3
insufficient space		2	2
other features	4	4	8

Staff were asked to say what type of ward they liked to work in and to give their reasons. The rank order of preferences are given below.

Table 10.44 Type of ward preferred by staff

Ward types	new	no. of nominations old	total	%
separate rooms (2-4 beds)	4	6	10	32
open ward	3	6	9	29
4 bed bays	1	4	5	16
'circular ward'	1		1	3
no response	6		6	20

Supervision was the most frequently cited reason for preferring open wards (5 mentions). Other reasons given for preferring open wards were companionship, good communication and better morale.

Separate rooms were preferred by three respondents for their privacy, two of whom considered they provided a good compromise between privacy and companionship. One respondent supported their preference for bays as being a good compromise between privacy and supervision.

Staff were asked to say <u>how many beds</u> they preferred in a ward unit.

Table 10.45 Staff preferences for size of ward unit

No. of beds in unit	no. of nominations new	old	total	%
26-30	5	6	11	37
under 20	5	5	10	33
21-25	3	5	8	27
31-25	1	-	1	3

Staff were asked how many beds they preferred in multi-bed patients' rooms.

Table 10.46 Staff preferences for size of bed room

No. of beds in room	no. of nominations new	old	total	%
4	8	13	21	70
2	4	1	5	17
6	1	2	3	10
3	1	-	1	3

Opinions on adequacy ratings were requested for each of 21 specified ward design features, the options given being very good, good, poor or very poor. No options were given for 'don't know' or 'not applicable'.

The ratings were scored 3, 2, 1 and 0 respectively from 'very good' to 'very poor' and percentage mean adequacy ratings derived from the scores. Details of staff respondents' adequacy ratings are given in appendix E'', but the results are summarised below. Old wards were generally rated as considerably worse than new wards for all design features. Only three features scored below 50% in new wards.

Table 10.47 Features rated 'poor' in new wards

Features	%age rating
privacy, undisturbed sleep and rest	49
supervision, nurses station location	47
supervision by observation	42

Only one feature, 'cooperation as an aspect of supervision' was rated as 'good' in the old wards. Six features in old wards scored below 25%.

Table 10.48 Features rated 'very poor' in old wards

Features	%age rating
privacy using toilet	23
supervision, nurses station location	23
convenience of storage	21
privacy for using radio/TV	19
convenient access to toilets	17
privacy for undisturbed sleep or rest	12

Two features had rating differences of 40% or more between old and new wards.

Table 10.49 Features with biggest rating differences

Features	%age difference
supervision by call system	44
privacy for clinical examinations	40

Two features had rating differences of 15% or less between new and old wards.

Table 10.50 Features with least rating differences

Features	%age difference
supervision by observation	11
supervision by cooperation	15

Importance ratings

All staff were asked which three of the 21 features rated for adequacy they regarded as most important in an ideal ward. The descending order of frequency for the first five of 14 features voted for is given below:

Table 10.51 Five most important features (staff)

Features	votes (n = 28 x 3)
observation	15
personal seclusion	12
toilets convenient	10
n.stn. location	9
spaciousness	8

Summary of the country hospital survey findings

Most patients said they liked the size of bedrooms they currently occupied, reasons given being company, privacy and quietness.

About half of the 28 patients responding thought that four-bed rooms were ideal. Two bed rooms were less popular. Only one patient preferred an open ward, while three preferred single rooms.

Features liked most by patients in new wards were outside view, lightness airiness. Patients in old wards liked their spaciousness.

New wards were disliked for their drab decor, cramped two-bed rooms and lack of storage space. Drab decor and insufficient toilets were disliked in the old wards.

Over 95% of patients considered the new wards provided sufficient privacy, but patients in the old wards were almost equally divided on this issue. The main complaint was other patients not using earphones when listening to radio or TV.

Three-quarters of patients in new wards considered they provided good supervision, but only two-thirds had this opinion of the old wards.

New wards were rated by patients as both more convenient and more comfortable than old wards. Spaciousness appeared to contribute most to convenience, while lightness and airiness were the main factors affecting opinions on comfort.

By far the most important features for patients in an ideal ward were privacy when undergoing a clinical examination and easy access to a toilet. Lack of disturbance while sleeping or resting, and a good outside view, were also highly important.

Staff in new wards in the country hospital said they most liked their convenience and the central utility spaces, the views, and the spaciousness. Openness and easy supervision were the most popular features in old wards.

Features liked least by staff in new wards were poor supervision and cramped bed spaces. In old wards the lack of privacy and the inconvenient pan room location were most disliked.

Staff were about equally divided in their preference for wards with separate rooms compared with open wards, although a small proportion opted for 4 bed bays. Open wards were preferred for ease of supervision, companionship and good communication. Privacy and companionship were given as reasons for preferring wards with separate rooms.

More than a third of the staff gave the optimum size for a nursing unit as more than 26 beds, slightly less than a third preferred less than 20 beds, while just over a quarter opted for 21-25 beds.

Staff considered four-bed rooms by far the best size for multi-bedded patients rooms, with two-bed rooms and six-bed rooms lagging far behind.

The new wards were rated by staff as far more adequate than the old wards for all the 21 design features listed. The only feature rated above the 50% score in old wards was cooperation as an aid to supervision. Only three features were rated as less than 50% in new wards: privacy for undisturbed sleep, nurses' station location, and observation of patients.

Staff nominated the most important features in an ideal ward as easy observation and personal privacy for patients.

10.5 CONCLUSIONS ON WARD SURVEYS

The two pilot surveys emphasized the differences in perception between patients and staff regarding requirements for privacy and supervision, and how these are best provided for in ward design.

The comparison between open and separate rooms wards was most marked in the country hospital. This was at least partly due to the compact design of the modern ward and its convenient amenities, and to the relatively inconvenient and antiquated design of the old open wards.

Factors other than the degree of openness or subdivision of ward space have an important influence on respondents' assessment of suitability for privacy and supervision. Details such as floor finishes, design of bedside lockers, location of toilets, dimensions of bedrooms, and type of call system, all play a part in the overall assessment of suitability of the ward environment for patient care.

The need for privacy when undergoing a clinical examination or consultation, when using toilet facilities, and when sleeping or resting, are seen by both patients and staff as important requirements to be met. Design of the ward can only assist to some extent in meeting these ideals. Ward management policies, and the consideration of people for their neighbours, also play a significant role.

Supervision is not greatly aided by open wards. Nurses are able to adapt to other types of ward quite readily, but the extra effort required to ensure an adequate level of patient care in wards with separate rooms may create problems which can only be reduced by increasing staffing levels, or by lowering the level of personal care provided.

Further surveys would be needed to investigate more fully the reasons for different priorities of requirements, not only between patients and staff, but also between different types of people within these two groups. The surveys should aim to establish the effects (if any) of particular features of ward design, such as bedroom size, on respondents' behaviour in relation to privacy and supervision. Other aspects such as comfort, convenience, safety and adaptability should also be studied in relation to different kinds of ward design and equipment.

Opinion surveys by self-administered questionnaire are a fairly simple and economical means of highlighting important differences in various types of ward design. They do not however reveal important matters of detail which interview surveys covering the same topics can highlight more adequately.

10.6 OPINION SURVEY ON DESIGN FEATURES AFFECTING EFFICIENCY

Survey aims

Following the two pilot surveys of hospital wards with respect to privacy, supervision and convenience, a further survey was undertaken in 1980 on opinions of senior nursing and medical staff regarding ward design. This survey had the following aims:

1) to identify design features of wards which contribute both to efficient use of staff, and to comfort and convenience of patients.
2) to identify changes taking place in nursing and administrative methods with regard to patient care and medical and nursing education.
3) to identify social, economic and technological trends affecting patient care and consequently ward design.
4) to select examples of ward design which would merit further study.
5) to test users' opinions on a number of operational and design policy options affecting nursing methods and ward designs.
6) to identify priorities for research in ward design.

Respondents and survey methods

Thirty-three respondents were selected for the survey;- 29 nurses and four doctors. Twenty-two of the nurses and the four doctors were from a major Sydney teaching hospital. The other seven nurses were from a variety of government, professional and advisory organisations in Sydney.

Respondents were selected to provide a range of nursing and medical opinion from senior and mid-level staff. Over half the nurses had overseas experience. Nearly half were aged between 30 and 44, a third were over 45, and less than a quarter were under 30.

A large hospital was chosen as the main survey site for administrative convenience and to ensure that a good range of prior experience was represented. The hospital had a range of ward designs in use, both old and new, and a new main ward block was under construction at the time of the survey.

The hospital respondents for interview were nominated by the Director of Nursing and the General Medical Superintendent on the basis of degree of experience and area of specialisation. The interview lasted between one and two hours and all but four were tape recorded. Respondents were assured that their comments and answers would be treated as confidential and that no respondent would be identified in any report of the survey.

Prior to the survey a brief literature search was conducted on nursing methods, and on the interrelationship between ward design and nursing practice. A pilot questionnaire was then developed and tested, and a list of topics devised as the basis for the interviews.

All but two of the respondents completed a multiple-choice questionnaire on preferences of operational and design policies (see appendix E[12]). Nearly all respondents had extensive experience in a variety of hospitals in Australia and overseas, and some were also experienced nurse planners.

The interviews were conducted with the aid of a check list which had been worked out to give the interviewer sufficient control over topics discussed, but without inhibiting respondents' replies (see appendix E[12]). Recordings of the interviews were subsequently analysed for content and a detailed report compiled under the following headings:

Trends likely to affect ward design:

- nursing methods
- medical and nursing education
- changing roles of ward staff
- early discharge
- increasing longevity of population
- early ambulation
- health insurance
- consumers' rights
- confidentiality
- technological developments
- changes in management methods
- control of infection
- community health programs
- visiting arrangements

Perceived goals of ward design

Privacy and supervision

Design features affecting efficiency

Design features affecting patient comfort

Design features affecting staff comfort and convenience

As the findings were not based on a probability sample no conclusions can be drawn about the respondents' characteristics. Nevertheless the findings provide a representative range of viewpoints on ward design.

Findings of interview survey

The issue of nursing education was one on which many respondents held strong views and on which there were diverse opinions. Nevertheless there was general agreement that some nurse education would still go on in wards, although supernumerary student nurses would probably be supervised by experienced sisters, and there would be fewer student nurses to carry out more menial tasks. More space would be needed in wards for small group teaching.

Improvements in status for nurses, which were seen to accrue from higher standards of professional education, were likely to give nurses a greater impact on decision making and thus to have more say in hospital design.

Reduction in the average length of stay of patients was likely as a result of cost cuttings and the need for beds. This would increase the overall level of dependency of patients and emphasise the need for good observation in wards.

Coupled with reduced length of stay is the practice of early ambulation, even for high dependency patients who may still be attached to drips and drainage tubes. More sitting space would therefore be needed close to bed areas and under the supervision of nursing staff. Other sitting spaces would also be needed as well as easy access to outside areas, verandahs etc.

Another trend likely to affect the kind of patients being treated was the increasing average age of the population. Acute patients with chronic conditions, such as vision and hearing problems for example, would be admitted more often. These patients would be more demanding of nursing time and attention, would be less self-reliant, have difficulty using sophisticated equipment (such as call systems), and be liable to more danger from falls.

Single bedrooms were often demanded by patients with private health insurance, and who were upset if no private rooms were available. Most respondents thought certain categories of patients should be in single rooms for medical reasons, such as terminal illness. Many thought seriously ill patients should always be in open wards for safety's sake. Some patients became bored and lonely in single rooms and asked to be in an open ward or multi-bed room. Changes to hospital insurance schemes could well alter the demand for private bedrooms in public hospitals.

A common problem in wards was having nowhere private to conduct an interview or consultation. The increasing awareness of many patients of their right to know details of their condition was making it important to provide sound insulated interview rooms where confidential discussions could take place without fear of overhearing loud conversations (eg if the patient was deaf).

One purpose of the survey was to obtain recommendations of 'good' ward designs to study in use. Only one respondent nominated a ward in an Australian hospital which merited this distinction. Several nurses, however, volunteered (unasked) their nominations for the 'worst' ward.

A variety of design features were mentioned by respondents which they considered contributed to good nursing care. These included good facilities for observation, such as glass partitioned bays, a high proportion of beds visible from the staff bases, and a convenient grouping of utility areas and bed areas to reduce unnecessary movement. A high proportion of nurses said they preferred open Nightingale wards, or else converted sub-divided open wards, with four-bed bays and half-glazed partitions between bays, which provided a little more privacy than open wards.

Nursing methods

Many respondents considered that any method of nursing could be carried out in any design of ward. Nevertheless, in response to detailed questions on the effects of ward design on efficiency, it appeared that some combinations of design features can contribute to efficiency, while others cause difficulties.

The four main methods of nursing practised today are 1) primary nursing in which one nurse is responsible for a patient from admission to discharge, 2) patient assignment in which a nurse is responsible for a patient only during a shift, 3) team nursing where two or three nurses are together responsible for a group of patients, and 4) task assignment where all nurses are allocated specific tasks to perform throughout the ward.

The first two methods aim to provide patient-centred care, but are more expensive in the use of staff time. They are, however, preferred by many nurses, and are considered to give a better standard of care and to result in greater nurse satisfaction. They are more easily adopted in wards where patients are grouped in rooms of four to six beds.

The two task orientated methods of nursing are often adopted when there is a shortage of staff or a higher than normal work load. Team nursing allows greater continuity of contact between nurse and patient than task assignment, yet allows student nurses to work under the supervision of trained nurses in the team. Most respondents considered that task assignment could be carried out equally well in any ward design, but overall supervision of student nurses was facilitated in more open ward layouts.

Findings from multiple choice questions on policies

Twenty seven of the nurses interviewed answered the questions on operational and design policy options (see appendix E[12]). Fourteen operational policies were specified and a further eight listed only. The opportunity was given to nominate and express opinions on any other policy topics.

The preferred method of nursing was by primary nursing followed closely by patient assignment. The table below shows the distribution of answers by respondent's role.

Table 10.52 Preferred nursing method

Respondent role	Primary nursing	Patient assign.	Team nursing	Task assign.
Administrator	7	2	-	-
Charge sister	-	7	4	-
Educator	3	-	-	-
Planner	2	2	-	-
Total	12	11	4	-

Several respondents who opted for primary nursing or patient assignment proposed an alternative method of nursing at night, such as team nursing or task assignment.

Over 64% of respondents considered it was preferable to carry out treatments in a treatment room rather than in multi-bed rooms, although 80% felt that it was acceptable to perform treatments in single rooms.

A majority of respondents preferred mobile beds as the means of transporting patients within the hospital. The full range of options mentioned are tabulated below.

Table 10.53 Methods of transport preferred

Method	no. of nominations
Mobile bed/wheelchair	12
Mobile bed	8
Wheelchair	3
Combination of above and walking	2
Trolley	1
Trolley/wheelchair	1
Total	27

Ambulant patients should be encouraged to wear day clothes, according to more than half the respondents, although there were some provisos:

Table 10.54 Policy on wearing day clothes

Options	no. of nominations
Yes, all day	11
Yes, part of day only	2
Yes, to go out of ward only	3
Up to patient to decide	2
Depends on procedures	2
No	7
Total	27

Most respondents preferred patients to have their meals in a day/dining room on the ward although other options were also mentioned. Some respondents gave more than one option.

Table 10.55 Preferred location for patient's meals

Options	no. of nominations
Day/dining room on ward	19
In sitting area in bedroom	9
By bed	6
Patients' cafeteria	1
Total	35

Cleansing of bedpans and urinals was considered a major problem. Disposables were disliked due to the waste of material resources, but few respondents had experienced their use in hospitals. Many methods of cleansing were felt to be unduly noisy, especially if washers/sterilizers were sited close to bedrooms. The preferred methods of bedpan and urinal cleansing are tabulated below:

Table 10.56 Method of bedpan/urinal cleansing

Methods	no. of nominations
Washer/sterilizer per ward	12
Washer/sterilizer per sub-unit	3
Washer per sub-unit, sterilizer per ward	2
Washer per sub-unit, sterilizer per floor	1
Disposable pan liners/urinals	6
Disposables to supplement washer/sterilizer	2
Total	27

About 60% of respondents preferred 'imprest' delivery of linen although trolley exchange was the only other option mentioned as a preference. Methods of storage preferred varied considerably as the following table indicates:

Table 10.57 Preferences on linen storage

Options	no. of nominations
Shelving in ward corridor	8
'Nurserver' per room	7
Separate storeroom with shelves	5
On trolleys	4
'Nurserver' per sub-unit	1
Don't know	2
Total	27

The subject of listening devices for TV and radio raised very strong comment from many respondents. Patients listening to personal TVs without earphones was widely condemned as one of the worst forms of noise nuisance in wards. Personal TVs were also a cause of obstruction in the bed area. Preferences for form of listening devices for radios and TVs were as follows:

Table 10.58 Preferences on listening devices for Radios/TVs

Options	no. of nominations
Headphones or earphones	18
Headphones	4
Earphones	3
Handset	1
No TV in bedrooms, radio earphones	1
Total	27

Opinion on visiting times were fairly equally divided between restricted visiting (13) and open visiting (11). A few respondents (3) suggested open visiting except for rest periods. A majority of respondents felt there should not be more than two visitors per patient, although five respondents suggested that it depended on the patients' condition. Large numbers of visitors were a problem with some migrant families.

Other policies on which preferences were given included smoking, restrictions, storage of dangerous drugs, location of teaching facilities, storage of patients' records, and sitting space for patients.

Almost all respondents preferred smoking restricted to certain areas of the ward, decentralised drug storage in a fixed lockable cupboard, and teaching to be conducted in special teaching spaces or in the treatment room. There was an equal division of opinion on whether teaching could sometimes be conducted in bedrooms.

Most respondents preferred patients' notes to be kept on a trolley at the staff base although a small proportion felt they could be kept at the patients' bedside or at sub-stations.

A majority of respondents felt that patients should have sitting space in bedrooms as well as a separate sitting room for the ward unit or sub-unit. The tendency for many post-operative patients to be encouraged to get up soon after their operation meant that sitting space was needed in high dependency areas.

Eight other policy topics were listed in the questionnaire and two were added by respondents. The table below shows the number of respondents' comments made on each.

Table 10.59 Other operational policy topics

Topic		no. of comments
Safety		21
Death		17
Interviewing		14
Catering		11
Cleaning		11
Rest periods		10
Clerical assistance		8
Communications between staff/departments		7
Allied health and ancillary staff facilities	added topics	4
Discharge lounges	added topics	2

Safety was referred to in respect of a number of aspects affecting both patient care and staff safety.

Table 10.60 Safety aspects mentioned

Aspect	no. of nominations
Slippery floor	6
Toilet areas : locks, steps, rails	6
Hot water scalds	4
Fire	3
Falls from beds	3
Aged and handicapped patients	2
Signposting and equipment labelling	2
Chairs for disturbed patients	2
Lifting	1

Confidentiality was a major problem with interviewing especially in multi-bed rooms of two to four beds. A separate interview room was proposed by eleven respondents.

A major source of annoyance to staff and patients was noise from cleaning machines. Floor polishing tended to be overdone, especially by contract cleaners.

Complex call systems came in for adverse comment, especially in view of the trend towards a higher proportion of aged and high dependency patients in acute wards.

Thirteen design policy topics were listed in the questionnaire and respondents' preferences on design options are described below.

Most respondents opted for between two and four ward units per floor, although nearly a quarter had no opinion. The full range of options is given in table 10.61.

Table 10.61 Number of ward units per floor

Options	no. of nominations
3 or 4	7
4	6
2	6
8 or more	1
1	1
Don't know	6
Total	27

Ward units are sometimes divided into two or more sub-units of between four and six beds grouped round a staff base or utility area.

There was little support for ward sub-units, 16 respondents expressing a dislike for the concept. Of the 8 respondents in favour, four wanted four sub-units per ward unit, one preferred three, one preferred two, and one said 'it depended on the ward specialty'.

Preferences on numbers of beds preferred in a typical sub-unit were given by only six respondents. These are tabulated below:

Table 10.62 Number of beds per sub-unit

Number of beds preferred	no. of nominations
4 - 6	2
7 - 10	2
11 - 15	1
16 plus	1
Total	6

Three or four beds per room or bay was preferred by most nurses. Two-bed rooms were disliked. The range of preferences are given below:

Table 10.63 Number of beds per multi-bed room or bay

Options	no. of nominations
4	14
3 or 4	5
5 or 6	3
2 - 4	1
2	1
4, with some 5 or 6	1
16 bed open ward, with some 4 bed rooms	1
Don't know	1
Total	27

The number of single rooms preferred per 30 bed ward unit varied from none to eight or more.

Table 10.64 Single rooms per ward

Options	no. of nominations
4	10
6	7
3	5
5	2
8 plus	1
None	1
Don't know	1
Total	27

There was considerable disagreement on the extent to which beds should be easily visible from a central staff base.

Table 10.65 Percentage of beds visible from staff base

Percentage visible	no. of nominations
25% of beds	9
50%	5
10%	4
100%	2
75%	2
Not necessary	1
Not necessary except for task assignment	1
Don't know	3
Total	27

Despite technical advances in patient call systems a majority of nurses preferred 'buzzer only' systems.

Table 10.66 Preferences for call systems

Options	no. of nominations
Buzzer	19
Talk two ways	4
Buzzer plus talk two ways	2
Talk one way	0
Don't know	2
Total	27

A majority preference was for a central staff base location, although many provisos were expressed, depending on the nursing method adopted.

Table 10.67 Staff base location

Preference	no. of nominations
Central in high dependency area	11
Central in ward unit	7
Decentralised to sub-units	3
Central to pair of ward units	1
Near ward entrance	1
No base for primary nursing, but central for high dependency beds for task assignment	1
Central to two units for primary nursing, central to unit for task assignment	1
Don't know	2
Total	27

Over 85% of respondents wanted either a central treatment room in each ward unit or per floor. Two said no treatment room was needed and two didn't know.

There was also a general preference for one central utility area per ward unit, although some respondents opted for two or more per ward. Three respondents had no opinion.

'En-suite to bedrooms' was the preferred location of toilet areas by almost all respondents, although three had no views on the matter. The siting of en-suite toilets, however, was a subject of dispute:

Table 10.68 Preferred site for en-suite toilets

Options	no. of nominations
Between bedrooms	12
Between bedroom and corridor	8
On outside wall	3
Don't know	3
Total	27

Over half the respondents preferred multi-bed rooms to be open to the corridor, although a third would like part-glazed doors. Three respondents wanted solid doors, and one didn't know.

Mobile lockers with fixed wardrobes were generally preferred for storage of patients' belongings, although four respondents liked the idea of a combined mobile wardrobe/locker, and four liked fixed lockers and wardrobes.

Seven design topics were only listed in the questionnaire, and one topic 'windows' was added by three respondents. The frequency of comments on each topic are tabulated below:

Table 10.69 Listed and additional design topics

Topic	no. of comments
Lighting	25
Flooring	24
Telephones	24
Ventilation	22
Cubicle curtains	21
Sun shading	12
Thermal control	12
Windows (added topic)	3

The main points made on each of these topics are summarised below:

Table 10.70 Lighting preferences

Aspect	no. of nominations
Adjustable bed head lighting with switch easily reached by patient	12
Dimmer control on general lighting	6
Good floor night lighting	4
Glare control	1
Good daylight	1
Spot light in special units	1

Table 10.71 Flooring preferences

Aspect	no. of nominations
Carpets preferred in wards	15
Quiet washable non-slip floorings	9
Carpet in corridors and sitting areas but not bed areas	2

Table 10.72 Telephone preferences

Aspect	no. of nominations
'Phone points by each bed	15
'Phone points between beds	4
Fixed 'phones preferred to mobile	6
'Phones not necessary for patients	1
Enough 'phones for staff use	2

Table 10.73 Ventilation preferences

Aspect	no. of nominations	
Natural ventilation preferred	18	
Air-conditioning preferred	3	4
Air-conditioning plus openable windows	1	
Access to balconies desirable	3	

Table 10.74 Cubicle curtain preferences

Aspect	no. of nominations
Cubicle curtains between beds essential in shared rooms	21
Suspended curtain tracks preferred	2
Concertina dividers preferred	1

Table 10.75 Thermal, visual & solar control aspects

Aspect	no. of nominations	
Sun shading desirable	12	
Good thermal control	12	
(individually controlled	8	9
(centrally controlled	1	
Windows and view desirable for patients	3	
Double glazing and integral venetian blinds	1	

Topics for further research

At the end of the interview suggestions were invited on those aspects on which further research was thought to be needed. The following table lists the more frequently cited topics out of the total of 55 nominations by all respondents.

Table 10.76 Topics suggested for research

Topics	no. of nominations
Means of reducing demand for acute beds	4
Staff facilities on wards	3
Interior decor in wards, colour	3
Quieter methods of cleaning floors	3
Nurse aide training on wards	3
Traffic and supply systems	2
Bed fittings design	2
Drug and record trolley design	2
Equipment storage space	2
Linen supply and disposal	2
Clerical work facilities	2
Utility areas, design and location	2
Noise reduction generally	2
Improved pan washers/sterilizers	2
Effects of having registered nurses only on wards	2

Nineteen other aspects were mentioned once only.

Conclusions

From the interview section of the survey it was clear that some changes in nursing, medical and management practice will be difficult to implement in certain types of more recent ward designs in which privacy for patients has been given high priority.

Social factors, such as increasing age of the population, will mean that more patients are likely to be highly dependent, yet some may also need facilities for early ambulation after surgery. Technological developments are unlikely to ease the work of nurses on wards, rather the reverse. Economic pressures to reduce staff numbers may put an increasing strain on nursing and other ward staff. Professional aspirations of nurses and the trend towards college education of nurses may also reduce the availability of nursing staff for the more menial and routine tasks. There is therefore likely to be an increasing division in the nursing workforce between fully trained registered nurses and nursing aides. This will affect priorities in requirements and hence preferred types of design.

While many nurses preferred primary nursing or patient assignment in principle, the increasing pressure on nursing staff may well limit the extent to which these methods can be adopted. Physical design may also limit the extent to which these more patient-centred methods of nursing can be adopted.

Respondents' opinions on policy options were very varied,but were fairly clearly divided between issues on which there was agreement and those on which there was general disagreement.

Most respondents said they preferred three or four nursing units grouped on one floor level, and for patients to be in groups of four (or multiples thereof) depending on their dependency level. Bays were preferred to separate rooms. A high dependency area with about eight to 16 beds within each ward unit was favoured by many respondents.

In general it was surprising how little design awareness many respondents had concerning the effect of environment on behaviour of staff and patients. Most respondents accepted that they would have to adapt to whatever design of ward they were in, and did not see it as necessary for design to be based on nursing methods. Many respondents felt that any method of nursing could be practised in virtually any type of ward - Nightingale, Nuffield, or all single rooms. However it was also evident that there was a preference for the more open type of ward by most of the more experienced nurses, as distinct from the nurse planners who tended to prefer the more modern 'hotel' style wards with en-suite toilets.

One aim of the survey was to identify aspects of ward design which would be most likely to affect nursing efficiency. The results showed, however, that few nurses had thought out what 'efficiency' really meant. The range of opinions on some basic policy questions such as grouping of bed areas, means that a good ward design has to provide for a range of possibilities. Objective data are required from observation of ward activities in order to make reliable recommendations on those design features most likely to make efficient use of staff, but without reducing standards of care. Design guidance should make clear the conditions under which wards may operate and the criteria by which design options may be evaluated.

10.7 RESULTS OF EVALUATION OF WARD DESIGN

Hospital ward designs have evolved through four phases of development:

1) open wards with up to 30 beds in one large space, usually with cubicle curtains round each bed space;
2) subdivided wards with from four to eight beds in bays separated from each other by solid or glazed partitions;
3) wards with most of the beds in separate rooms containing up to four or six beds, but a proportion in single bedrooms;
4) wards with mostly single or two-bed rooms, each with its own ensuite toilet.

Each of the four phases of design evolution offers increasing degrees of patient isolation in terms of visual, auditory and olfactory perception of other patients' activities. Ease of nursing supervision is however decreased by the degree to which patients' bedspaces are separated from each other. Other requirements such as comfort, convenience, efficiency and adaptability are also affected by the degree of spatial subdivision.

Surveys of ward design in North America and Britain have shown that there are widely differing attitudes among ward users regarding the need for privacy for patients, and the best means of providing good nursing supervision of patients. In Britain there has recently been a marked trend away from subdivided wards and towards more open wards in National Health Service hospitals.

To test users' opinions in Australia two pilot surveys were conducted in hospital wards in the Sydney area. Four new wards with separate bedrooms and five old open wards were included in the surveys. Views of patients, staff and visitors were obtained on how adequately the wards satisfied their users' needs for privacy, supervision and convenience.

Although all the wards surveyed suffered from a number of design disadvantages, some of the older wards were rated quite highly with respect to features such as cooperation between patients and staff, and ease of nursing observation. The older wards were however considered deficient in terms of privacy and convenience for toilet activities, and quietness when sleeping or resting.

The more modern wards with separate multi-bed rooms were generally quite highly rated by both patients and staff, although they appeared to be deficient in terms of supervision. They were not markedly less noisy or more private than open wards.

There are substantial differences between patients and staff in their opinions of adequacy and importance of specified design features. These differences are due not only to their different user requirements, but also to individual respondents' widely differing viewpoints on matters such as personal privacy, status and social conventions.

Further research by interview on policies and trends in patient care affecting ward design showed considerable areas of disagreement between respondents on policy matters. Lack of awareness by many of the senior and mid-level nursing respondents on the interaction between environmental design and ward routines is suggested as a cause of many of the problems encountered in many modern ward designs.

The Nightingale ward evolved in conjunction with innovative ideas on efficient ward management. More recent types of ward design have introduced a variety of other requirements which have complicated design, added to building and running costs, and resulted in conflicting requirements which have not been satisfactorily resolved.

Lack of definition of the problems to be solved by ward design, and lack of agreement on priorities of requirements, have also led to a variety of types of ward designs which apparently do not satisfy their users. Clarification of ward design requirements, and agreement on priorities and policies, are therefore seen as the next steps in producing guidelines on good practices in ward design and management.

CHAPTER ELEVEN

EVALUATION AND DESIGN OF FURNITURE FOR HANDICAPPED CHILDREN - Synopsis

A short account is presented of research into design of furniture for handicapped children, particularly seating for posture control. Aims and origins of the study are briefly described. Methods of investigation of users' needs and problems are then outlined, including a questionnaire survey of therapists and teachers familiar with this type of furniture.

The survey set out to establish users' opinions on requirement priorities, and to use these to evaluate products currently in use. General comments on design and use were also invited. Responses showed that a major problem was finding information on available furniture. Another problem mentioned was lack of adjustability to fit clients' needs.

A design specification was evolved based on detailed evaluation of selected existing products and design options. The design process used is outlined together with a description of subsequent phases of development.

The project illustrates an attempt to obtain feedback of information from evaluation of effects and to use this in briefing and design.

Although the problems involved in furniture design necessarily differ in kind from those of hospital and ward design, this project was included in the thesis to examine how the methods it used might be applied on a larger scale in the health facilities field.

11.1 ORIGINS OF THE STUDY - the problems

The need for a design study of furniture for handicapped children originated from three main sources:

1. Comments by a furniture manufacturer that chairs and tables for handicapped children in special schools were often poorly designed and unsuitable for their purpose.
2. Comments in literature on design of seats and tables for handicapped children suggesting that many manufacturers and designers were insufficiently aware of the special problems of handicapped children, and of their parents and therapists.
3. Criticisms by occupational therapists and physiotherapists that chairs and tables used by handicapped children were often inconvenient and unsafe for the purposes for which they were used.

These comments indicated that user requirements of furniture for handicapped children had either not been adequately investigated, or that information on these requirements was not being used by designers and manufacturers of such furniture.

A research project was therefore initiated in 1977 to undertake an evaluation survey of furniture currently being used by handicapped children. The results of the survey were to be used in formulating statements of functional requirements (a brief) from which designs could be developed.

A small research team was formed to conduct the study. The team consisted of an industrial designer, an architect and an occupational therapist. This chapter describes the first phase of the research program and summarises the second phase which was concluded in 1980.

11.2 METHODS OF INVESTIGATION

Four approaches were used in gathering information about requirements for furniture and equipment aids on which an evaluation study of currently available products could be made.

The first approach was to interview several therapists at centres for handicapped children such as special schools, hospital departments and residential centres. This was followed by a detailed questionnaire survey involving about twenty therapists and teachers who were asked about the equipment needs and problems of handicapped children, ideas on requirements of seating aids, specific play and learning activities, and experience in use of one aid (see appendix E[13]). The interview and questionnaire surveys were supplemented by observing children during play and learning activities, and by studying some of the furniture currently in use.

The second approach was to make a literature search to identify aspects worth investigating in more detail. Many comments in the literature concerned attitudes to information and lack of understanding of problems to be solved, especially by manufacturers. Two of the most valuable research reports were discovered by seeing an editorial comment in a journal retrieved 'accidentally'.

The third source of information was a Rehabilitation Engineering Seminar at the University of NSW in 1977 which provided useful personal contacts and references to information sources, although the seminar itself was of limited value to the research team. The seminar revealed a tendency among some researchers in the engineering field to push a particular branch of technology rather than to try and understand the 'human problems' involved in use of aids. Two other seminars on aids for the handicapped were also attended, one organised by Technical Aids for the Disabled, and the other by the NSW Hospital Planning Advisory Centre. Both provided further useful contacts.

The fourth approach was to compile an index of some of the seating aids available commercially in Australia which could be obtained from overseas. The index described features of aids which could help in their selection by therapists, teachers and parents. The index excluded aids which were 'home-made' or adapted from commercially available products.

The report on the preliminary study (Green et al 1979) included an account of the preliminary survey; a discussion on anthropometric and manufacturing aspects; an index of furniture available in Australia; a select annotated bibliography; check lists for design, evaluation and selection of furniture; and a list of people and organisations contacted.

11.3 QUESTIONNAIRE SURVEY

A number of therapists, teachers and parents of handicapped children were interviewed, firstly on requirements of seating aids, and secondly on how aids they used performed in use. A detailed survey was not possible with the resources available, so it was decided to carry out a preliminary questionnaire survey of about twenty respondents in Sydney to get the feeling of the problem, and as a basis for a later more detailed survey of requirements and of aids in use.

A series of informal interviews had identified several people with experience and interest in the project and these agreed to act as respondents for the first questionnaire survey. The researchers spent about five minutes explaining the purpose of the survey to respondents, a few of whom had been involved in earlier discussions on problems to be explored. The questionnaire took about an hour to complete, one researcher being available to clarify questions if necessary.

The preliminary survey questionnaire contained thirty-seven questions. Eighteen therapists and teachers from four institutions in Sydney took part. The respondents consisted of one education consultant, two teachers, four physiotherapists and eleven occupational therapists. Ten respondents came from two schools for handicapped children, the remaining eight were from occupational therapy departments of two major teaching hospitals. Respondents were selected because they were mostly experienced in work with handicapped children, especially in a teaching or therapy role.

11.4 CLIENTS' DISABILITIES AND PROBLEMS

Clients of the teachers/therapists ranged in age from birth to eighteen years, the majority being in the 0-12 years range. A few respondents' clients were limited to a smaller range, eg 5 to 12 years or 0 to 5 years. Clients suffered from many kinds of disabilities including cerebral palsy (mentioned by fifteen out of eighteen respondents), spina bifida (eleven respondents), burns and injuries (8), mental retardation (5), multiple sclerosis (3), and learning difficulties (2). Other disabilities mentioned were absence of limb, blindness, brain dysfunction, clumsiness, deprivation, congenital deformity and developmental delay.

Respondents were asked to select one of their clients and to answer questions concerning their particular disabilities. Six respondents said their clients were extremely disabled, eight said the disability was 'major', and three said moderately disabled. One respondent did not answer this question. The disabilities (mentioned by ten respondents) included cerebral palsy, spina bifida, burns, metabolic disorder, muscular dystrophy, blindness and loss of limbs. Their clients' ages (given by eight respondents only) ranged from twenty months to sixteen years. Parts of the body affected varied from 'all parts' (six clients) to either upper or lower limbs, or both. Two clients were mainly affected on one side only.

The senses most affected were balance (mentioned 13 times), coordination (12 times), speech (6) and sight (twice). Two respondents did not answer the question. The skills most restricted included reading, writing, manipulation, learning, toilet, eating, drinking, anti-gravity movements and (in one case) learning braille. Difficulty with toilet activities was mentioned most frequently. A wide variety of clients' abnormalities was described from lack of support and poor balance to periodic spasm in limbs and spasticity or 'tightness'.

Various suggestions were made by respondents for maintaining satisfactory posture of their clients. Some respondents described parts of the body needing support or correction and the way this should be done eg:

> "Has no hand function at all, no matter what position or how much support, so can really only participate on verbal/visual levels, ... mainly needs some means of maintaining head in midline and all limbs and trunk stabilized."

Other respondents were less specific, but some described in detail the physical means of achieving the correct posture control eg:

> "High backed padded chair, padded wedge cushion to maintain hip flexion, pelvic strap, cut-out tray with padded thoracic support, foot platform, padded abduction block, built up surround on foot platform to prevent feet slipping off platform."

11.5 USER REQUIREMENTS AND ACTIVITIES

Respondents were next asked to rate twelve listed requirements of aids into three categories of importance, an option being given to add other important requirements, and also to give them a rating (only one respondent did so). The requirements are set out below in order of importance as rated collectively by all respondents.

Table 11.1 Order of importance of requirements

Requirement	Rated 'highly important' by
SAFETY	18 respondents
COMFORT	16 "
MOBILITY	14 "
ADJUSTMENT RANGE	13 "
ADJUSTMENT EASE	11 "
COST TO PURCHASE	8 "
TRANSPORTABLE	8 "
DURABLE	6 "
FOLDABLE	5 "
ATTACHMENTS AVAILABLE	4 "
CLEANABLE	4 "
APPEARANCE	3 "

There was considerable variation in the overall level of importance which respondents gave to requirements. One respondent commented that two requirements - APPEARANCE and FOLDABLE - would probably be rated highly important by parents. More than half the respondents gave ratings higher than the median.

SAFETY, COMFORT and MOBILITY were rated consistently as being highly important, while APPEARANCE, CLEANABILITY and AVAILABILITY OF ATTACHMENTS were rated generally as least important.

Respondents were next asked to elaborate on those requirements which they had put as 'highly important'. SAFETY was described in terms such as:

"able to leave child alone for short periods without risk"
"to give feeling of security and confidence"
"avoid risk of tipping over"
"avoid risk of facturing fragile bones"
"avoid falls, sharp edges"
"make stable, absence of sharp edges, adequate safety belts and catches, locking casters..."

Other respondents commented on COMFORT, referring to problems such as irritability of the child if left for lengthy periods, discomfort due to pressure soreness, and sweatiness in hot weather. ADJUSTABILITY (and versatility) was referred to by several respondents as being important where children used the same aid, or where the same child used the aid over several years. Variability in a client's need for postural support was mentioned by two respondents.

Verbatim examples of two respondents' replies are given below as illustrating the kind of problems described with respect to SAFETY and COMFORT:

"The child must be comfortable or they will fight against the corrected posture. They must feel secure when moved around in the chair or again abnormal postures will result. They also should not feel that people around them are battling to adjust, move or clean their aids or again it will increase tension unnecessarily."

"No sharp edges, or possibility of child fiddling dangerously with parts. Essential to prevent equipment becoming rickety and dangerous. Also to prevent further costs incurred in replacement."

and on the need for RANGE OF ADJUSTMENT the same respondent wrote:

"...in view of child's growth and possible asymmetry... ease and range of adjustment, collapsible/foldable and transportability (are) essential points for parents and therapists in relation to everyday living and speed and ease of coping with equipment. Equipment should be light, compact."

Despite APPEARANCE being given a low rating by many respondents, two commented on this aspect thus:

> "....so many aids are workshop built and therefore often solid and heavy, rather unattractive, look as though they're disabled aids; whereas I feel surely they must be able to be nice in appearance, light and much less cumbersome."

and

> "Appearance - this is most important! For the child to fit in as well as possible with the rest of the group. They have enough problems with being different. Elaborate contraptions aren't good."

The need for ADJUSTABILITY of both chairs and tables was eleborated by one hospital occupational therapist:

> "Enough range of adjustment to ensure good 'fit', correct positioning, posturing. Padded seats, arm rests, chair backs, acceptable to patient. (Adjustable) seat height, back height and angle; removable arm rests; foot plate - height, angle, removable; tables - height and top angle."

DURABILITY was related to COST and ADJUSTABILITY as another occupational therapist pointed out:

> "Most equipment is expensive and therefore it is necessary that it lasts as long as possible. This factor goes hand in hand with adjustability as a child grows so quickly that this factor eliminates (the) need for new chairs less frequently."

Several respondents referred especially to the need to encourage movement, independence and to reduce tension in the child.

Respondents were next requested to give examples of creative and/or educational activities their clients did often. In addition information was asked for on the physical requirements of one activity. Activities mentioned most frequently were painting or drawing (mentioned 8 times); radio, T.V. or records (5 times); pasting/scrap book (4); eating (4); cooking (3); construction (3); reading (3); writing (3); dressing and undressing (3).

Many activities did not need to be done seated or at a table, depending on whether the child required postural support to sit or stand. Some activities were messy, wet or noisy, and needed a suitable environment and equipment. Others, such as typing, chess or sewing (with machine), needed special equipment and appropriate supporting table or desk. Although many activities listed were 'solitary', some respondents drew attention to the need to encourage group interaction with other children, parents and helpers. Difficulties with eating and toiletting were also mentioned, particularly the need for specially adapted cutlery. Some activities were designed to extend the child's range of movement or capability, or were more suited to the needs of a particular child, eg using a foot pedal to operate a sewing machine.

Conventional sitting positions were not suitable for many activities. A wide range of movements and types of posture needed to be provided for in aids designed to cater for the activities as varied as those mentioned by respondents. Descriptions of sensory, motor, psychological and social requirements of selected activities were asked for. This information was given in the form of short descriptions, as in the examples below.

For playing chess:

> "Requires concentration, good eye-object contrast, communication and interaction with opponent, verbal skills. Requires someone to assist by making his moves for him."

For feeding:

> "Balance, dexterity not needed with adapted spoon, although makes it much easier - firm, bigger plate with raised rim helps compensate for poor dexterity, as does non-skid matting underneath."

For painting:

> "Awareness of position in space (a starting frame of reference). Movement of the painting implement over the surface of the material."

11.6 ASSESSMENT OF AIDS USED

Information on kinds of furniture or aids used by clients was asked for next. The majority listed chairs, tables, trolley boards (or prone boards), standing frames and boxes, wheelchairs, 'buggies', 'rollers', 'wedge seats', potty seats and 'Chailey carts'."

Aids were mostly obtained from the institution's own workshops or from prison workshops, some being home-made from designs seen in publications or adapted to suit individual clients. In many cases cost of the aid was given as 'nil' or 'materials only'. Information about aids was obtained from a variety of sources including 'seen in a journal' or 'professional advice'.

Aids were used in many situations for which they were not specifically designed. Floor surfaces presented mobility and stability problems, particularly rough or soft surfaces. Inability to take or use aids outside 'in the park' or 'on the beach' was a common complaint.

'Special features' of aids considered useful by respondents included means of providing restraint or support such as straps, abduction blocks, and arm or head rests. Some aids were adjustable, but often this facility was difficult to use, or of insufficient range to cope with the variety of children using the aid. Although some aids were 'washable', in many instances the types of shapes or materials used did not facilitate cleaning.

Methods of construction of many aids described by respondents were such that they could easily be made at home or in institution workshops, rather than in a factory.

Various methods of adjustment were described for variable height tables and for arm and head supports of seats. A few respondents mentioned collapsible or foldable as a 'special feature', this being mainly in respect of transportable chairs that could be taken in a car or on public transport.

The last section of the questionnaire asked respondents to select an aid which they preferred, and to assess its suitability in terms of features:

a) found most useful
b) omitted, but which were needed
c) found least useful
d) which needed altering

Respondents were also asked to state whether they would recommend the aid unreservedly, with some reservations, with caution, or not at all, and then to assess their selected aid in terms of the twelve requirements listed previously in the questionnaire.

Features listed as 'most useful' included:

assists attention to teaching
mobile with little exertion
scrubbable, cleanable
stable, safe
convenient to use
abduction block
easy to cope, easy to make
low cost
adjustable legs
light, easy to move
non-threatening
versatile, adjustable

Features which were omitted, but which were needed, included:

restraint but not restriction
adjustment (various types mentioned)
deeper top to table
interchangeable cut-outs to tables
removable table top
more durable top
casters or swivels for mobility
padding on seats, more comfort
edging to table top
attachments to secure book for supine user

The least useful features were given as:

- discomfort in hot weather (due to non-absorbent covering on seats)
- lack of adjustability
- too high for safety, tips over
- liability to straining, non-cleanable surfaces
- disturbing pattern on table top
- difficulty in lifting child in and out
- lack of mobility, heaviness
- bulkiness, inconvenience to fit in

Features which respondents wanted to alter included:

- more restraint, less restriction
- improved support in back and seat
- better resistance to damage
- easier to adjust, more adaptable
- more versatile
- more comfortable
- better stability
- providing more independence
- straps which can be put on and off easily
- more attractive in appearance
- easier to maintain and repair

Of the fifteen respondents who answered the question on how they would recommend the selected aid to another person in the same situation, seven put 'unreservedly' and eight said 'with some reservations'.

The aids were next assessed by each of the fifteen respondents on a six-point scale from 6 (good) to 1 (bad). SAFETY was the feature rated most highly with a mean score of 4.66, while DURABLE came next with 4.64, and CLEANABLE third with 4.57. Other features in order were:

COST to purchase	4.46
COMFORT	4.21
MOBILITY	3.64
APPEARANCE	3.60
TRANSPORTABLE	3.06
ADJUSTABILITY ease	2.77
range	2.54
FOLDABLE	2.31
ATTACHMENTS available	2.11

Respondents' rank orders of preference given for 'important requirements' earlier in the questionnaire were compared with orders of assessment given to their preferred aid (see table 11.2).

Table 11.2 Comparison between order of importance and assessments of selected furniture

Most important requirements	Assessments	Variation
1. SAFETY	1	0
2. COMFORT	5	-3
3. MOBILITY	6	-3
4. RANGE of adjustment	9	-5
5. EASE of adjustment	10	-5
6. COST to purchase	4	+2
7. TRANSPORTABILITY	8	-1
8. DURABILITY	2	+6
9. FOLDABILITY	11	-2
10. ATTACHMENTS available	12	-2
11. CLEANABLE	3	+7
12. APPEARANCE	7	+5

Features which ranked poorly in the assessments as compared with order of importance, were ADJUSTABILITY (both range and ease), COMFORT and MOBILITY. Features ranked markedly better in the assessment were CLEANABILITY, DURABILITY, and APPEARANCE.

This comparison suggested that features which respondents most wanted to be improved were EASE and RANGE OF ADJUSTMENT, and COMFORT. Other features which could be improved with benefit were MOBILITY, FOLDABILITY, availability of ATTACHMENTS and TRANSPORTABILITY (in that order).

Many respondents had apparently chosen aids for reasons of personal preference rather than as a result of systematic evaluation of alternatives in relation to predetermined requirements. Evidence for this came from the finding that several respondents gave significantly different orders of priority for needs, compared with how they evaluated an aid selected by them as a 'good example'. While this may be due to lack of clear thinking when answering the survey questionnaire, it indicated that aids which these respondents felt to be 'good' did not meet the requirements which they had specified.

11.7 GENERAL COMMENTS BY RESPONDENTS

The final question sought general comments on such problems as obtaining aids or information, and the need for research. Nine respondents made comments of which four of the more interesting are summarised below.

On obtaining suitable aids:

> "Problem is finding people with the time, interest and knowhow to adapt and innovate aids for mobility and therapeutic use."

On information and research:

> "No information centre advising on suitable aids and range and cost, or providing aids to try out for clients in advance of their buying them. Need for far more research."

> "There is no central source of information about aids for handicapped children and no discussion between centres. A lot of problems are handled in the best way possible at the time without looking for a permanent solution to that problem."

On adjustability and cost:

> "Finding an adjustable piece of furniture which suits more than one child is a problem. Our suppliers are good and usually adapt furniture well at a cost in labour (and occasionally materials) which is high. I would welcome interchangeable parts and easy adjustment heightwise."

Respondents' answers showed that adjustability was an important but largely unmet need. Concern about appearance and psychological aspects of design of aids for handicapped children was partially supported by comments of those respondents who were both a parent of a handicapped child and a therapist.

11.8 AVAILABILITY OF INFORMATION

Several respondents commented on lack of information on seating and other aids for the handicapped. This was despite the existence in Sydney (at that time) of the library of the Australian Council on the Disabled, and the NSW Hospital Planning Advisory Centre's library and exhibition of products. The researcher undertaking the detailed search for aids in catalogues found some information from the library at Cumberland College of Health Sciences serving the Schools of Occupational Therapy and Physiotherapy. Other data were obtained by writing to manufacturers who advertised in technical journals.

Manufacturers were generally poor at giving useful information on their products. They were often uninterested in 'feedback' comments on suitability of aids in use, and a stock answer to any complaint was "but we've never had anyone complain before".

Catalogues obtained from some overseas firms were excellent, both from the range of products illustrated and the clarity and detail of information provided. In Britain both the Disabled Living Foundation and the Chartered Society of Physiotherapy have published books and guides on aids for the disabled. The National Fund for Crippling Diseases in Sussex has produced a comprehensive nine-part catalogue of Equipment for the Disabled which is regularly up-dated. Two equipment manufacturing firms, one American, one Swedish, have also produced comprehensive and well-illustrated catalogues of their products for the disabled (J.A. Preston Corporation 1974, International Society for Rehabilitation of the Disabled 1972). The few catalogues and leaflets of products produced in Australia, or available from Australian agents, were relatively uninformative by comparison with the overseas examples.

During the course of the research program a considerable number of books, journal articles, research reports and manufacturers' catalogues were searched for references relevant to design, evaluation or use of seating and table aids for physically handicapped children in Australia and overseas. Virtually no research was reported from Australia, the main sources being United States, Britain, Switzerland and Sweden.

The references were divided between those describing design or adaptation of simple chairs and tables at minimum cost, and those describing mobile and adjustable aids which were usually both expensive and complex. No clear indication emerged of a preferred approach to the research except that it was important to assess carefully the clients' needs and capabilities, and to encourage client involvement in selection and modification of aids. Adaptability and mobility were recognised as important but often unsatisfied needs. Appearance was only referred to occasionally, although psychological aspects were stressed, particularly with regard to other people's attitudes to the handicapped. Correct posture support and means of restraint were the main considerations, suprisingly little reference being made to safety. Comfort and avoidance of pressure sores were important considerations, especially for clients who were unable to move their position, or who were left for long periods without attention from helpers.

11.9 DESIGN DEVELOPMENT

Some of the problems encountered in discussing aids currently available, or which had been home-made in an institution's own workshops, suggested that many of their shortcomings were due to what Norton (1970) described as a 'vicious circle' process of design rather than a 'linear' process.

The 'vicious circle' process starts by inventing a solution to a problem which has become apparent in an existing product. As a result the original problem is only partly solved and new unexpected problems emerge in attempting to improve the faulty solution.

The 'linear' process starts by identifying objectives and functional requirements and attempts to identify design features which would answer these requirements. Designs are then developed and tested until a satisfactory means of answering the requirements is found. In the 'vicious circle' process there is no systematic evaluation because no criteria have been established on which evaluation of design options could be based (see also chapter 2 section 6).

The two kinds of process are set out in the four diagrams which follow together with their theoretical application to the process of design of seating for handicapped children (see figs 11.1 to 11.4).

The research project, while being primarily concerned with trying to produce better designs for this type of therapeutic equipment,was also concerned with developing a general approach to design, evaluation and feedback which could be applied to other types of design problems.

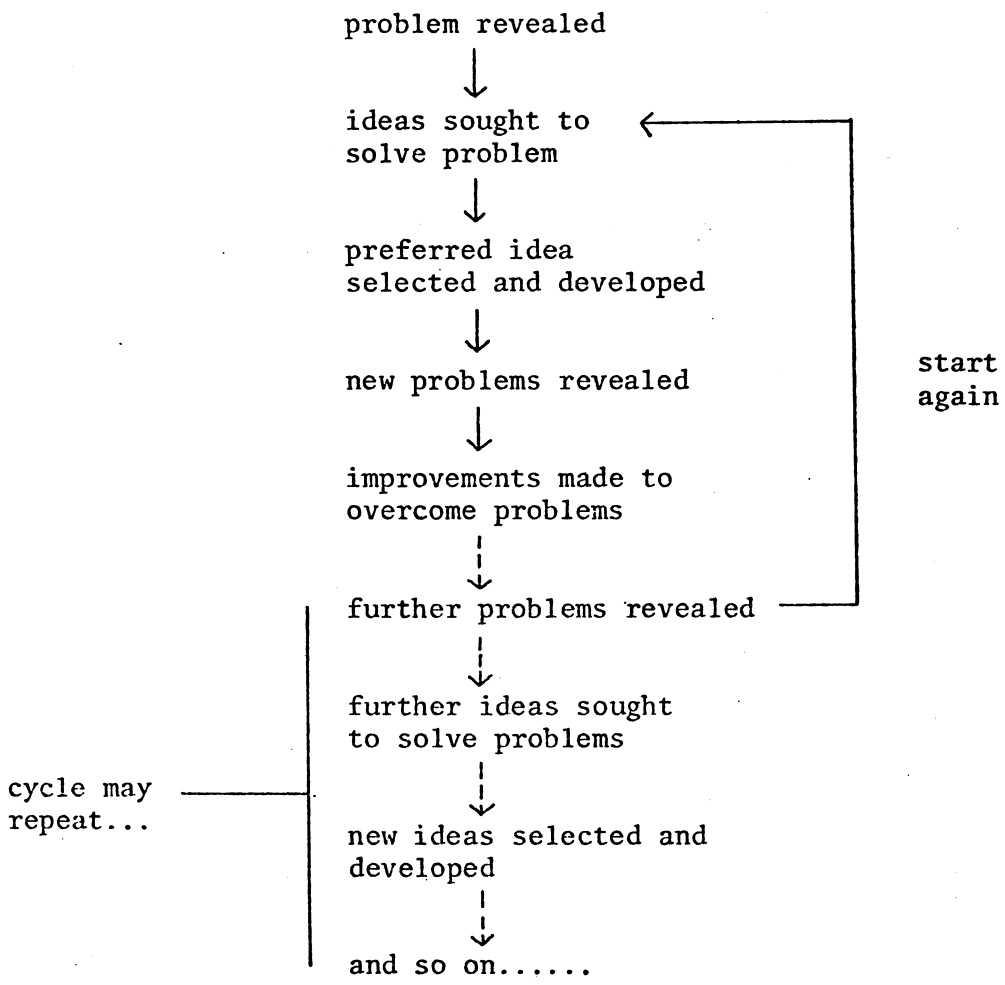


Fig 11.1 'VICIOUS CIRCLE' DESIGN SEQUENCE

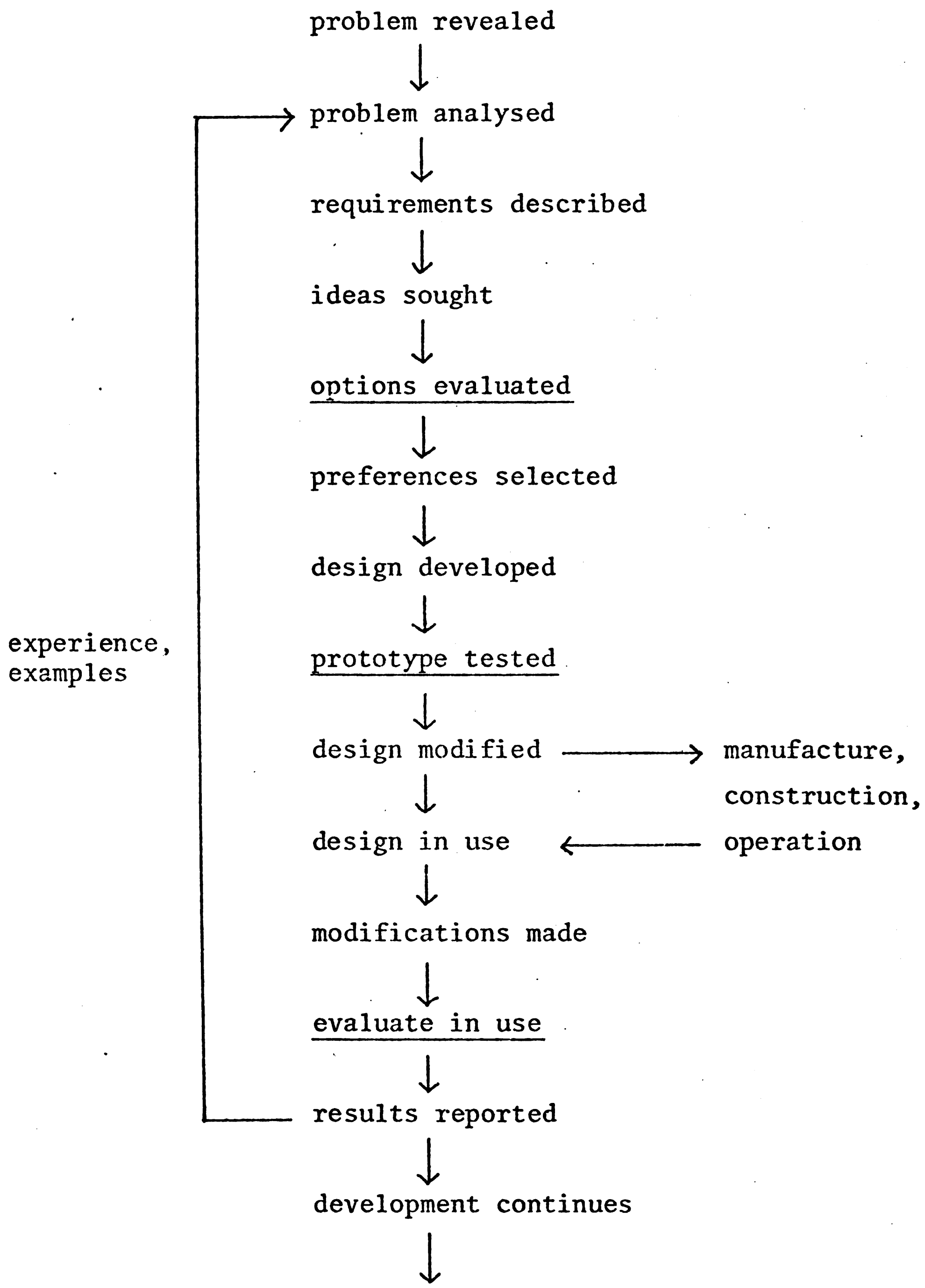


Fig 11.2 LINEAR DESIGN SEQUENCE

handicapped children need physical support while engaged in creative play activities

↓

ideas sought from colleagues, aids obtained from manufacturers, equipment suppliers, splint makers.....

↓

existing school chairs adapted to individual needs, home made aids produced to order, special chairs obtained from manufacturers

↓

experience in use reveals problems of mobility, adjustability, cleanability, etc.

↓

adjustments made to improve mobility, adjustability, cleanability, etc.

↓

problems of mobility, adjustability, cleanability, etc. accepted as needing new type of solution

↓

new ideas sought to overcome problems of mobility, adjustability, etc.

↓

new means of providing mobility, adjustability, etc. developed or selected

↓

experience in use reveals other problems of safety, cost, foldability...

↓

adjustments made to overcome problems of safety, cost, etc.

↓

problems of safety, cost etc. accepted as needing new type of solution

cycle repeats

Fig 11.3

FAILURE TO SOLVE PROBLEM OF SEATING AIDS FOR HANDICAPPED CHILDREN DUE TO VICIOUS CIRCLE DESIGN PROCESS.

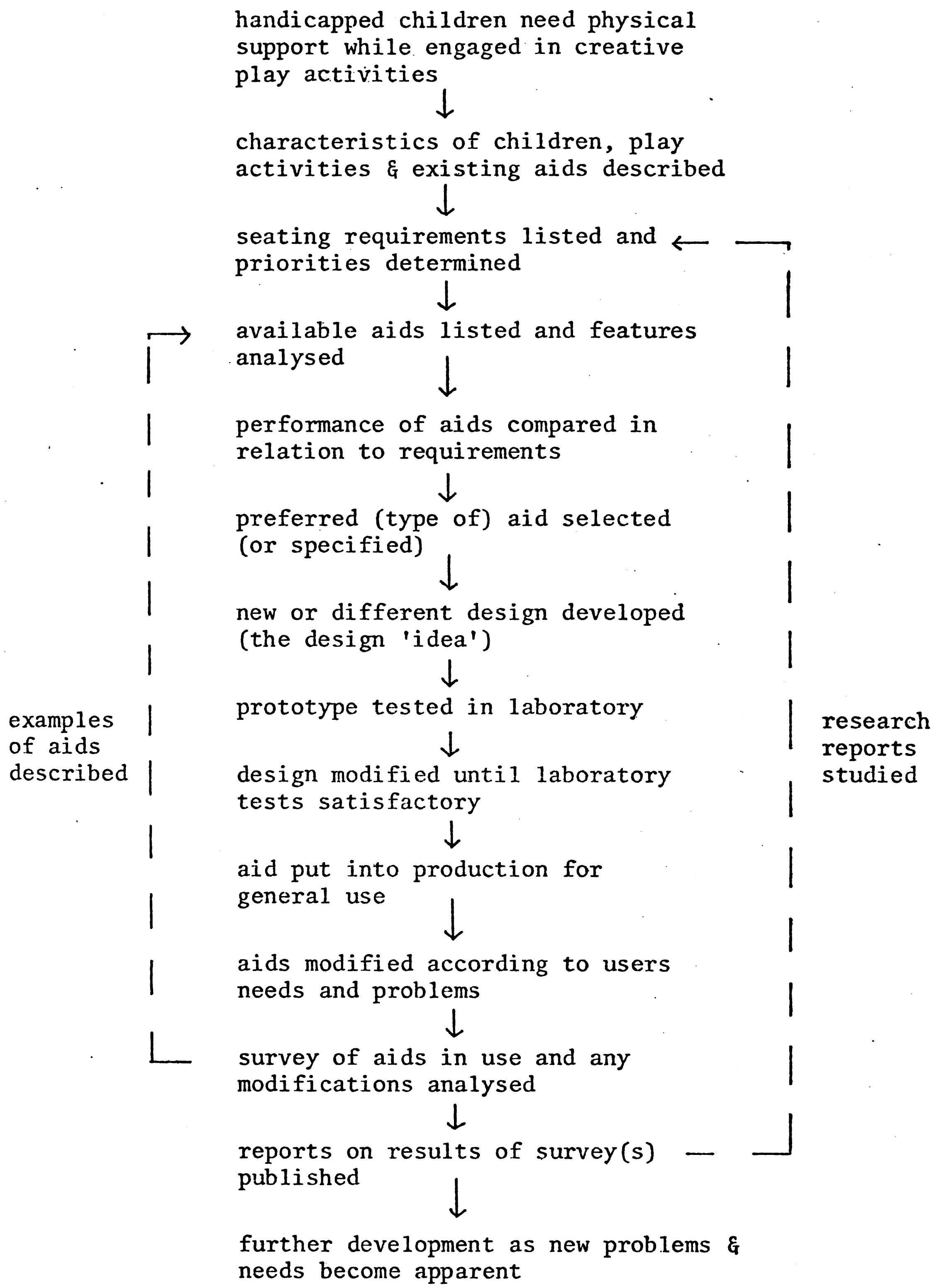


Fig 11.4

APPLICATION OF LINEAR DESIGN PROCESS TO SEATING AIDS FOR HANDICAPPED CHILDREN.

Four possible approaches to design development were evaluated:-

1. Modify an existing design which is considered to be the best currently available.
2. Identify good features in various existing designs and develop a new design which combines these features.
3. Develop design ideas from discussion and experiment and test whether they meet the users' apparent needs.
4. Determine priorities of users' needs by discussion with advisers and explore possible design options for meeting each need. Analyse interactions between needs and designs to identify compatible features.

A combination of approaches 2, 3 and 4 was finally adopted:

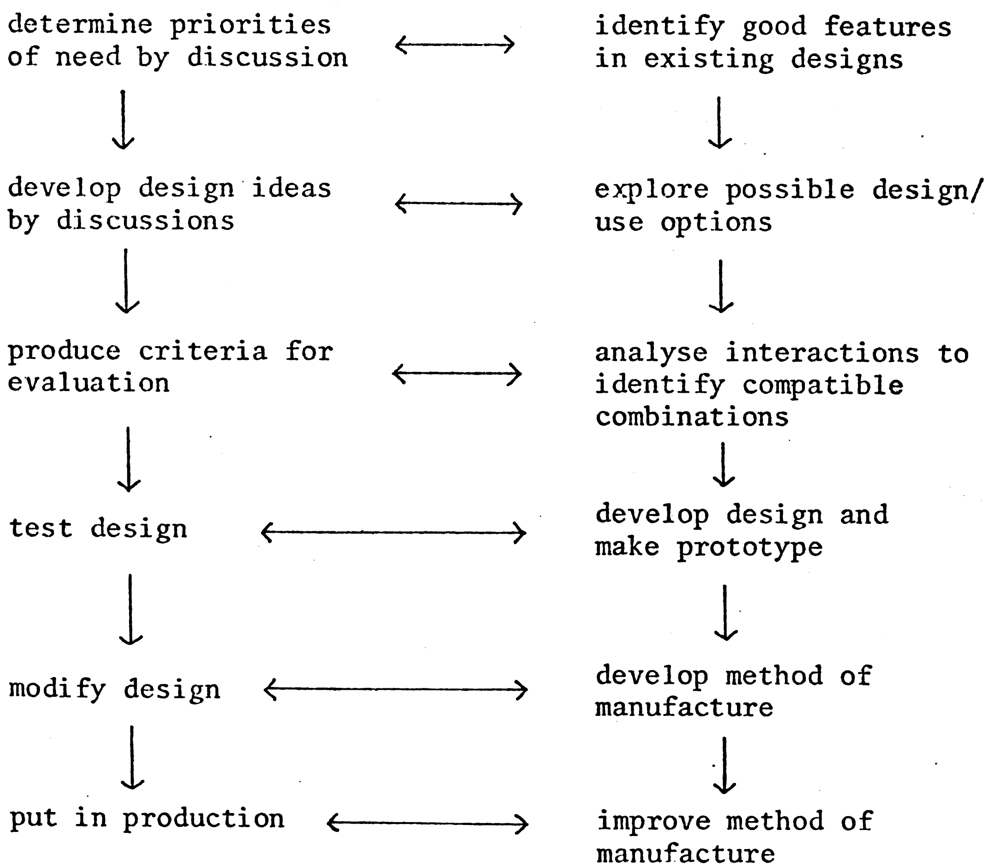


Fig 11.5 Design approach selected for furniture design project

11.10 FINDINGS

As a result of the preliminary survey the following statement of problems and requirements was formulated:-

1. Problems with many existing designs of seats and tables are:

   a) a tendency for the child to slip forward in the seat

   b) a lack of adequate means of head and trunk support for some severely handicapped children

   c) a lack of means of adjusting height, depth and angle of seat base, and back, arm and foot rests to give reasonable comfort in use

   d) tables and trays which could not be modified to suit the activity and dimensions of users

   e) inability to clean adequately all parts of the seat or table

   f) excessive cost to purchase

   g) insufficiently robust for normal abuse

   h) too complex in adjustment

   i) unsafe to leave child alone for short periods

   j) uncomfortable, especially in hot/humid weather

   k) clumsy, heavy and degrading appearance

2. The age of children to be catered for may range from one year to sixteen years. The degree of disability to be catered for should include 'extreme' and 'highly dependent'. The kinds of disability should include those needing total support and/or restraint.

3. Lack of a reasonably priced design for a matched or combined adjustable seat and table top is a major deficiency in the furniture available for more severely physically handicapped children.

4. A simple, secure and safe means of adjusting the height of seats and worktables is needed. Methods available are either too clumsy in operation or too complex and hence costly to manufacture. The means of adjustment should be quick and easy enough for a parent, teacher or therapist to operate with both hands, yet not sufficiently easy for the child using the equipment to actuate intentionally or unintentionally. One-handed operation of the means of adjustment would be ideal, but it is likely to allow the child to tamper with the adjustment, or even to cause injury to the hands or legs of the child sitting on the seat.

5. Other features of the seat, such as angle of inclination of back rest, seat platform or arm rests (if provided), also need to be adjusted to suit a) the size and shape of the user, b) the kind of activity being performed, and c) the stages of mental and physical development of the user. Other factors influencing the need for adjustment are the need to experiment to find an ideal or acceptable position, and the degree of ability or disability of the user.

6. The table top or tray attachment should be adjustable in height and angle of inclination through an arc from horizontal to vertical. Means of stopping objects rolling off the table/tray are needed.

7. Methods of manufacture should allow for experiment and modification of the design as feedback from experience in use is gained in different situations. In particular the materials and methods used should be practicable for home or institutional workshop manufacture and adaptation.

8. Both seat and table should allow for ease of wet cleaning and disinfection, for production in a range of colours, for use of transfer designs, and for repair if scratched, dented or broken.

9. Provision should be made for mobility of the seat and table on a variety of surfaces, but with provision for 'locking' or otherwise preventing 'rolling' movement when not required.

10. Aids which are likely to be transported from place to place need to be easily but safely folded or collapsed when not in use. A similar need exists for aids which require to be stored in limited space.

11. Options which need to be explored for both seat and table include:

    a) material for table top/tray, seat base and/or back
    b) material of legs and/or frame
    c) means of attaching seat/table top to frame
    d) means and degree of adjustment for height
    e) means and degree of adjustment of angle
    f) means of providing/preventing mobility
    g) means of attachment of ancillary equipment to seat/table top.

11.11 SUBSEQUENT RESEARCH

Following completion of the preliminary survey, funds were obtained to employ a full-time research officer for two years. This period was spent in further detailed analysis of the literature, a detailed evaluation of four seats and two tables, a survey of mechanical means of adjustment applicable to seats and tables, a commissioned study on postural needs of handicapped children, the specification of detailed design requirements to meet specific user needs, and the development of possible designs to answer the design requirements. This research period was concluded in January 1981 and the following is a resumé of the more significant aspects of the study to date.

Two detailed literature searches were conducted, one on posture needs and problems of handicapped children, and the other on means of preventing pressure sores, both of which were considered to be important aspects of design which had not been satisfactorily solved hitherto. A number of relevant items were retrieved which were later incorporated into the statement of requirements.

An evaluation of four selected seats and two adjustable table systems was carried out using three testers who represented different degrees of manual and intellectual capability, but who had no previous experience in the handling of handicapped children. Each aid was tested for a full range of adjustments and movements, but without the involvement of any handicapped children. A variety of scaling techniques was used in the evaluation program. Examples of some evaluation proformae are shown in appendix E.[14]

A further assessment of four selected aids was conducted using four experienced attendants who were asked to rate each aid in respect of fifteen features. Twelve of the features were those used in the preliminary questionnaire survey, but with the addition of 'convenience of use', 'number of adjustments' and 'versatility'.

From an analysis of the above two evaluation programs, a series of draft requirement specifications were produced for each of the design characteristics used in the assessment program. Each requirement specification identified specific types of user need, each of which were supported by 'reasons', and by evidence from the evaluation program and from 'the literature'. The implications of each specific requirement were then described in terms of what the aid should be capable of doing, rather than a description of what the aid should be like. In this way design preconceptions were avoided and a basis established for systematic testing and development of design possibilities (see appendix B[11]).

The survey of mechanical means of adjustment was intended to apply not only to design of furniture aids, but also to other products involving adjustability of size, position or shape of elements. The survey covered approximately sixty different methods of adjustment, each of which was described in terms of its type, method and range of movement, locking method (if any), and suitable materials for fabrication. A drawing of a typical example was included together with explanatory notes on applications to seating and on methods of operation. Sources of information were given and whether there were any special conditions of use.

A suitable design of seating aid for even moderately physically handicapped children largely depends on the type of postural support provided. It was therefore decided to commission a detailed study of postural requirements from an experienced paediatric occupational therapist. This study described the various clinical conditions and disabilities commonly found in handicapped children, and the most suitable means of providing posture control and support as an aid in treatment and rehabilitation. The kinds of support required by each part of the body were then analysed and anthropometric details derived from these data.

The development of possible designs for seating aids was based on the various inputs described above, in conjunction with consideration of methods of manufacture, cost of production, range of applications, suitable materials, appearance, and likely marketability.

Further stages of development are 1) build working prototypes of several design ideas, and 2) test these in use in real-life situations. Each design can then be evaluated on a similar basis to the earlier evaluation program. Further development and modification will depend on the evaluation findings and on the interest of manufacturers, potential purchasing agencies and individuals.

CHAPTER TWELVE

A FRAMEWORK FOR FEEDBACK - Synopsis

The chapter starts with a review of methods of using feedback to improve design and reduce the incidence of errors. Information derived from experience in planning and design of past projects is considered in terms of four main feedback channels - planning systems, information services, educational programs and evaluation research. Interactions between these four channels are examined for their potential for reducing barriers to knowledge utilisation.

The development of a planning 'map' is described next, emphasizing the cyclic nature of the planning process and its reliance on ethics and values to maintain directional control.

The sequential process of planning and design is then examined in terms of typical 'phases' of planning activities interspersed by procedural 'stages' of approval and documentation.

An approach to the organisation of information in each planning phase is proposed, the aim of which is to formalise the collection and analysis of information, and to ensure that all relevant aspects have been considered.

The idea is suggested of a loosely structured series of indexing terms based on facet analysis. These terms are intended for use in a variety of tasks throughout the planning and design process, and for aiding in research and education.

Requirements of an information system for planning are proposed as a basis for developing a 'framework for feedback'. A series of twelve facets is described, of which four are selected as fundamental for defining any planning information.

12.1 STRUCTURING INFORMATION FOR FEEDBACK

> "Feedback is information about action which is returned to the source of action.....in research in the human service agency there are three major kinds of within-program feedback:
>
> 1. return of data collected about (the) program to program staff in the form of information about how they are doing...
> 2. reporting of findings of research to agency administrators, along with the implications
> 3. communication of agency responses about a new program."

(from TWAIN D 'Developing & Complementing a Research strategy' in STRUENING E L & GUTTENTAG M (1975) p.36)

Beer (1972) defined 'variety' as "the number of possible states of a system". Changes to a system occur as a result of external factors, and the system responds by trying to adapt to the new environment in order to preserve itself. New forms of the system thus emerge, some by accident, some by deliberately searching for a more stable state. The concept of 'feedback' is used by Beer and others to describe the means by which a system regulates itself. 'Negative feedback' is what happens when an error occurs in the system and the control mechanism acts to compensate for the error, thus maintaining homeostasis. In 'positive feedback' the system overcompensates, thus setting up a vicious circle which can lead to disaster unless something intervenes to stop the process of disintegration (Beer 1975, Lovelock 1979).

'Innovation' is the means by which systems develop or evolve to meet changing situations. Stable or closed systems in unstable environments fail because they cannot adapt. By a process of 'trial and error' adaptive or open systems find which new ideas are beneficial and which are not. Their evolution thus depends on a continual process of experiment, evaluation, feedback and modification.

'Information' is the medium which systems use to learn how to respond and adapt to changing external forces. But the information must be able to represent the true nature of these forces otherwise the control mechanism cannot interpret the state of the external environment correctly, and will thus cause errors and breakdown of the system. In cybernetics (which is defined as the science of communication and control), information used in regulatory or control mechanisms, such as the human brain, depends on Ashby's Law of Requisite Variety (Beer 1975 p 111, Ashby 1952/1965 p 229).

The implication of Ashby's law is that any information feedback loop or link has to be able to reflect both the variety of possible environments in which systems (such as hospitals or health centres) exist, and the variety of characteristics which may be exhibited by the systems themselves. Beer (op cit) goes on to discuss the concepts of modelling of systems:

> "A model is a formal account of a system which identifies how it actually works" (p 112).

Models of a health facility planning and design process should therefore represent those features of the process essential to its functioning. Models of hospital organisations or building designs should likewise represent those characteristics which influence how effectively or efficiently they work if they are to be capable of being evaluated. The information which flows through the planning and design process should be able to portray, in an understandable way to all concerned, all the qualities and quantities which planners and designers need to know about to make rational decisions (Markus et al 1972).

There are four main channels for the feedback of information to the 'source of action' in planning and design:

1. Through the planning system, ie by means of processes and procedures intended to foster repetition of 'good' designs and to ensure that innovations are adequately tested before being put into practice.

2. Through information services provided for the professional needs of planners, eg libraries, advisory services, information retrieval systems, and serial publications.

3. Through formal and informal education programs aimed at developing professional skills and amplifying knowledge in both inexperienced and experienced planners, designers and clients.

4. Through research undertaken in the context of project planning or program planning, and intended to demonstrate links between 'causes and effects'.

Each of these channels has developed different kinds of structures and methods for the processing of information. Planning and design processes, for example, rely mainly on project documents in the form of briefs, performance specifications, and design drawings for communication between the various professional groups involved in each phase of planning. Enquiry services are essentially concerned with solutions or products which answer specific kinds of needs or problems. Teaching programs focus on techniques for solving problems, or on facts about functions and facilities. Evaluation research deals with the descriptive characteristics of phenomena and their physical or behavioural effects.

The often tenuous links between these four feedback channels may partly explain the poor utilisation of knowledge in planning, design, construction and use. One means of improving this situation is to develop similar information structures for all four channels so that information can be transferred readily between them.

The subject of 'lighting', for instance, may need to include concepts such as visual comfort, daylight factor, light fittings, glare index, spectral distribution, and reflectance. In the planning channel these concepts will be represented by standards for illumination, and by drawings and specifications of lighting installations. The information channel will contain articles on illumination technology, manufacturers' lighting products, descriptions of lighting installations etc. Education programs will be based on textbooks about lighting theory, and may include visits to examine lighting installations, and assignments to test students' knowledge of good lighting practice. The research channel will be concerned with evaluating users' reactions to specific kinds of lighting designs, and with comparing the cost effectiveness of various types of installation.

The facets and keywords developed for an experimental bibliography on lighting design (described in chapter 8) aimed to provide an overall structure for information on design of hospital lighting. The bibliography also aimed to link theory with practice, and to facilitate retrieval of information on specific kinds of lighting problem. It did not pretend to present information in a way which could be used directly by practitioners. Another bibliography on outpatient department design, which contained more easily absorbed abstracts of the contents of selected publications, provided a means of utilising these primary sources when applied to typical problems. A combination of the two approaches would arguably have been more acceptable to users (see appendix I[3.5]).

'State-of-the-art reports', rather than bibliographies, are a popular form of feedback medium, but they are time consuming to prepare and are necessarily selective in their message (Heath & Green 1976 pp 80 & 134).

Other kinds of document identification and retrieval systems, such as bibliographic indexes, abstracting services, and computer-based citation lists on specific topics, tend to serve only the specific needs of librarians, students or researchers. They are not effective in linking planners and designers with reports on the findings of research and evaluation studies. This is achieved more effectively through formal tertiary education programs in planning and design, or by continuing education courses and conferences on specific types of planning and design problems. Informal channels of communication, such as seminars and discussion meetings, are widely used by planners and designers, and to a lesser extent by 'informers', educators and researchers.

The preference of many information users for informal and unstructured information sources, such as people to consult and projects to visit, has to be recognised. Information outputs from these sources nevertheless need to be formalised (structured) if they are to be incorporated into the decision making process. This is because disorganised information cannot effectively be retrieved in response to enquiries on specific topics. To have to search through masses of unstructured information to find a required item is needlessly time-wasting and mind-deadening.

The advent of computer text-scanning systems may possibly alter this situation, but a well-trained human brain, aided by a simple structure for analysis of information, is likely to be more acceptable and more effective. The question remains however as to the most effective means of structuring information for feedback. The following sections examine ways of reducing barriers to feedback of information and propose various means of making information on health facility planning and design more accessible and understandable.

.2 REDUCING BARRIERS TO KNOWLEDGE UTILISATION

Some of the barriers to utilisation of planning and design knowledge appear to be due to information providers not being sufficiently aware of the problems and needs of planners, educators and researchers. Each of these four professional groups tends to be isolated from the others. One reason is because knowledge which could be effectively utilised is instead 'hidden' in specialised journals, books and libraries which are not widely read by planning practitioners.

To explore how barriers between the four professional fields could be reduced a matrix was drawn to represent interactions between the four fields. Actions of each field upon itself were also included, resulting in 16 areas of interaction, each of which contained a number of possible methods of utilising knowledge. The cells of the matrix show types of information resulting from interactions between the professional fields heading each of the columns and those denoting the horizontal bands (see fig 12.1 overleaf).

from / to	PLANNING & DESIGN	INFORMATION & DOCUMENTATION	EVALUATION & GUIDANCE	RESEARCH & EVALUATION
P & D	1 design methods design strategies planning the planning	2 guidance publications advisory services project documentation	3 design methods decision theories planning procedures	4 planning, design & building research evaluation of design options/ proposals
Inf & D	5 records of design experience results of planning & design projects	6 library guides subject categories advice on advisory services	7 learning how to find information guidance on presenting information	8 research bulletins & indexes evaluation reports
Ed & G	9 problem orientated design projects used for education case studies as a basis for guidance	10 books, journals libraries teaching aids	11 teacher education learning how to learn	12 research project case studies findings from evaluation studies
Res & Ev	13 development projects experimental design projects project evaluations	14 research indexes bibliographies SDI services retrospective searches current journals	15 teaching research methods evaluation projects as a means of learning	16 research on research methods research into results of research evaluating evaluation techniques

Fig 12.1
MATRIX OF INTERACTIONS BETWEEN PLANNING, INFORMATION, EDUCATION AND RESEARCH

Each of the 16 cells in the above matrix is considered below from the viewpoint of how barriers to utilisation of knowledge might be reduced or avoided:

1. EFFECT of PLANNING on PLANNING

a. Develop more awareness of how particular design methods actually work

b. Check on the effects of particular planning and design strategies, eg is time spent on 'briefing' effective in producing better designs which last longer or work better?

c. Obtain more feedback during the process of planning a project to decide whether the plan is going according to plan, or how it might be redirected with benefit.

2. EFFECT of INFORMATION on PLANNING

a. Produce guidance publications which are clearly either mandatory or advisory.

b. Ensure publications are easy to understand, and that recommendations are applicable to current problems.

c. Orientate advisory services to reflect current planning and design problems, and obtain feedback on effectiveness of advice in producing desired effects.

3. EFFECT of EDUCATION on PLANNING

a. Encourage students to experiment with planning/design methods and to develop systematic approaches to problem solving and decision making.

b. Ensure that student projects are realistically evaluated and that students get sufficient opportunity to evaluate buildings in use.

4. EFFECT of RESEARCH on PLANNING

a. Ensure that research is geared to current needs and problems of the professions.

b. Develop greater involvement of research organisations in evaluation of design proposals and of designs in use.

5. EFFECTS of PLANNING on INFORMATION

a. Results of planners' and designers' experience to be recorded for other people to refer to

b. Technical, economic and social effects of planning and design projects to be recorded for reference in subsequent project planning.

6. EFFECTS of INFORMATION on INFORMATION

a. Provide clear guides to users of library and advisory services on how to get the best use from these services.

b. Easy-to-use catalogues, abstracts, bibliographies and SDI services to be available for information providers aiding enquirers working in their own fields of interest.

7. EFFECTS of EDUCATION on INFORMATION

a. Library and information service education to give sufficient emphasis to the problems and needs of information seekers.

b. Educate teachers and students how best to find, apply and present information in their own professional fields.

8. EFFECT of RESEARCH on INFORMATION

a. Results of research projects to be fed into information systems through regularly updated research indexes and research bulletins.

b. Publication of research results to be covered in grants for research projects, and regular bulletins published summarising the results of research.

9. EFFECTS of PLANNING on EVALUATIONS

a. Develop links between 'live' planning and design projects and the education of planners and designers.

b. Maintain regular contact between planning/design offices (both public and private) and schools of architecture, planning and design.

10. EFFECTS of INFORMATION on EDUCATION

a. Ensure availability of well-written and up-to-date books and journal articles for students.

b. Ensure availability of efficient and comprehensive library and advisory services for students.

c. Informative and up-to-date teaching aids to be available through information resource centres, eg tape/slide lectures, TV cassette programs etc.

11. EFFECTS on EDUCATION on EDUCATION

a. Develop feedback to teacher education and refresher courses of the effects of different teaching methods and approaches.

b. Provide courses for students in the best ways to learn, study, read, experiment etc.

12. EFFECTS of RESEARCH on EDUCATION

a. Involve students in selected research projects over sufficiently long periods of time to ensure awareness of the effects of particular research strategies.

b. Ensure students are kept aware of results of current research in relevant fields.

13. EFFECTS of PLANNING on RESEARCH

a. Utilise selected current planning and design projects for research and development.

b. Problems in current planning/design projects to be recorded for feeding into research programs.

14. EFFECTS of INFORMATION on RESEARCH

a. Ensure regular publication and availability to research workers of publications of research findings.

b. Bibliographies and SDI services to be available to research workers in a form which is easy to scan and comprehend

c. Develop capability in retrospective information searching to meet the needs of researchers for reliable, relevant and comprehensive information on specific topics.

d. Ensure availability of current journals and reports, which record results of recent research in relevant fields.

15. EFFECTS of EDUCATION on RESEARCH

a. Educate researchers in research methods appropriate to their fields of work.

b. Utilise educational programs for increasing research potential.

16. EFFECTS of RESEARCH on RESEARCH

a. Research into effects of different research methods.

b. Ensure research findings are effectively utilised in framing research proposals, programs and policies.

Although some of the means of improving information flow suggested above are beyond the scope of this thesis, many of them would nevertheless benefit from having some kind of common information structure to allow knowledge to flow more easily.

12.3 A PLANNING MAP

Planners and designers frequently use drawings or maps as a means of exploring (and explaining) ideas and relationships, partly to check 'fit' and partly as a means of developing ideas. Diagrams are however highly selective in the information they present. Political maps, road maps, geological maps each present a particular set of information about the same bit of the world. 'Personal maps' are used both by geographers and by social scientists to deduce how people perceive their environment (Gould & White 1974).

To explore and explain the relationships between planning, design and information, attempts were made by the writer to produce a map or network diagram which would not only identify the essential elements involved, but also provide a framework for improvement. The history of the search for this framework is of little consequence although it owed its inspiration to many sources (eg Vickery 1960, Broadbent 1969, Jones 1970, Eldin & Croft 1974). One of its starting points was a diagram representing four descriptive facets of DESIGN FUNCTION, ADMINISTRATIVE STAGE, APPLICATION LEVEL and INVESTIGATIVE ASPECT:

AMDINISTRATIVE STAGES (proposals and approvals eg feasibility)	INVESTIGATIVE ASPECTS (problems and needs eg staffing)
APPLICATION LEVELS (decisions and effects eg rooms)	DESIGN FUNCTIONS (services and activities eg surgery)

Fig 12.2 Four descriptive facets

Another starting point was a diagram linking the four elements of PLANNING AND DESIGN PROCESS, EVALUATION AND DECISION MAKING, RESEARCH AND BRIEFING METHODS and INFORMATION SOURCES AND SYSTEMS:

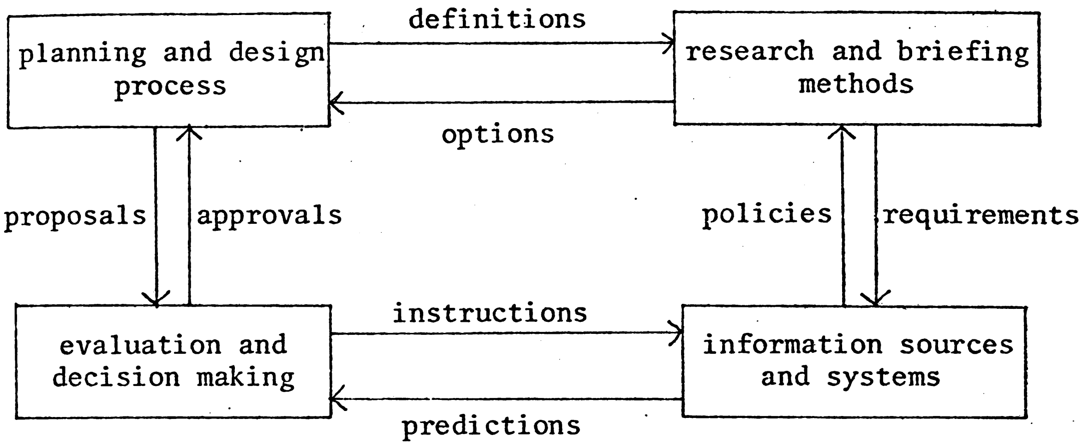
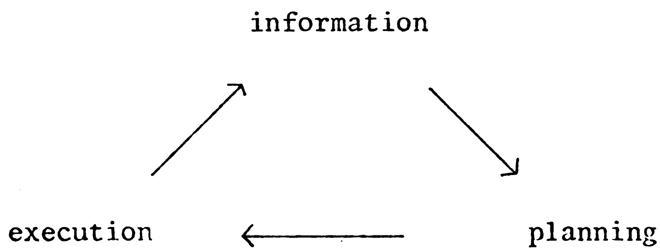


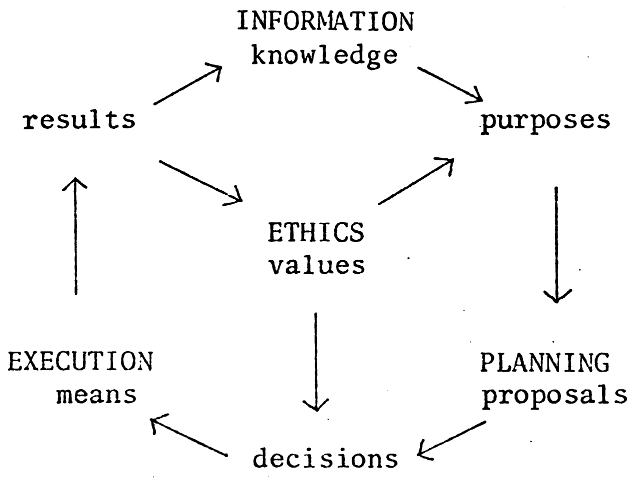
Fig 12.3 Four elements in planning

Neither diagram represented adequately all the essential features, although the second diagram came nearer by showing interactions between the four elements.

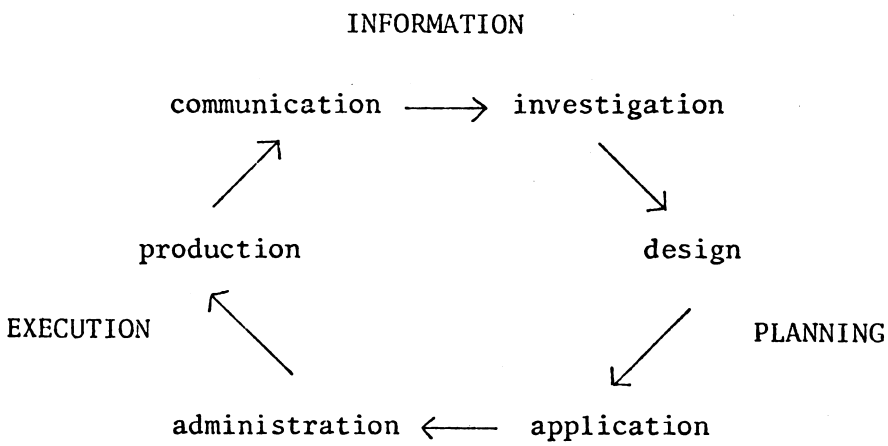
Evolution of the map was a process of periodic revision and refinement. At various times it took the form of a tree structure, a clock face and a linear flow diagram. The result was a combination of all three. The basis of the diagram (and of the idea behind the hypotheses) is a circular flow from information to planning to execution and back to information:



Joining each of the 3 foci are arrows representing purposes, decisions and results. Information in the form of knowledge and experience is used to establish purposes and objectives. Planning involves making proposals and leads to decisions on means of execution. Knowledge of results (actual or simulated) provides further information which redefines the purposes of planning. Governing the whole process are ethics and values, based on evaluation of results and their effects on people:



The next stage of elaboration takes the three main foci and splits each into two 'approaches':



'Information', for example, consists of 'communication', ie describing and conveying ideas about experiences, and 'investigation', whereby information is both sought and analysed for use in 'planning'.

Each of the six 'approaches' is then split into two 'viewpoints':

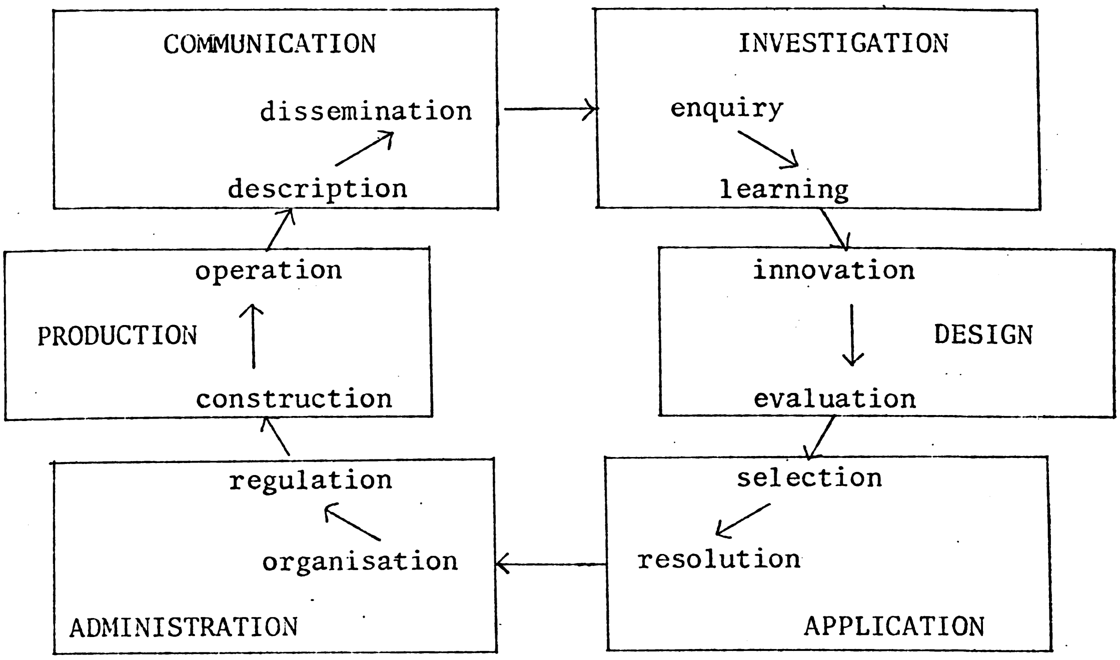
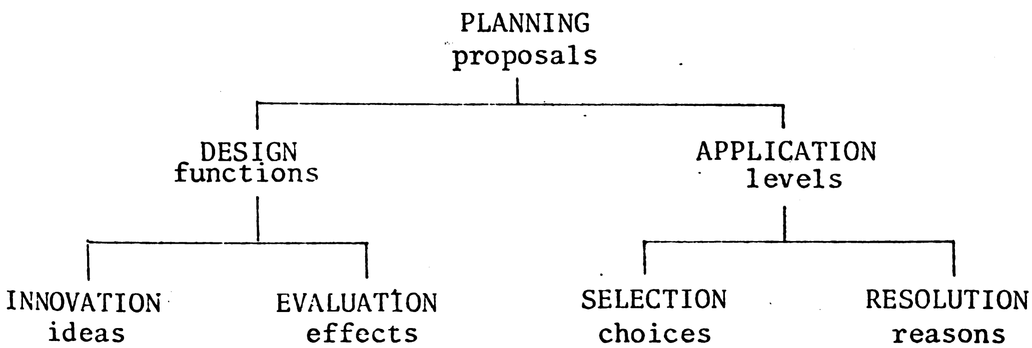
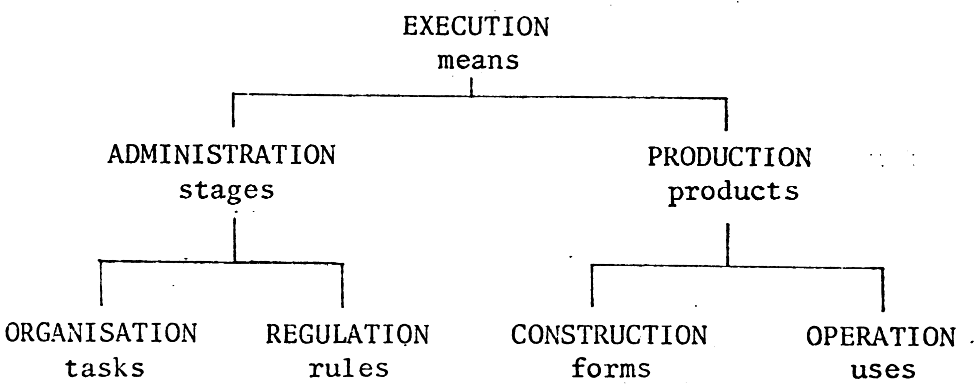


Fig 12.4 Six planning approaches

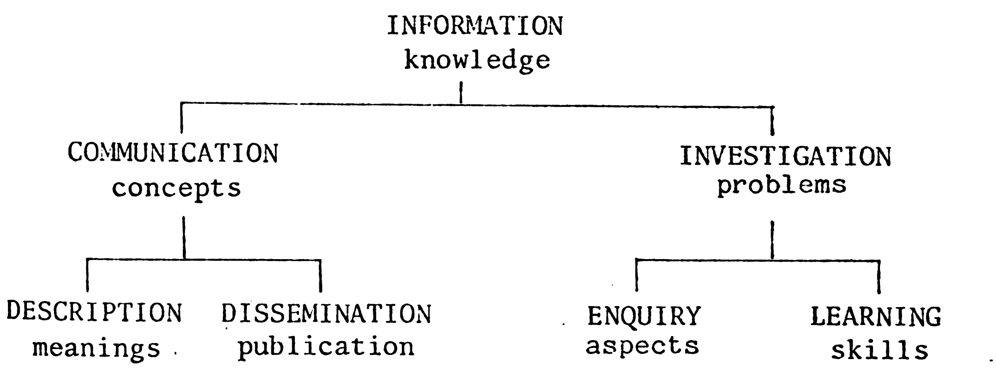
'Design', for example, is split into two viewpoints of 'innovation' (ideas) and 'evaluation' (effects) and is concerned with meeting functional needs. 'Application' concerns levels of the system such as regions, cities, buildings and rooms. Each application level involves selection from a range of possible proposals, followed by resolution of any problems or conflicts before decisions for execution are finalised:



'Execution' involves both administrative <u>stages</u> of implementation and the means of producing <u>products</u>. 'Administration' concerns organising tasks which are regulated by rules or procedures. 'Production' is concerned with construction forms and materials arranged to fulfil operational requirements of users:



'Information' contains knowledge which is communicated by <u>concepts</u>, the meanings of which are disseminated in publications. When a problem is investigated, its aspects are explored and skills are developed in learning how to solve the problems.



The final map is shown below in the form of a 'clock' face centred on ethics and with three sectors of planning, execution and information. The flow sequence is mainly 'clockwise', but links are not restricted to consecutive or adjacent elements (see fig 12.5).

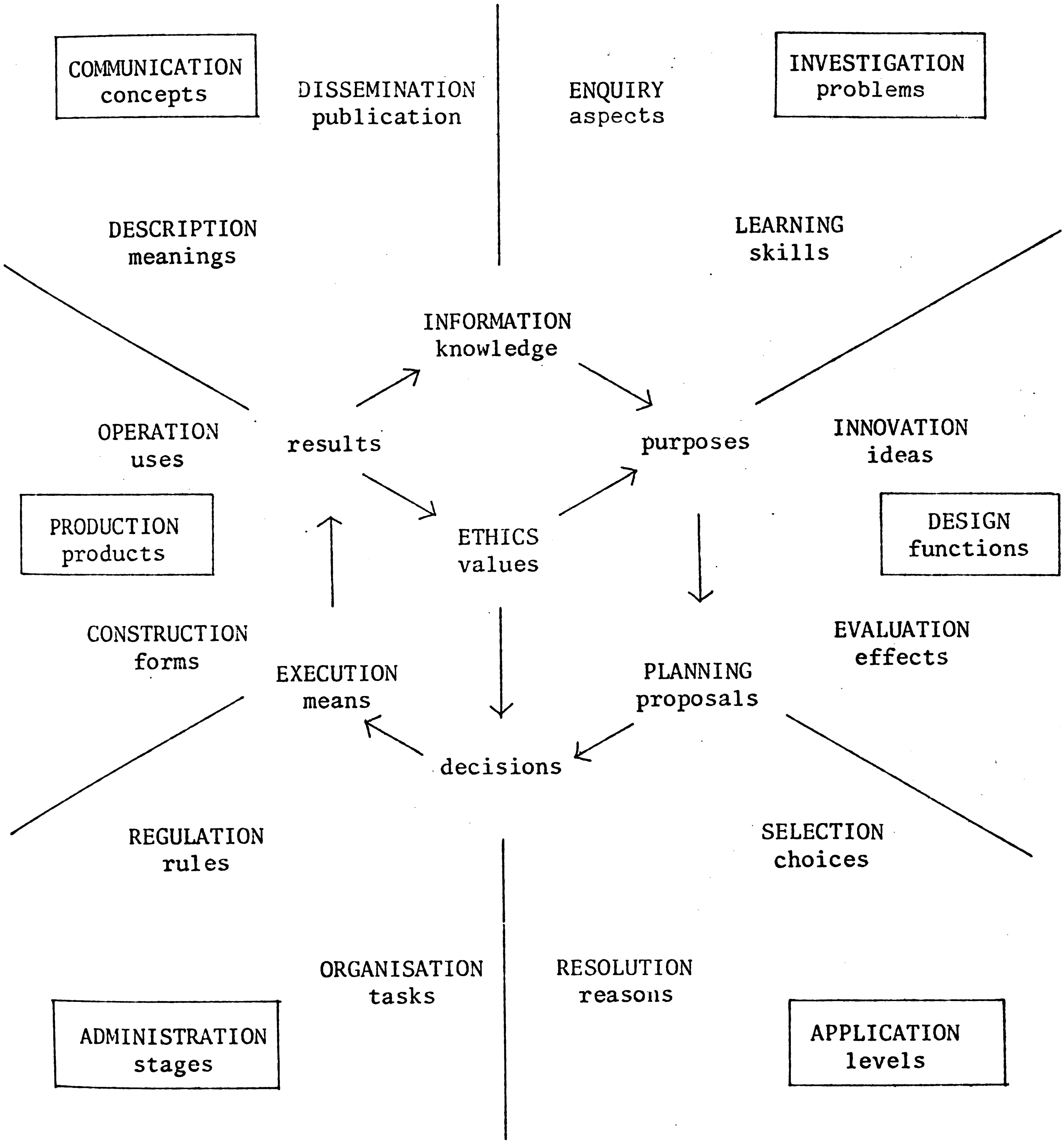


Fig 12.5 A planning map

One use of the map was in defining information facets for generating a controlled language. Other uses included explaining planning concepts to students, and illustrating a book on health service facility planning and design (Green 1974). A drawing can however be more helpful in clarifying the thoughts of its author than as a means of communication. For this reason the map should not be taken too literally or interpreted as a precise system.

An alternative form for the map was considered by which the strength of links between the elements would be evaluated subjectively, thus determining the disposition of the elements. This was explored both by means of an interaction matrix and by a network, but revealed little of benefit. The purpose of this exercise was to try out various planning strategies and to develop a coordinating structure for planning and design information. This idea is further developed in the next sections.

2.4 SEQUENCES OF PLANNING & DESIGN

The review of planning and design methods and processes in chapters two and three revealed no obvious universal procedure for planning health facilities. Similarities between the methods described nevertheless suggest that there is enough common ground for proposing a chronological sequence of planning activities as the principal dimension for a coordinating structure for feedback.

Although many planning processes and procedures represent planning in terms of a succession of decision making activities, few of them distinguish clearly between phases of information processing and problem solving, and stages of documentation and approval. 'Stages' and 'phases' differ mainly in respect of duration and interrelationship, phases being periods of activity which may overlap or even coincide, while stages are event-like, dividing phases from each other in a time sequence:-

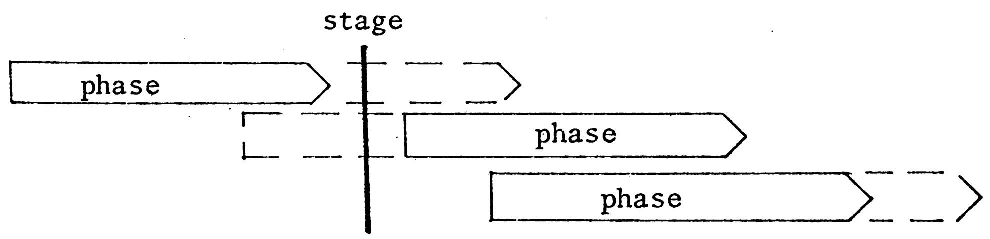


Fig 12.6 Phases and stages in planning

The following diagram describes a typical sequence of facility planning made up of twelve planning phases and seven approval stages. It is intended to apply to a new building project using competitive tendering and erected in one phase of construction. Other contracting methods (or phased construction) would cause phases 5 to 10 to be altered in sequence or split into subphases (See fig 12.7).

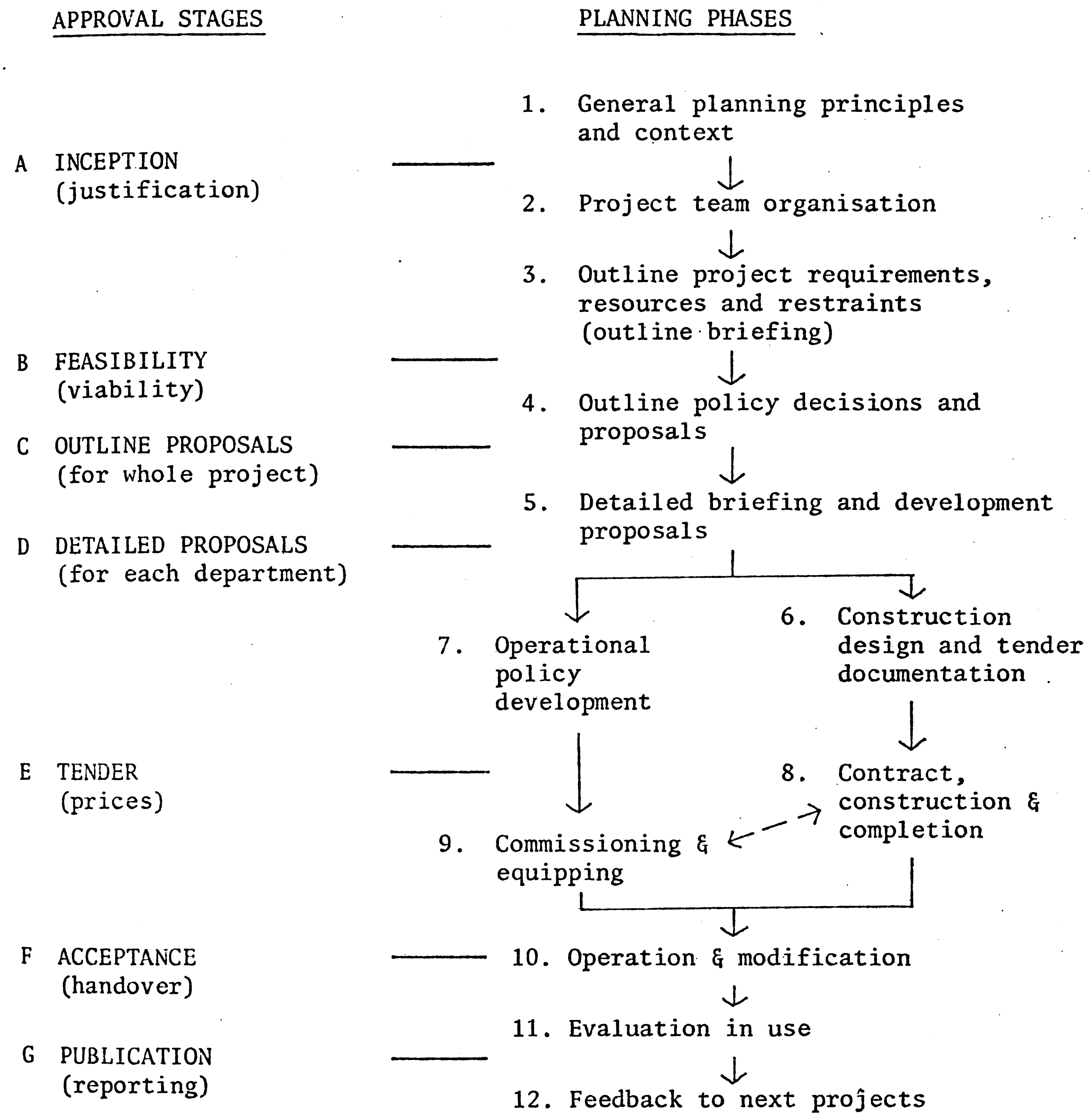


Fig 12.7 SEQUENCE OF PLANNING STAGES & PHASES

Phase 1 in the above sequence of planning represents activities occurring <u>prior</u> to a decision to provide a new facility in a particular locality. It would ideally consist of the series of activities shown in the following diagram (fig 12.8).

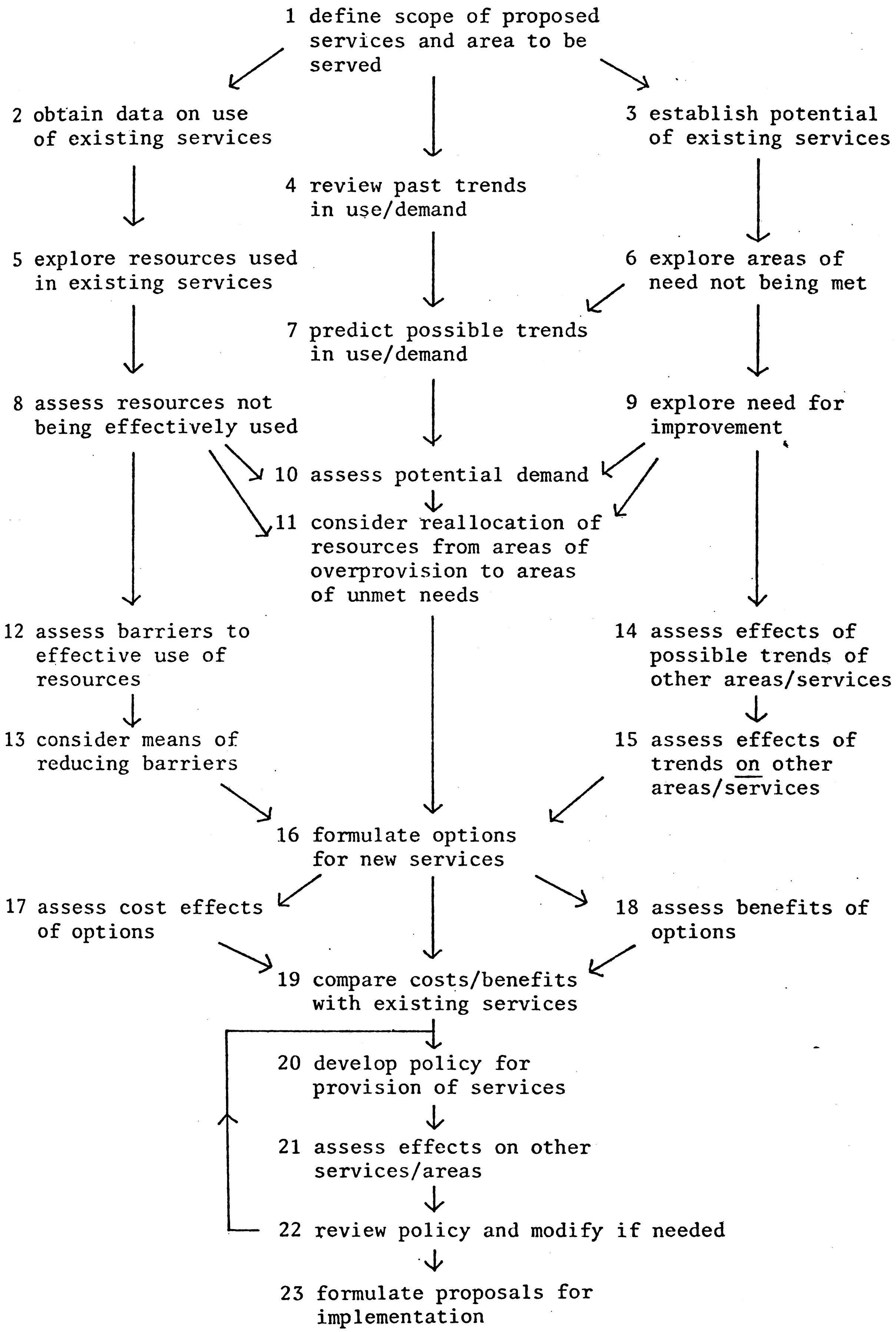


Fig 12.8 ACTIVITIES PRIOR TO DECISION TO BUILD

Each phase of planning can be analysed in a similar manner to the above network. While this is usually done to control the construction and commissioning phases in complex projects, it is not often done for the whole sequence represented by phases 1 to 12. A more readily comprehended form of the planning process is shown below in an approximately chronological sequence of discrete activities listed under each of the twelve phases of planning:

Phase 1 State planning principles
Establish existing context
Organise planning team

Phase 2 Define roles and responsibilities
Secure financial and political support

Phase 3 Identify scope, size, timing of project
Estimate and justify need for project
Establish resources needed
Establish restraints - legal, site, staff etc.

Phase 4 Decide objectives, priorities
Consider operational methods
Explore options, possibilities
Define specific needs, criteria
Evaluate options, consider effects
Selected preferred methods, designs
Develop policies for implementation
Describe outline proposals.

Phase 5 Develop proposals in detail
Identify tasks, parts, systems
Establish relationships between parts
Integrate system elements

Phase 6 Describe proposals in terms of layout, size, content cost, materials, construction, equipment etc.
Propose methods of tendering, type of contract, construction system, project control methods.

Phase 7 Describe operational systems in terms of workload, staffing, traffic, mananagement etc.

Phase 8	Obtain prices, tenders
	Ascertain time require to complete
	Agree terms of contract and award
	Establish means of controlling costs, timing, quality, variations
	Provide instructions to contractors
	Supervise construction, installations
	Check for defects, omissions
	Verify performance, completion
Phase 9	Develop operational manuals, maintenance systems
	Train operators
	Initiate operation
Phase 10	Identify defects, determine remedies
	Rectify faults
	Modify design, operation
	Monitor performance, workload, costs, accidents
Phase 11	Evaluate in use, objectively, subjectively
Phase 12	Report evaluation findings
	Recommend modifications to design, planning method, other projects' guidance etc.

The actual sequence of activities on any particular project would probably vary somewhat from the above. Nevertheless the activities shown occur on most major building projects.

Sometimes the same information moves on from phase to phase as the project proceeds, or it may be added to or modified as more knowledge is gained through experiment and development. Considerable efforts are often expended in compiling evidence to justify allocation of finance in the early phases of planning. Later phases are more involved with tendering and contract information, with cost estimation and control, and with development of operational methods.

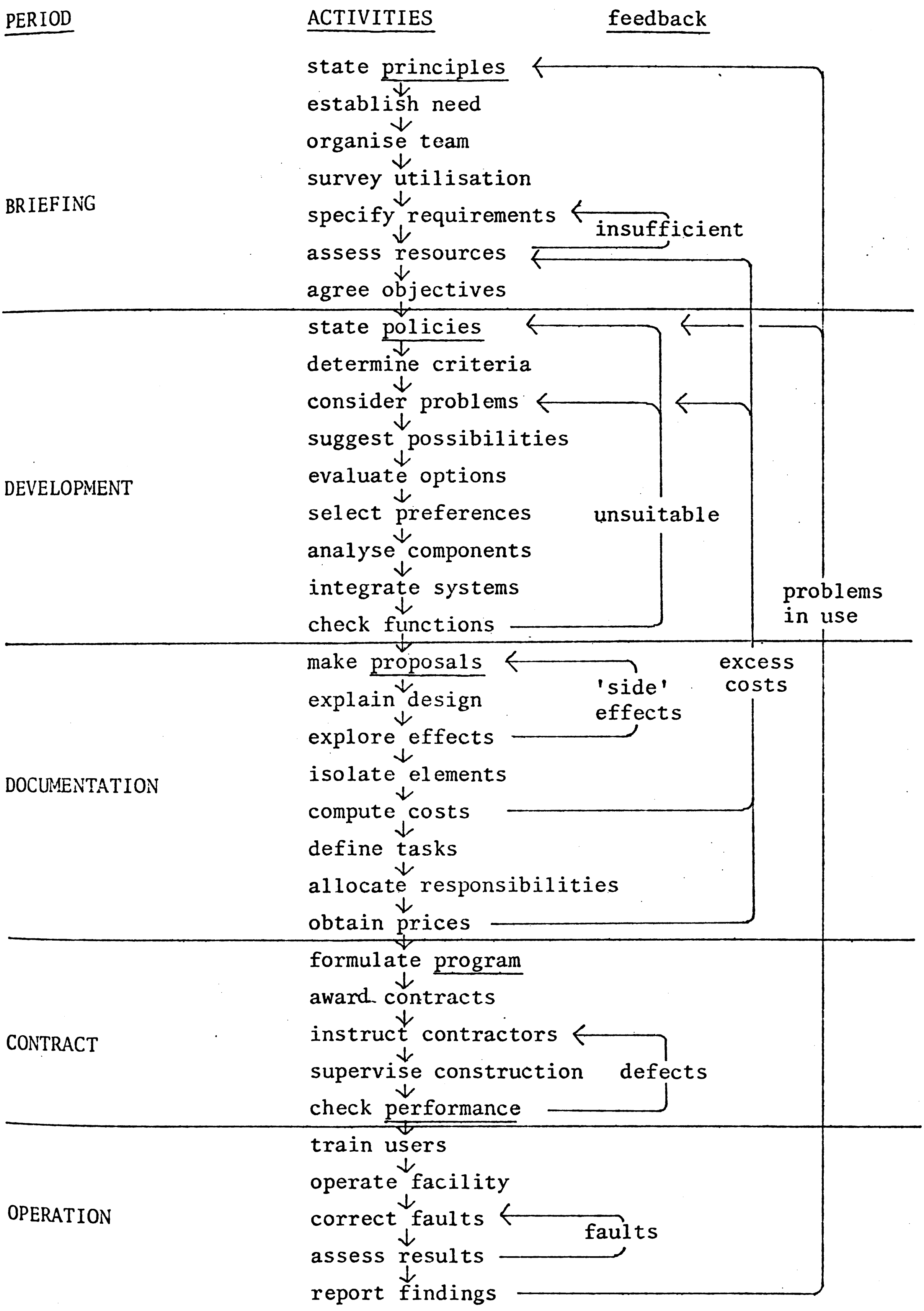


Fig 12.9 PERIODS AND ACTIVITIES OF PLANNING (see explanation overleaf).

A more detailed representation of the building planning process is given above in the form of a series of decision points in a linear flow chart. Even this over-simplifies the process and ignores some of the recycling of decisions and ideas. It does however emphasise the range of activities and tasks involved and the inter-dependency of some activities on others. The activities are grouped into five fairly discrete 'periods' of planning activity (see fig 12.9).

In the diagram 'principles' are those guidelines which apply to all projects in a program; 'policies' represent the application of the principles to particular projects or problems; 'proposals' result from developing the policies into tangible forms. Policies and proposals can each concern function or design, but policies are usually expressed in words, while proposals are more often depicted in diagrammatic or model form. Policies relate to what is to be done, proposals describe how it is proposed to do it. Proposals may however sometimes have to precede policy decisions in order to be able to test the likely effects of the policies.

When all decisions regarding details of the design have been finalised a program for construction is formulated. This program provides the basis for project control. After construction is completed the performance of the design is checked prior to operating the facility and reporting on the findings of evaluation in use.

Feedback loops occur at many points in the sequence of activities. These loops indicate backflow of information concerning problems which require reconsideration before further progress can be made.

An optimum sequence for facility planning depends ultimately on a chain of <u>decisions</u> regarding quantitative aspects such as floor areas and costs, and the <u>data</u> required to make these decisions (see fig 12.10).

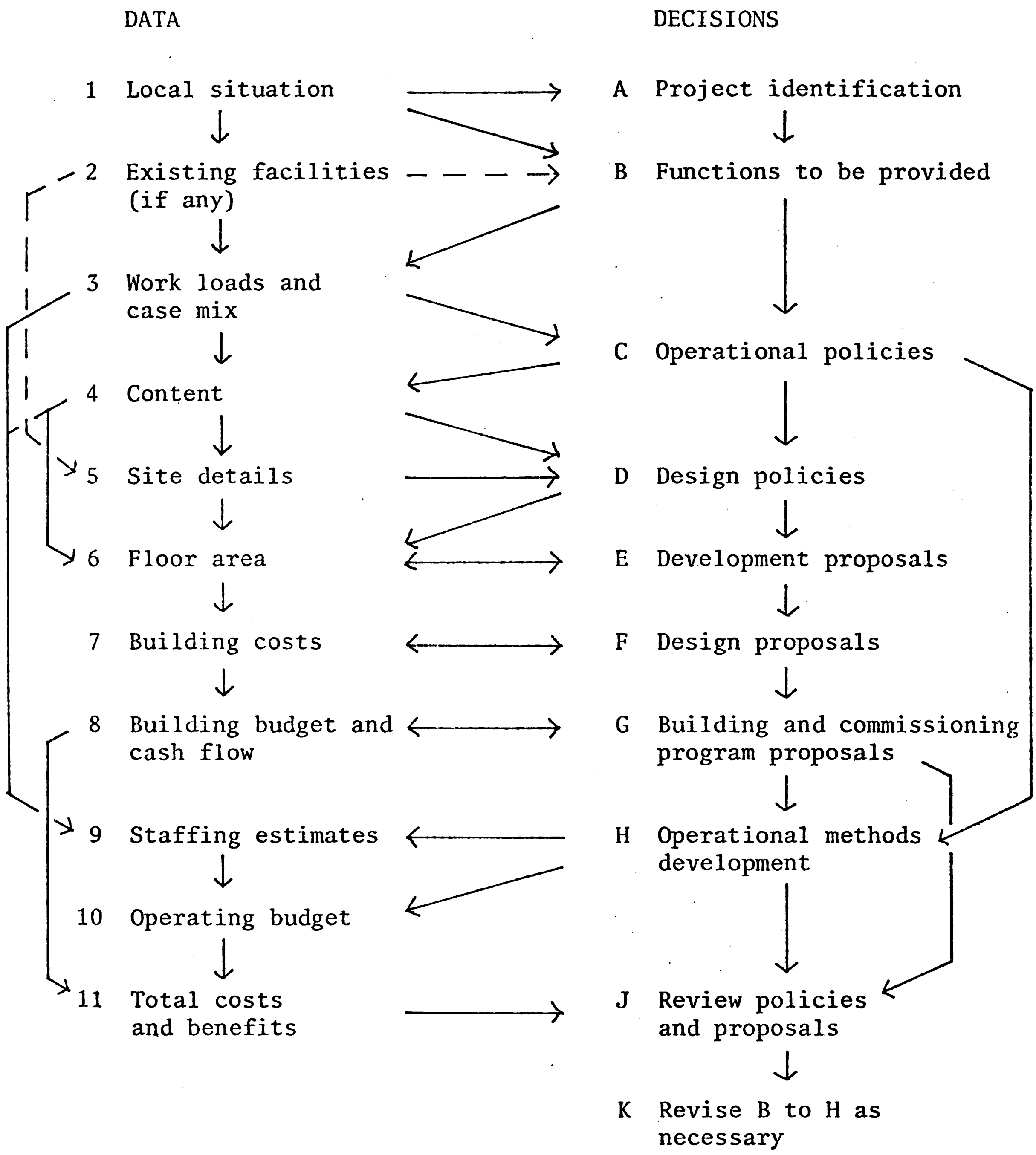


Fig 12.10
INTERRELATIONSHIP OF DATA AND DECISIONS IN PLANNING & DESIGN

The kinds of data required at 1 to 11 in the above diagram are elaborated below:

1. Local situation - population projections, age distribution, morbidity characteristics, social and economic status, political influences, resources available.

2. Existing facilities - type, services provided, age and condition, location, utilisation.

3. Work loads and case mix - work load anticipated in each specialty and supporting services.

4. Content - in terms of units of provision, eg beds, operating theatres, examination spaces, meals etc.

5. Site details - location, size, topography, services available, geology, surroundings, microclimate, legal constraints, other planning proposals.

6. Floor areas - space allocations to departments, traffic circulation, engineering services systems, carparking etc.

7. Building costs - cost of materials, methods of construction, quality of finishes, engineering services, elemental cost plan, allowances for site conditions, tendering climate, inflation rate etc.

8. Building budget and cash flow - allocation to building, engineering, equipment, fees, on-costs and overheads.

9. Staffing estimates - number and grades of staff for each department and service.

10. Operating budget - estimated expenditure in each major category: staff, energy, maintenance, supplies, rates etc.

11. Total costs and benefits - determination of costs per unit of service to be provided and comparison with existing costs/ norms; estimate of consequential savings/improvements.

The kind of decisions to be made are described in more detail as follows:

A. Project identification - name or title, possible location or site, timing, client organisation, planning/design team, consultants, approximate cost allocation.

B. Functions - range of functions and services to be provided indicating likely trends in demand or utilisation.

C. Operational policies - types of services proposed, organisational relationships, responsibilities and roles, programming of work load.

D. Design policies - type of structure, method of integrating engineering services, extent of deep planning and air conditioning, location of plant, provision for growth and change, methods of traffic handling, landscaping etc.

E. Development proposals - shape and layout of buildings, phasing of construction and occupation, decanting of existing facilities.

F. Design proposals - drawings and specifications describing details of shape and layout of each department, methods of construction, engineering service distribution and control, traffic systems, materials, finishes, equipment and fittings.

G. Building and commissioning program - methods of tendering, type of contract, timing of each phase of construction, with estimated duration of each type of work and personnel involved, recruitment and training program for staff, equipping program, maintenance arrangements etc.

H. Operational methods - detailed descriptions of functional processes involved for each service indicating activities to be performed and inter-relationship with other functions and activities.

J. Review policies - opportunity to reconsider any decisions before proceeding with construction of project eg alter method of construction, revise sequence of phasing, modify commissioning timetable.

In the simplest analysis planning information consists of four main types:

1. REQUIREMENTS or expectations of users, clients or the public
2. RESOURCES such as money, energy, knowledge and skills.
3. RESTRAINTS or limitations such as legal conditions, site restrictions or budget allocations.
4. RESULTS or outcomes of planning such as running costs or accident statistics of users.

These four types of information interact in various ways, for example requirements are affected by the resources available, while expected or actual results are conditioned by clients' views on requirements,and by environmental restraints, such as climate. Criteria established in the definition of requirements are used in assessing the effectiveness of results (see over, fig 12.11).

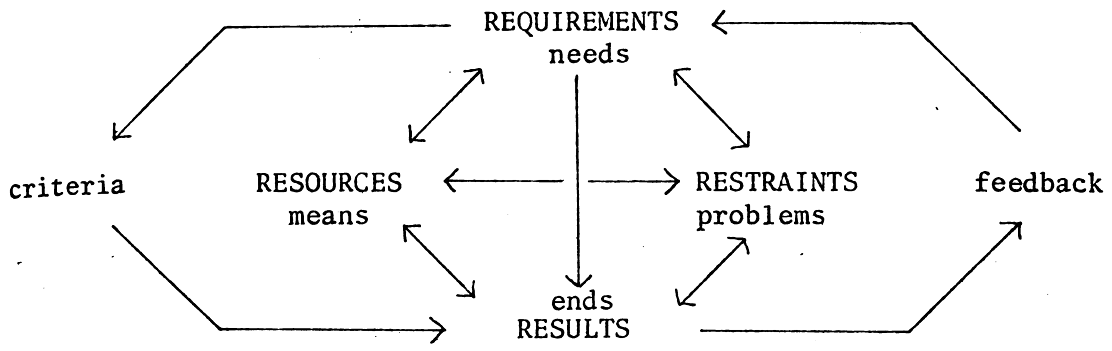


Fig 12.11 Four types of information

Requirements are defined in the briefing process, resources and restraints govern the design process, while evaluation is concerned with results. Feedback transmits 'knowledge of results' on to the briefing and design of subsequent projects where this knowledge is incorporated with requirements.

Evaluation occurs at two principal points in the planning process, both of which generate feedback information useful for briefing and design. 'Guidance' in the diagram below represents the more formal channels for information feedback from evaluation, while the informal channel is represented by means such as visits and seminars (fig 12.12).

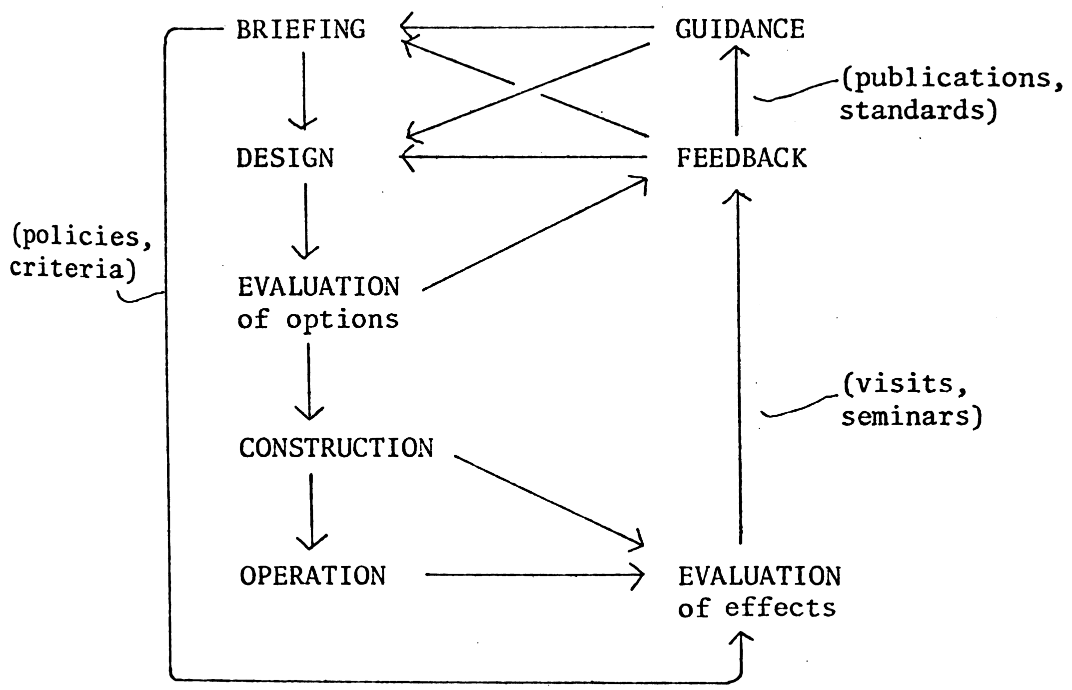


Fig 12.12 FORMAL AND INFORMAL FEEDBACK CHANNELS

A framework for improving the utilisation of knowledge from evaluation findings needs not only to assist in regulating the formal (guidance) channel, but also the more direct but informal channels. The following sections explore ways of making these channels more consistent in the way they structure the information they contain.

?.5 AGENDA FOR BRIEFING AND EVALUATION

Methods of collecting information for design influence how the design process is conducted, and hence its physical and social outcomes. If the briefing method can encourage both a logical and an imaginative approach to problem solving, then, it is argued, better designs will result than if no such methods are used.

Some briefing and design methods, especially those developed for hospital design in Britain in the mid 1960s, focused on user functions and activities (rather than departments and rooms) as a primary target for enquiry. This approach emphasised 'ends' rather than 'means' and applied especially to design problems involving complex and often conflicting requirements. Traditional design methods, by which improvements were evolved incrementally, were not suitable for handling such complex tasks.

In those design methods based on logic, explicit functional criteria are theoretically used to evaluate design options. Yet many hospital designs have failed to satisfy even simple needs, such as ability to control thermal conditions or to find the way around easily. Lack of clear statements of requirements is claimed to be one reason for these design failures.

To help collect information on user requirements, and to organise this information for developing and evaluating design proposals, a systematic but open-ended approach is to use a series of agenda headings. These headings can be arranged in an approximate order of dependency, which nevertheless allows information to be added, altered or deleted as a project proceeds from phase to phase. The headings should ideally follow a logical sequence of design decision making so that each step provides the basis for the succeeding ones.

In addition to the headings, which can either be expressed in the form of questions or topics for discussion, check lists of items are needed for application to particular types of problem or task. If these check lists are based on arrays of topics used to classify and index documents by facet analysis, then it will be easier to establish links between methods of briefing, decision making, information processing and outcome evaluation.

If, furthermore, design guidelines adopt similar agenda headings and check list topics, then a common pattern of topics can permeate the whole process of planning, design and evaluation.

In practice, many architects' search for a useful array of headings for briefing and evaluation is based on rooms as the primary focus of enquiry. The following series of headings is typical of many examples of room based enquiry methods:-

Location of room (hospital, department)
Type of room (eg anaesthetic room)
Uses of rooms (ie anaesthetising patients)
Users of rooms (eg nurses, anaesthetists, patients etc)
Times of use (specify periods of use)
Methods of use (explain sequence of activity)
Equipment used (list, describe)
Supplies used (list, describe)
Services needed (list, specify)
Environmental conditions (list, specify)
eg thermal
light
air
acoustic

Types of finishes (list, specify)
eg floor
wall
ceiling

This method of briefing can apply equally to analysis of existing buildings or to specifying requirements for new buildings. Using rooms or spaces as the basic unit of enquiry means, however, that the functional basis of building design tends to be obscured. Division of building space into rooms follows logically from the analysis of functions and activities to be accommodated. If user functions and activities are selected as the primary unit for enquiry this helps to avoid design 'preconceptions' which occur with room-based methods.

A sequence of headings for obtaining information about functional requirements and activities is outlined below:-

Type of activity

Purposes of activity

Benefit(s) of activity

People involved
- eg patients
  - clinical staff
  - cleaners
  - maintenance staff

Times of activity
- eg times of day/week
  - length of time
  - regularity

Other associated activities (list)

Links with other activities
- eg traffic
  - services
  - environmental
  - spatial

Inputs to activity
- eg information
  - supplies
  - energy

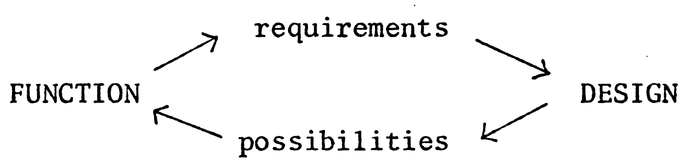
Outputs from activity
- eg products
  - services
  - information

Equipment used for activity
- eg fixed
  - mobile

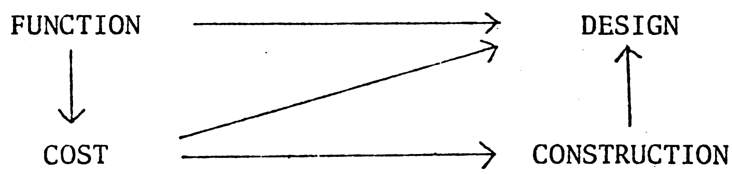
Environmental conditions needed
- eg comfort
  - convenience
  - safety
  - security
  - supervision
  - privacy etc.

Information on activities and their requirements is obtained either by analysing existing 'satisfactory' activities, or by discussing 'ideal' activity requirements with representative users. When activities have been described in sufficient detail to explore their design implications, such as layout and spatial grouping, tentative designs can be proposed and evaluated in terms of known and agreed functional requirements.

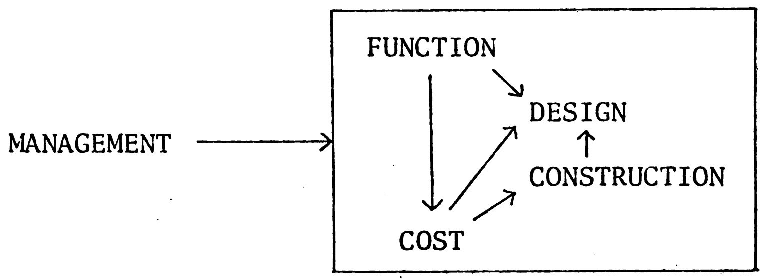
Functional needs and design possibilities are thus developed by a mutually interactive process:-



Two further 'decision areas' have to be considered however before a suitable design can be developed. Firstly the method of construction must be known or proposed; secondly the cost constraints and conditions must be satisfied:-



Allocation of information topics to these four decision areas is seldom clear-cut. Nevertheless they provide a convenient basis for coordinating information on facility planning. A fifth decision area, namely management, controls the other four:-



For analysing requirements and recording decisions a more detailed series of 'agenda' headings is needed however. These headings may need to be applied at any phase of planning, at any decision level, at any scale of application, and for any type of function or design problem. The headings may also need to be used by any participant in the planning/design process, and hence will need to be readily understandable without complex explanation.

The following series of thirteen agenda headings are grouped under the five decision areas:-

FUNCTION	DESIGN	CONSTRUCTION	COSTS
Aims	Provision	Plant	Economics
Context	Situation	Fabrication	
Operation	Security		MANAGEMENT
Logistics			Integration
Ergonomics			Coordination

The following arrow diagram shows the principal dependency links between the thirteen headings:-

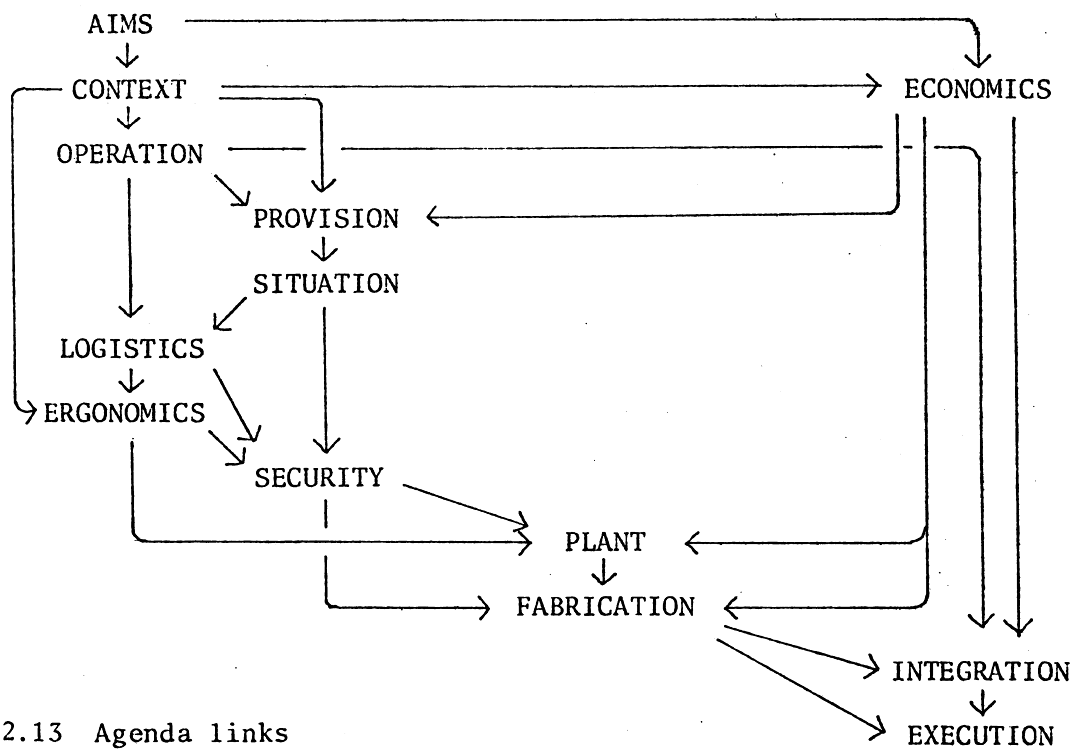


Fig 12.13 Agenda links

Each of the thirteen headings can now be split into several sub-headings corresponding to the third level of the hierarchy:

DECISION AREAS eg design
AGENDA HEADINGS eg situation
SUB-HEADINGS eg layout (see fig 12.14).

Headings	Sub-headings
AIMS	Purpose, objectives Scope, inclusions/exclusions Applications to/from other projects
CONTEXT	Needs, workloads Conditions, restraints Content, facilities needed/provided
ECONOMICS	Resources, skills, knowledge Expenditure, utilisation Benefits, outcomes
OPERATION	Methods, activities Organisation, roles People, tasks
PROVISION	Limitations, regulations Accommodation, zones, types Space, areas, volume
SITUATION	Layout, shape, levels Siting, surroundings, zoning Location, access, climate, geology
LOGISTICS	Support, supply Traffic, routes, links Transport, vehicles, conveyors
ERGONOMICS	Environment, comfort Perception, senses, awareness Response, behaviour, comprehension
SECURITY	Hazards, risks Safety, alarm, escape Protection, insulation, isolation
PLANT	Equipment, supplies Installations, fittings Structure, materials, components
FABRICATION	Production, assembly, sitework Program, supervision Maintenance, repair
INTEGRATION	Priorities, values Conflicts, resolutions Relationships, coordination
EXECUTION	Communication, documentation Implementation, tasks Control, feedback

Fig 12.14 AGENDA HEADINGS AND SUB-HEADINGS

The agenda headings and sub-headings have been adapted to several different purposes, for example as briefing questionnaires and as evaluation check lists. Examples of these are given in appendices F[3] and F[4]. Each heading or sub-heading may be amplified further into more detailed questions or topics of enquiry.

The approximate dependency sequence of the thirteen agenda headings was derived by the following outline process of argument. (This is explained in more detail in appendix F[1].)

1. CONTEXT of a project depends on the purpose and scope of the facilities being planned (or evaluated) and possible applications of results to or from other projects.
2. ECONOMICS of the project depend on prevailing conditions, anticipated workloads, and the content of facilities (to be) provided.
3. OPERATIONAL methods depend on scope of services to be provided, needs to be met, and resources available.
4. PROVISION of facilities depends on methods and activities to be adopted, organisational patterns proposed, and people to be accommodated.
5. SITUATION of the facilities depends on siting limitations, kinds of accommodation needed, and space requirements.
6. LOGISTICS aspects depend on layout, siting and location of the facilities, types of services provided, and operational methods adopted.
7. ERGONOMIC aspects depend on operational methods, facilities provided, the situation of the facilities, supporting services required, and traffic and transport facilities provided.
8. SECURITY aspects depend on operational methods, facilities provided, the situation of the facilities, logistic systems, environmental conditions, and perceptual and response requirements.
9. PLANT required depends on the operational methods, the facilities to be provided, the situation of the facilities, and the logistic, ergonomic and security requirements (safety & protection).

10. FABRICATION methods depend on the operational methods, the facilities to be provided, the situation of the facilities, the logistic, ergonomic and security requirements, and the equipment, installations and structural systems proposed.

11. INTEGRATION of the above decision areas involves identifying priorities and relationships between decision areas, resolving any conflicts, and coordinating the production program.

12. EXECUTION of the project involves communicating intentions, documenting instructions, controlling resources, allocating tasks and implementing the proposals.

A more structured diagrammatic version of the above explanation of dependency relationships is given below (fig 12.15).

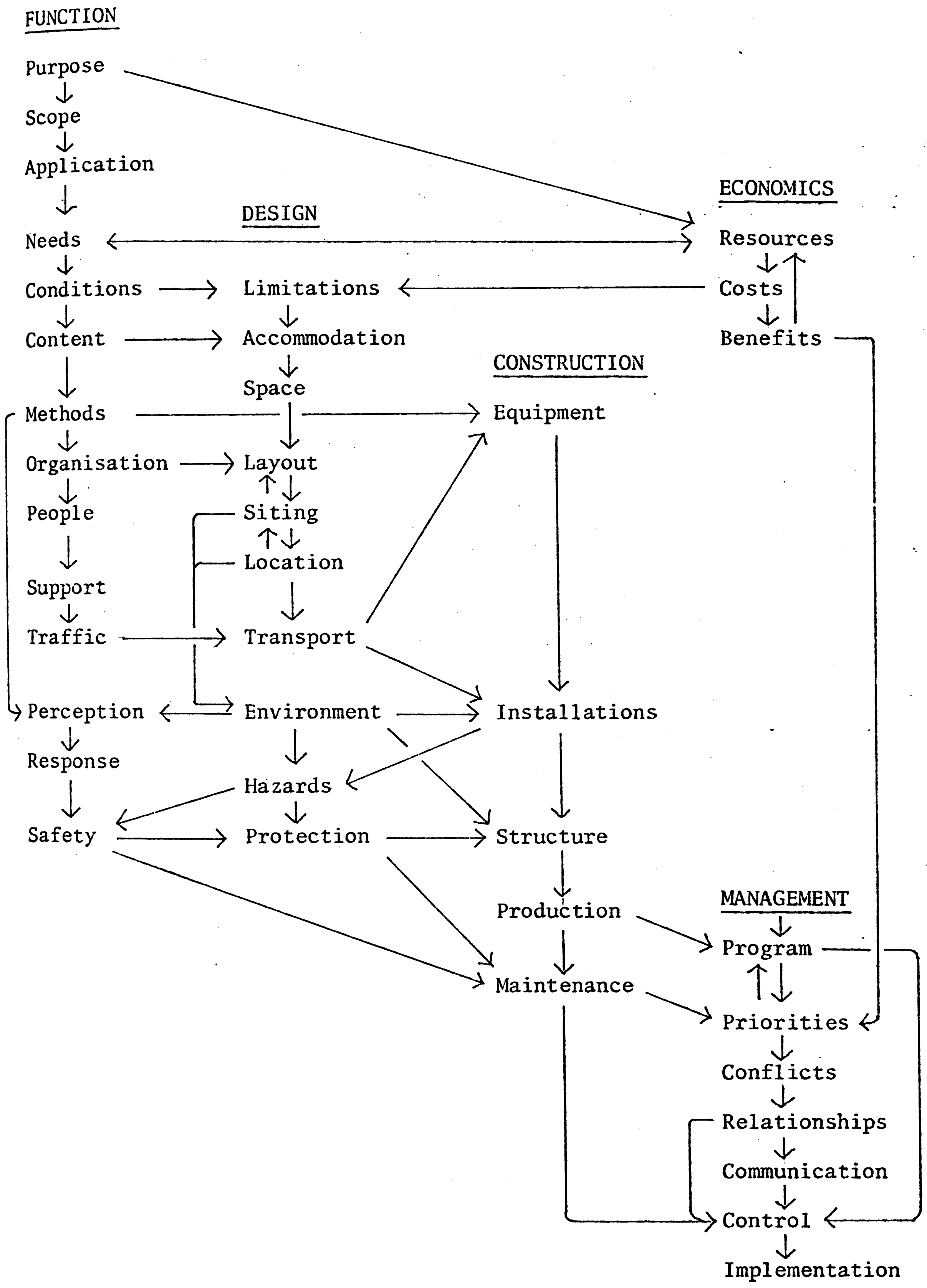


Fig 12.15 RELATIONSHIPS BETWEEN AGENDA SUB-HEADINGS

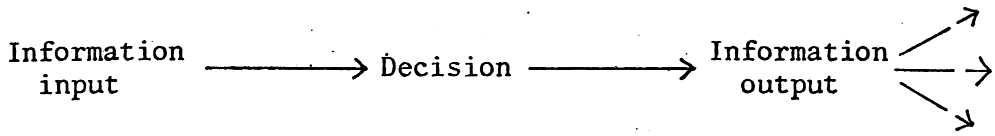
The matrix below shows examples of detailed investigation topics derived from interactions between the thirteen agenda headings described above and the four main information types referred to in section 12.4:-

agenda headings	information types: Requirements	Resources	Restraints	Results
Context	policies objectives	land people existing services	politics economics	social benefits problems/ solutions
Needs	services facilities	staff surveys	case load demands	waiting times length of stay
Economics	economy profitability	finance cost control	budgets cost plans inflation	costs profits
Operation	efficiency economy	experience staff training	costs knowledge time	healthy people longer life cost savings happy staff
Provision	space facilities	sites existing facilities	site size & shape	convenience privacy adaptability
Situation	accessibility outlook	sites trees topography	buildings industry transport	appearance noise levels
Logistics	convenience speed reliability	energy supplies staff	loads noise heat loss	convenience speed reliability
Ergonomics	environment control perception	light heat sound	climate weather site surroundings	comfort awareness
Security	safety protection	insulation supervision	visibility strength	'incidents' damage deterioration
Plant	reliability durability	energy techniques	cost availability	environment control communication
Fabrication	stability	materials shapes	corrosion loading	deflection decay wear
Integration	compatability	theories methods value systems	tolerences negative attitudes	'fit' degree of conflict
Execution	cost control quality control time control	documents words penalties incentives	language time skills attitudes	comprehension satisfaction acclaim health

Fig 12.16 RELATIONSHIPS BETWEEN AGENDA HEADINGS AND INFORMATION TYPES

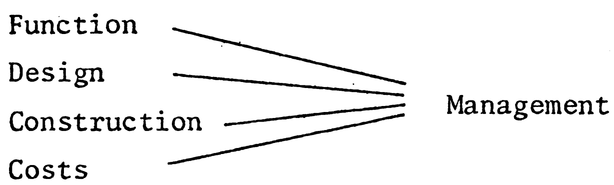
ORGANISING INFORMATION FOR DECISION-MAKING

Planning processes were described earlier in terms of sequences of decisions depending on information inputs to maintain progress. Outputs of information from decisions subsequently become inputs to other decisions:-



As information is fed from one decision to the next it may be changed in form or content. It will nevertheless be 'about' something which retains its essential identity throughout the planning process.

As discussed previously five main decision areas (or themes of 'aboutness') are apparent in building planning:-



The management decision area monitors progress in the other four areas by means of information inputs from these areas. Control is maintained by information outputs (instructions) to each of the other areas. Feedback occurs either continuously, or at the end of each phase of planning activity: (see fig 12.17 overleaf).

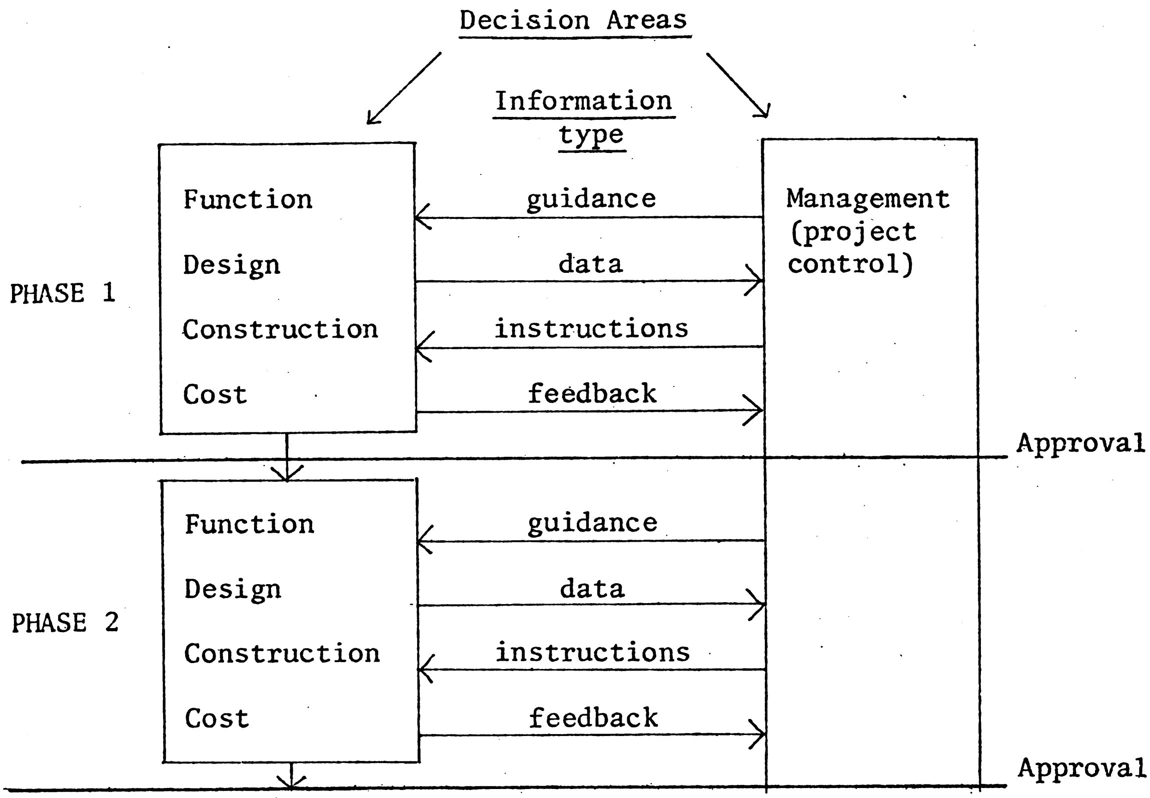


Fig 12.17 Information flow between decision areas

As information is passed on from phase to phase so it changes as further decisions are made, more information is added, or other related aspects are considered. For example, information on factors affecting choice of structural system in the early phases of planning will be amplified in later phases by more detailed instructions on methods of assembly of structural components.

The form and content of information may also change from phase to phase due to changes in personnel, policies or priorities. Nevertheless a lack of consistency in the identity, form and content of information flowing through the planning process may contribute to difficulties of access to (and application of) the information. Both types of variability in form and content of information lead potentially to planning and design failures. Discontinuity of information can however be remedied, either by one person (with an infallible memory) controlling the whole project, or by adopting an efficient system of recording, filing, retrieving and reviewing information.

Since a 'one person' project team is both undesirable and unlikely, project information needs to be made easily accessible to all team members, and to other legitimate information seekers. Methods of arranging project information should therefore help in the collation, analysis and synthesis of information by people with various professional interests.

General requirements of information systems for design were discussed in chapters 4 and 7 on 'briefing' and 'information'. The conclusions reached there suggest that a framework for coordinating planning information would need firstly to enable information to be described in terms of its subject and content, secondly to be identified in terms of its application and purpose, and thirdly to be specified by its origin, form and type.

The following three lists of types of indexing terms represent the range of means of describing, identifying and specifying project information in detail.

LIST 1 INDEXING TERMS DESCRIBING SUBJECT & CONTENT

1. FUNCTIONS for which the service or facility is intended -
   eg education, catering, transport

2. ACTIVITIES for which a facility is designed -
   eg lecturing, washing, repairing

3. PARTS of a facility to which information relates -
   eg floors, walls, ducts

4. FORM or type of parts -
   eg flat, corrugated, mesh

5. COMPOSITION of part
   eg metal, ceramic, wool

6. USER(S) of facility or service
   eg patients, nursing staff

7. CONDITIONS of use of the facility
   eg urban, tropical

8 PERFORMANCE or quantity required of a facility or product
eg high speed, low temperature

9 SIZE or quantity of project or item
eg 30 bed ward unit, 12m

LIST 2 INDEXING TERMS IDENTIFYING APPLICATION & PURPOSES OF INFORMATION

1 PROJECT(S) to which it applies
eg St. John's Hospital, ward block

2 LOCATION of project
eg Newtown, NSW

3 STAGE(S) of approval to which the information relates
eg feasibility, tender

4 PHASE(S) of planning to which the information applies
eg briefing, documentation

5 TASK(S) for which information is produced
eg cost analysis, equipment selection

6 EVENT(S) to which it relates
eg day 5, finish floorlaying

7 INTEREST(S) for which information is produced
eg nursing, engineering

8 LEVEL(S) to which decisions were made
eg regional, departmental

9 SCALE of application of decisions
eg rooms, equipment

10 NAME(S) of products used/involved in project
eg ABC Bricks

LIST 3 INDEXING TERMS SPECIFYING ORIGIN, FORM & TYPE OF INFORMATION

1 FORMAT or method of presentation

eg report, drawing

2 FOCUS or degree of detail

eg general, specific

3 STATUS or degree of certainty

eg provisional, final

4 ORIGINATOR or producer of information

eg publisher, printer

5 AUTHOR(S) or AUTHORITIES responsible for publication/production

6 DATE of production or revision

7 PLACE of publication or production

eg Kensington, NSW

8 DISTRIBUTION

eg client, contractors

9 AVAILABILITY

eg internal, restricted

10 LANGUAGE or notation used

eg Cobol

11 TITLE of item of information

eg 'Guidelines for Ward Planning'

The sequence of terms used to index and identify uniquely the subject of an item of information depends on one or more of the following rules:-

1. Increasing (or decreasing) degree of specificity

   eg hospital before department

2. Citation order of facets

   eg product : form : material
   (carpet : broadloom : wool)

3. Natural language

   eg broadloom wool carpet

4. Order of assignment to predetermined categories

   eg TITLE : SUBJECT : PROJECT

5. Arbitrary order

   eg alphabetical

The choice of sequence will partly depend on the subject field and the potential use of the information. Principles such as 'general before specific', although easy to follow in some instances, are, however, difficult in others. Is wool, for example, more or less 'general' than carpet?

A suitable sequence may therefore have to be found by experiment in a particular field of application. Rules for citation orders of facets, while effective in ensuring consistency, do not necessarily result in comprehensible document descriptive terms, nor in useful grouping of documents in files.

Means of labelling and coding information which have been developed by the writer include the following:

1. Mnemonic codes using two alphabetical and two numerical symbols giving over 60,000 possible code combinations

   eg Zn:06:X = Hospital planning, wards: departments: evaluation

2. A faceted system using two sets of words respectively to identify and describe items of information

   eg Jones 1981: design method

3. Subject headings preassembled to give over 750 terms at up to three levels of specificity

   eg Hospital equipment: signs: direction finding

4. Headings for use in questionnaires, agendas and check lists. The headings depend on a logical sequence of concepts which can be applied at different levels of detail

   eg Method of use
   type of activity
   bedmaking

Each of these four identification methods has been used by the writer in a number of planning tasks:-

1. Organising office technical information
2. Collecting information on project requirements
3. Discussing and presenting project proposals
4. Filing and indexing books, articles and photographic slides
5. Lecturing on hospital planning and design
6. Writing notes for external studies students
7. Evaluating designs in use
8. Producing guidelines on planning and design
9. Producing bibliographies on specific topics
10. Investigating design problems

The results of these trials showed that systems using natural language rather than codes were easier to understand, but that simple codes provided a more reliable means of arranging items in sequence for filing and retrieval.

Systems based on 'logical' sequences of headings provided a more useful framework for project documentation, teaching and investigation. The basis of the logic was however not always readily apparent to the other people involved in using the systems (see appendix C[10]).

A preferred method of arranging and indexing information for quick and effective decision making is that which the decision makers find easiest to use and which can be used by a variety of users. It should therefore be self-explanatory as far as possible, and be based on commonly accepted conventions, such as sequences of planning phases or topics of enquiry. The other means of describing, identifying and specifying the main characteristics of planning information should be used only to avoid ambiguity, or to subdivide larger concepts.

The purpose of this section was not to recommend a particular method of organising information for effective decision making, but rather to explore the choices available. The next section goes further in suggesting a pattern of subject headings based on a logical sequence of questions which can apply at any phase of planning and design.

7 REQUIREMENTS FOR A FRAMEWORK FOR FEEDBACK

From the foregoing sections, and from earlier chapters in the thesis, it will be apparent that the requirements of a framework for information feedback are both wide-ranging and complex. This section attempts to summarise some of the main characteristics such a framework should possess. The requirements are set out under the following headings:-

1. Objectives of a framework
2. Tasks for which a framework may be used
3. Bases for developing a framework structure
4. Factors influencing the number of headings
5. Uses for lists of topics in a framework

A four dimensional basis for a simple framework is then proposed. This is further developed in the concluding section.

The objectives of the framework are as follows:-

1. Aid in information processing at each planning phase
2. Assist in communication between the various professions involved
3. Apply to any kind of concept
4. Be easy to understand by its users
5. Be applicable to any level of complexity
6. Promote useful methods of thinking
7. Assist in collection, organisation and analysis of information
8. Provide information relevant to evaluation and decision making.

The framework should be suitable for use in the following types of planning <u>task</u>:-

1. General project planning
2. Setting up a project information system
3. Investigating project requirements
4. Pooling experience from other projects
5. Checking proposals against requirements
6. Controlling resource allocation and expenditure
7. Identifying possible errors and omissions
8. Educating planning team members
9. Coordinating research for planning and design.

Possible <u>bases</u> for developing a coordinating framework include the following:-

1. Typical thought processes used in planning and decision making
2. Recognised stages in established planning procedures
3. Conventions for grouping information into subjects and disciplines
4. Division of information into pairs of opposites e.g. art and science
5. Degrees of significance for particular users
6. Alphabetical sequence of commonly used terms in a particular language
7. Chronological sequences of events
8. Orders of magnitude (ascending or descending)
9. Ordinal sequence of numbers assigned to items
10. Mnemonic associations of codes or symbols
11. Geographical or spatial groupings
12. Arbitrary sequence

The number of headings or topics needed in the framework will be influenced by:-

1. The need to distinguish one topic from another
2. The range of user interests involved
3. The number of levels of application to be included
4. The state of knowledge in the subject fields covered
5. The degree of pre-coordination of terms to be adopted in labelling concepts
6. The amount of overlap between terms.

The uses to which lists of topics in the framework could be applied include:-

1. Section headings in documents
2. Agendas for meetings and discussions
3. Questionnaire headings and interview topics
4. Check lists for use in briefing and evaluation
5. Indexing and retrieval of documents
6. Analysing activities and roles
7. Cataloguing products and design details
8. Organising personnel for tasks.

Existing systems for organising planning and design information have mostly been based on literature analysis rather than on an understanding of design and decision making processes. This has tended to fragment information into professional categories or subject fields when what was needed was a means of integrating information throughout the planning process.

The main requirement for a system of integration is that it should allow information on any topic to be easily 'diffused' throughout the four main dimensions of planning:-

1. PURPOSE - Functions of facilities and uses of services
2. PERIOD - Chronological phases of design and stages of documentation
3. STATUS - Levels of decision and scales of application
4. LOGIC - Dependency of agenda topics and relationship of decision areas.

For diffusion to occur a number of conditions have to be satisfied; for example, the people concerned must want to know how to make improvements, and there must be incentives to cooperate rather than to compete.

While the existence of a framework for feedback will not of itself result in improvements, if a means exists by which feedback can more easily occur, then, it is argued, it is more likely to happen.

The next section amplifies the four dimensions into twelve main facets and eighteen supplementary facets, thus providing a choice of degree of detail by which information can be defined for various purposes.

The use of mechanical means of information processing is clearly essential for analysis by more than four or five facets. The development of a computer aided system for information feedback based on the approach described here is a next logical step. It is however beyond the scope of this thesis.

8 THE BASIS FOR A FRAMEWORK

The proposition is advanced in this thesis that an ordered or structured arrangement of information for facility planning offers a greater opportunity for feedback and re-use of knowledge than if the information is unstructured or disorganised. Even if it can be shown that organised or structured information leads to better design, two questions need consideration:- 1) what degree of structuring leads to significant design improvements, and 2) what kinds of structure or framework are most beneficial?

Influencing the use of feedback information is the kind of approach used in planning, designing or problem solving. The choice ranges from highly structured methodologies to more pragmatic or experimental approaches. Most methodologies fall between these two extremes, a 'middle of the road' approach being justified by the need both to have firm constraints or guidelines to maintain control, and yet to allow sufficient freedom to encourage innovation and experiment.

The methods of structuring information for feedback reviewed earlier in this chapter had, respectively, five main objectives:-

1. To explain the overall nature of the planning/design process by means of a planning 'map' or chart.

2. To examine reasons for barriers to communication of information in planning and design, and to suggest means of reducing the barriers.

3. To develop a typical sequence of planning activities in terms of information inputs, decisions, and information outputs. The sequence would have applications for developing formalised approval procedures for educating planning team personnel, and for rationalising information processing and documentation in project planning.

4. To provide typical 'agenda' headings for surveys, questionnaires, meetings and reports. The headings would apply to briefing, to analysis of information, to synthesis of ideas, and to evaluation of outcomes.

5. To rationalise methods by which information is described and specified for decision making in planning and design. The methods should assist in a) retrieving information on specific topics within one project, and b) coordinating information on similar topics in different projects.

Although there are potentially many means by which planning information can be labelled, analysed, classified and coded, there will be few which meet the requirements specified in section 12.7. To use all 30 types of indexing terms listed in section 12.6 to describe, identify and specify planning information would be both unworkable and unnecessarily complex. To use only two or three types of terms, while more concise, would not be sufficiently precise for most purposes.

Typical faceted information classification and indexing schemes in use in the planning/design field use, for example, five facets (CI/SfB), ten facets (CIT), and twelve facets (HIF). Although a smaller number of facets is obviously more convenient, the limitations of CI/SfB for project documentation indicate the need for more precise systems such as CIT and HIF. Experience of HIF in use suggests however that the upper limit of convenience may have been exceeded and that a smaller number of facets may be more workable.

An examination of the types of terms required to <u>describe</u> adequately an item of planning information by its subject and content suggests that about four principal facets would be needed. Sub-divisions or supplementary descriptions may also be needed to qualify or extend the main indexing terms:-

1. FUNCTION or purpose of facility or product
   subdivided (or supplemented) by ACTIVITY or objective
2. PART of facility or product
   subdivided by FORM or type
   subdivided by COMPOSITION or material
   subdivided by SIZE or quantity

3. CONDITIONS or requirements of use
    subdivided by PERFORMANCE or quality

4. USER(S) or clients of facility or product

To identify information the following additional five facets may be needed:-

5. STAGE and/or PHASE of project planning
    subdivided by TASKS in planning/design
    subdivided by EVENTS in planning

6. LEVELS of decision and/or SCALES of application of information

7. PROJECT(S) to which information relates
    subdivided by LOCATION of project
    subdivided by POSITION in project

8. NAMES or make of proprietary materials, items or products to which information refers
    subdivided by TYPE of product

9. INTERESTS for which information is produced

The origins, form and type of information may also need to be specified.

This can be condensed to three main facets:-

10. FORMAT or method of presentation
    subdivided by LANGUAGE or notation
    subdivided by FOCUS or degree of detail

11. ORIGINATOR or producer of information
    subdivided by PLACE of origin
    subdivided by AUTHOR or authority
    subdivided by AVAILABILITY

12. STATUS or certainty of information
    subdivided by DISTRIBUTION
    subdivided by AVAILABILITY

The TITLE of an item of information may additionally be used for indexing.

Each of the above facets are mutually exclusive, although homonymous terms may occur in more than one facet. For example 'equipment' may refer either to a scale of application or to a part of a facility.

For a short form of indexing the following four facets are usually the most important:-

FUNCTION/purpose of facility
LEVEL/SCALE of application
INTEREST/viewpoint of user of information
PHASE/stage of planning/design

Using this four facet formula would result in a typical document being described in terms such as:

'Maternity Department Design Brief'
(Facet formula = Function : Level : Viewpoint : Phase)

The order in which the facets are cited may either be grammatical (as above), or it may conform to an analytical order designed to bring related concepts together in a collection of documents.

Sections within documents or files may be arranged to follow 'agenda' HEADINGS as described in section 12.5. As some 'agenda' headings may be similar to terms used for indexing, a means of differentiation may be needed, such as a distinctive type face or code prefix.

To summarise The proposition has been made that an open-ended, faceted system of describing, identifying and specifying items of planning information helps to reduce design errors by improving information feedback. In addition, the organisation of information within planning documents and files should follow a sequence based on logical dependency relationships between topics of enquiry and decision. This sequence of agenda headings should remain constant regardless of information being added, deleted or altered.

The sequence of agenda headings, while following a logical sequence of decisions, is quite independent of phases of planning activity. Each phase may thus 'contain' information set out following the sequence of agreed agenda headings.

What is proposed is a multi-dimensional method for categorising and arranging planning information for health facilities. It can also be used for planning other types of facility such as educational buildings or housing.

The effectiveness of systematic methods of organising design work, and its associated information, is difficult if not impossible to demonstrate in practice. The truth may nevertheless be found in a saying attributed to Lao Tse which is (approximately):-

> "It is first necessary to have a system, but having learned to use the system, one can dispense with it."

Planning and design are essentially systematic thinking processes relying on past experience to produce improvements in the future. Although means are available of acquiring and 'storing' knowledge of results, and of using in it making decisions about the future, these means have not been effectively utilised. This would appear to have increased the likelihood of repetition of errors and failures in planning and design.

CHAPTER THIRTEEN

CONCLUSIONS - Synopsis

The principal findings of the thesis are presented first in the order in which the main topics occur in the text. The two hypotheses are reviewed in the light of these findings.

Twenty three recommendations are then made on planning and design, on information and communication, on education and training, and on research and evaluation.

A personal commentary on the main issues raised in the findings and recommendations is presented in section three.

The last section is in the form of a prognosis of the extent to which any significant improvement in design information feedback is thought likely in future.

FINDINGS

Why have 'errors' in planning and design continually recurred when many apparently adequate solutions were already available? The thesis considered this question in relation to hospitals and other kinds of health facilities by examining how information was used, firstly to define objectives and requirements, and secondly in making decisions about design and construction.

An historical perspective covering the last twenty years identified two contributory factors: a lack of adequate feedback from 'knowledge of results', and the desire of many designers to experiment and innovate. Non-availability of information appeared to be less of a problem than lack of awareness of its existence, although knowledge of how best to obtain and apply it to a particular task was sometimes lacking.

Methods of organising multi-disciplinary planning teams, and the degree of continuity of planning team personnel during the life of a project, will affect how information flows throughout the planning process. The extent of involvement of hospital users in discussions on needs and design options can also significantly affect the suitability and adaptability of the resulting design in use.

Attitudes and awareness of planners and designers affect the way knowledge is utilised in project planning. Political prejudices and priorities, for example, can sometimes reduce the objectiveness of planning decisions.

Another factor reducing effective utilisation of information is the difference between various professions' approaches to problem solving. This largely results from the differing objectives of planning and design practitioners and their user counterparts. Multi-disciplinary education of planning team members is a means of reducing this problem, but the learning process needs to be based on problem analysis rather than posing different kinds of solutions.

Health facility planning and design procedures differ in their capability for utilising information for problem solving and design development. Some procedures assist in generating new knowledge and in expanding the range of choice; others place the main emphasis on measures of space, cost and time rather than on evaluations of functional efficiency, effectiveness and adaptability in use.

The type of planning process used for a particular project affects how decisions are made, and hence the outcomes of the project. The degree to which a planning process is 'open' or 'closed', for example, influences the extent and type of user participation, and hence the degree of users' satisfaction with the results of planning.

'Briefing' is a difficult task for many members of planning teams to comprehend and contribute to usefully. While most participants in the briefing process find the experience offers an opportunity to learn, it nevertheless provides little opportunity to use the experience gained unless it is repeated on a number of projects. Many planners argue, therefore, for use of standardised design data and even standard designs. The consequence is that both good and bad designs are repeated, and there is a reduced incentive to experiment and learn from experience. Briefing then becomes merely a task of assembling pre-conceived answers to known problems, rather than an opportunity to analyse the problems as a means of developing appropriate solutions.

Some methods of organising and presenting planning and design information encourage logical and innovative thought, and can assist in producing relevant and timely information. But many information classification systems tend to divide rather than integrate knowledge. Ways of identifying and arranging information are needed which can help bring together related concepts in a useful sequence to aid in problem analysis and design synthesis.

The role of libraries, information services and filing systems needs to be considered more closely in relation to the work of planning teams. The role of 'information broker' has potential value in a planning team, but from reported experience in experimental situations this is not likely to be acceptable if it constitutes a threat to professional expertise, despite its possibilities for making more effective use of available knowledge.

Comparison of various forms of information retrieval and advisory services, such as abstracting journals, state-of-the-art reports, computer based citation indexes, and participatory seminars, show that none answer users' needs especially well. Those which encourage personal contacts and direct experience of design effects are, however, regarded as the more useful forms of feedback.

Results of surveys of information usage in the field of hospital planning and design identified 'reports of evaluation studies of design in use' as a valued kind of information, but it is the least available. The direction of research should therefore focus on design evaluation methods, and on means of making evaluation findings more accessible to designers in the briefing phase.

A number of design evaluation methods were compared for their potential in providing useful design data. Methods which concentrate mainly on psychological and statistical aspects are considered less valuable by designers than methods emphasising architectural and sociological aspects.

The three comparative evaluation studies of whole hospital buildings, hospital ward units, and equipment design, used pre- and post-determined objectives and priorities as a basis for assessment. There is however a need to investigate discrepancies between users' stated perceptions and their actual reactions to a design, and also to question closely what users understand by particular design concepts such as 'privacy' and 'efficiency'.

As a result of the comparative evaluations of hospitals, wards and furniture aids, the following objectives for evaluation are suggested:-

- to make improvements before design decisions are finalised
- to derive general policies for application to other projects
- to improve performance in use
- to test the effectiveness of planning and design methods and procedures
- to identify topics for further research and development

The following guidelines are suggested for developing appropriate evaluation methods:-

- avoid inconveniencing patients and staff as much as possible
- be as objective as possible in describing design effects
- record data in a form which can be easily and quickly applied
- avoid staff feeling that they are being evaluated
- enable results to be compared with requirements stated in briefing statements
- including some briefing and design team members in evaluation studies
- supplement evaluation seminars with detailed observations and interview surveys

Methods of design-in-use evaluation considered appropriate are:-

- recording users' comments and answers to value rated questions
- observing users' activities
- measuring performance in use

Evaluation topics can be derived from a number of viewpoints:-

- planning phases, eg construction, commissioning
- departments/functions, eg wards/nursing
- design aspects, eg finishes, lighting
- operation aspects eg cleaning, supervision
- scale of application, eg whole hospital/department/room

Several arrays of typical topics or 'questions' which arise in building design are compared in chapter 12. Such arrays can provide the agenda for a planning brief, a comparison of alternative proposals, or an evaluation of a building in use. The agenda can act as a framework for linking design problems and decisions with the results of evaluations of designs in use.

In summary the various approaches to planning, design and evaluation of health facilities surveyed in the thesis suggest that:-

1. both briefing and evaluation should be regarded as integral parts of all phases of the planning process
2. methods of stating requirements, resources and restraints should not restrict the form of the design solutions
3. design methods should allow for exploring design options, and for assessing their suitability in particular applications
4. design problems cannot properly be considered independently of design solutions; therefore methods for collecting, organising and presenting design information should emphasise this interdependence.
5. there is no ideal method for planning or evaluation, each project team will need to work out its own method according to circumstances.
6. the benefits and costs of different approaches to planning should be evaluated at the outset of any planning program.
7. the purpose of briefing is to identify potential conflicts in satisfying requirements; the purpose of design is to reduce or eliminate the conflicts.
8. the purpose of evaluation is to establish the effects of design decisions; feedback helps to reduce the repetition of design errors.
9. the four principle activities in planning - briefing, design, evaluation, and feedback - should be linked by a common set of descriptive terms.

Therefore the findings are that:

1. Systematic planning procedures, briefing methods and design evaluations could contribute to a significant reduction of design errors in health facilities, BUT they have not achieved their potential in this respect in those examples studied.

2. A common set of descriptive terms could facilitate the feedback of information from evaluation of health facility designs in use to briefing and decision making, BUT because of increasing disorganisation of health facility planning and design, and of professional competitiveness, it is unlikely that this will be achieved.

;.2 RECOMMENDATIONS

On planning and design

1. A generally applicable and easily understood 'model' of the health facility planning and design process is needed to show how decisions are made in each phase of work.

2. The model should be suitable for conversion to a 'procedure' so that specific information required by controlling authorities at each stage can be shown.

3. Health facility planning proposals should be subject to evaluation by a national autonomous body before being approved for funding assistance or loan support.

4. Operating cost estimates of proposals should be checked before approving funds for detail design or construction work.

5. Greater standardisation of tested and proven designs should be encouraged.

On information and communication

1. An 'information framework' should be developed for health facility planning and design.

2. The framework should be based on a typical sequence of planning activities, on functions of health facilities, on levels of decision making, and on agenda topics.

3. The framework should be used for coordinating information in briefing and decision making throughout project planning, for sharing information between projects in a program, and for aiding communication between planning team members.

4. The framework should differentiate information by its form, origins, applications, and professional interests.

5. Interconnections between functional, design, construction, management and economic decision areas should be made apparent by the framework.

6. Information should be presented in suitable forms for the various people involved, particularly users and client authorities.

7. Jargon-free language should be used, supplemented by clear illustrations where appropriate.

<u>On education and training</u>

1. Tertiary training programs for health facility planners and designers should be further developed in Australia and elsewhere in the Pacific and South East Asia region.

2. The programs should cater for administrative, medical, nursing, architectural, engineering and economics personnel in addition to staff such as equipment officers, therapists and welfare workers.

3. The program structure should be based on the interdisciplinary nature of health facility planning.

4. Program content should emphasise the importance of feedback from experience in planning and in use.

5. The information 'framework' should be used to assist program participants to learn the elements of planning and design, and to experience the benefits of an organised approach to application of knowledge.

On research and evaluation

1. A research and development program for health facility planning and design should establish what information can reliably be recommended for general application.

2. The R & D program should identify gaps, conflicts or uncertainties in knowledge,and what should be done to remedy deficiencies.

3. The R & D program should use the 'information framework' as a check list to ascertain and record the state of knowledge in each subject area represented in the framework.

4. An index of current research and development in health facility planning should be produced and regularly updated.

5. Evaluation studies of selected health facilities should be commissioned to be undertaken by organisations unaffiliated to the client authorities or professional consultants involved.

6. The evaluation reports should identify the projects and personnel concerned and clearly describe the operational effects of specific design decisions.

3 COMMENT

Over the time this thesis has been in preparation there have been many political, social, technical and economic developments affecting health facility planning and design. Yet ease of access to information seems as much a problem as ever. Developments in information retrieval and evaluation methods do not appear to have appreciably improved health facility designs.

Complaints made over ten years ago with regard to inadequacy of briefing and design information have, for example, continued to be made (Green et al 1971, Heath and Green 1976, 'Tyro' 1977, McGilloway 1980). Seminars on topics such as health service building planning (Green 1973), hospital ward planning (Green and Jackson 1980), and briefing for health facilities (Green et al 1980) showed that attitudinal factors and difficulties of communication between the different professions involved are at least partly to blame.

Although the research has not covered all aspects intended, the overall direction has remained the same. Greater emphasis was given to comparative evaluation of design because this not only met the criterion of empirical research, it also followed a direction suggested by many respondents to the information usage surveys.

The empirical research has shown the difficulties of linking design objectives with observed effects. While improvements can result either from incremental design development, or periodic in-depth research on specific aspects, the need is for quick feedback from comparative studies of the effects of design in use.

13.4 PROGNOSIS

Lack of effective feedback in planning and design of health facilities is due to many problems, few of which have any obvious or easily applied solutions.

While many of the suggestions made for improvement in the preceding sections are perhaps unduly optimistic or costly, some are capable of implementation in 'controlled' situations. Others depend on coordinated action by many people, which, with present economic and political influences, are unlikely to be realised.

Options for improvement range from many small efforts by individuals working independently, to some kind of agreed international program utilising and directing the efforts of the participants.

The problem is perhaps more personal and professional than technical in that peoples' attitudes mainly affect how information is used. Lack of an agreed code of conduct, or direction for development, makes it difficult to propose any practicable program for utilising knowledge more effectively.

A program for research and development into means of diffusing knowledge gained in the planning, design, construction and use of individual projects could, for example, be undertaken. More widespread knowledge of problems and possibilities may result in greater enthusiasm for sharing information. Less knowledge may, paradoxically, cause unwillingness to learn from other people's experience. Political and commercial influences also tend to restrict accessibility and application of knowledge.

As Epstein (1978) remarked in relation to use of knowledge on the human effects of herbicides and food additives:

> "Information is the currency of political power,... information derived by an agency with an economic outcome affecting that

> agency is suspect, until proven otherwise...agencies will destroy or suppress information which threatens their existence."

The principle would also appear to apply to the health facility planning and building field.

Despite recent moves towards greater freedom of access to information in the public sector, any politically sensitive issues are unlikely to be revealed. A recent investigation into hospital efficiency in Australia was, for example, utilised for mainly political ends, little being done to implement recommendations which could have increased efficiency or social benefit.

Historical evidence suggests that competitiveness and protectionism will hinder initiatives directed at improving feedback of knowledge in the health facility planning field. There may however be more hope of improvement at individual project level where application of knowledge and experience has more immediate impact and is less threatening.

Increasing the amount of information available tends to make it more difficult to understand and use. Reducing the volume and complexity of information and making it easier to refer to is therefore an important task in any program of planning rationalisation.

While the framework outlined in chapter twelve and appendix F is intended to assist in coordinating and controlling information flow in planning and design, it cannot solve the political or attitudinal problems. It may however help to highlight the causes and effects of design defects, and thus to reduce their significance.

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(see Keyword Index to identify authors by subjects; numbers following citations refer to sections of the text in which the references appear, a dash signifies no specific reference)

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KEYWORD INDEX TO REFERENCES - an explanation

Owing to the large number of references cited in the thesis (approximately 600 with a further 100 or so listed but not cited) it was considered desirable to provide a subject index to these information sources. The index also serves as a key to sections of the text in which the references are cited.

The index was compiled using some of the principles discussed in chapters 7 & 12, particularly facet analysis and post-coordinate chain indexing. The aim was to provide a systematic means of locating reference sources by an alphabetic listing of descriptive terms arranged in facet sequence. Each index entry contains between two and seven terms according to the complexity and specificity of the reference item cited. Each reference is indexed once only and is identified by author name or acronym, followed by the last two digits of the year of publication (pre 1900 dates are in full). For multiple authors the first only is named followed by a +. Abbreviations of corporate authors are given in appendix A.

The numbered section(s) of the thesis in which references are cited are listed in the index following the authorship details. If no specific citation of a reference has been made in the text, then a dash (-) is shown. If the reference has been used in a particular section, but not specifically cited, then the section number is put in brackets eg (5.3). A full index entry might therefore appear thus:-

hospitals: buildings: design: methods JONES 69 3.4, (5.2).

The facets used to analyse the reference sources were derived 1) from an analysis of the topics covered by the literature, and 2) from the need to present each index entry in an easily understood form which accurately described the contents of the indexed item. The ten facets used were as follows:-

1. APPLICATION eg hospitals, wards
2. LEVEL eg buildings, equipment
3. FIELD eg architecture, management
4. ASPECT eg construction, lighting
5. PHASE eg briefing, evaluation
6. MEANS eg classification, procedures
7. PEOPLE eg staff, patients
8. TIME eg past, future
9. PLACE eg AUSTRALIA, UNITED STATES
10. AUTHORITY eg Dept of Health

Each index entry follows this sequence of facets. If several descriptive terms are used within one facet,the sequence of expressing these terms is grammatical rather than alphabetical or chronological. For example, an item on 'research methods used in determining requirements for design of buildings' would be indexed thus:-

	buildings:	design,	requirements:	research,	methods
facet:-	2	5	5	6	6

A colon is used to separate descriptors from different facets, whilst a comma separates those from the same facet. The full list of descriptive terms in each facet is given on the following page.

KEYWORDS used in indexing references

1. APPLICATIONS (A/Z)
   - health centre(s)
   - " facilities
   - " service(s)
   - hospital(s)
   - housing
   - industry
   - laboratories
   - office(s)
   - rehabilitation
   - surgery
   - ward(s)

2. LEVELS (by size)
   - environment
   - town(s)
   - building(s)
   - department(s)
   - room(s)
   - equipment
   - component(s)
   - material(s)

3. FIELDS (A/Z)
   - aesthetics
   - architecture
   - behaviour
   - information
   - economics
   - education
   - health
   - management
   - planning
   - politics
   - science

4. ASPECTS (A/Z)
   - access
   - change
   - comfort
   - construction
   - damage
   - direction finding
   - energy
   - engineering
   - flexibility
   - growth
   - layout
   - location
   - lighting
   - perception
   - performance
   - privacy
   - safety
   - security
   - sound
   - space
   - supervision
   - supply
   - traffic
   - ventilation
   - vision

5. PHASES (sequence)
   - problem(s)
   - survey
   - requirement(s)
   - briefing
   - design
   - development
   - communication
   - contract
   - production
   - use
   - evaluation
   - feedback

6. MEANS (A/Z)
   - advice
   - classification
   - computer(s)
   - decision(s)
   - document(s)
   - innovation
   - measurement
   - method(s)
   - participation
   - procedure(s)
   - research
   - retrieval
   - system(s)
   - terminology
   - thinking

7. PEOPLE (A/Z)
   - architect(s) (designers)
   - children
   - handicapped
   - patient(s)
   - staff
     - medical
     - nursing
   - user(s)

8. TIMES (chrono)
   - past
   - future

9. PLACES (A/Z)
   - Australia
   - Canada
   - Great Britain
   - New South Wales
   - New Zealand
   - South Africa
   - United States
   - World (International)

10. AUTHORITIES
   - (Australia)
     - Dept of Construction
     - " " Health
   - (Gt Britain)
     - Dept of Environment (MPBW, PSA)
     - Dept of Health & Soc Sec (MoH)
     - Scottish H & H Dept
     - King Edward's Hosp Fund
     - Med Arch Res Unit
   - (NSW)
     - Health Commission
     - Hospitals Commission
     - Hosplan
   - (NZ)
     - Health Dept/HDEU
   - (USA)
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     - Int'l Hosp Fed
     - W Health Org

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rooms: aesthetics: evaluation: methods	RONCO 71	6.5,6.7,9.3
" : design: participation: staff: USA	BECKER 80	-
" : space: measurement	WEEKS + 76	5.1,5.6
survey: Aust	AHHSC 74	3.1
space: requirements: methods: USA	SOUDER 63	5.4
" : use, evaluation: GB	MARU 77	6.7
" : " : measurement	GB DHSS 78	6.7
" : " : " : GB/MARU	RAWLINSON 78	6.3
traffic, engineering	STRAKOSCH 79	5.4

hospitals		
use, evaluation: computers	HOSKINS 75	-
vision: problems: Aust	MJA 70	5.4
wards: layout, lighting: GB	NE'EMAN + 66	6.6,6.7
" : supply: system: USA	Arch Rec 59	5.2
" : planning: layout	CLIBBON + 69	5.3
housing		
behaviour: design, evaluation: USA	JACOBS 64	7.2
buildings: comfort: design: Aust	JENKINS + 78	5.4
" : systems: USA	WEISBACH 69	5.2
design, evaluation: measurement, methods: GB	NUTT + 72	(6.3)
" : handicapped	US DHUD 79	7.7
flexibility: design: methods: GB	HAMDI + 71	2.8
health: comfort: measurement	GOROMOSOV 68	5.4
requirements, design: methods	HANSON K 69	2.7
industry		
behaviour, management: research: USA	ROETHLISBERGER+39	6.6
design: innovation, methods	WHITFIELD 75	5.5
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architecture: classification, methods	RIBA 60b	1.1
" : communication: systems	GOULDEN 76	7.5
behaviour: briefing: methods	PURCELL 80	2.4
" : documents: architecture: GB	GOODEY + 71	7.2,7.5,7.6
classification, methods	FAIRTHORNE 69	-
" , " , research	KEEN 76	7.7
" , retrieval	AUSTIN 76	7.7
" , " , methods	HUTTON + 68	-
" , system	MILLS 63	7.3
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" , "	VICKERY 60	7.2,12.3
communication	HALLORAN 78	7.8
" : computers	BAXTER 74	-
design: classification: systems	RAMAN 74	-
" : " , " : Aust/DC	McDOWELL + 74	7.3
" : " , systems: GB/DoE	GILCHRIST + 69	1.1
" : " , " : GB/DoE	GILCHRIST 72	7.4
" , communication	AGRON 73	7.2,7.5
" : methods	PITTS + 71	-
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" , problems, feedback	PITTS 71	-
" : procedures, participation	FRIEDMAN 72	2.2,2.6,4.3
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" , "	FOSKETT 77	7.2,7.3,7.4, 7.8
" , " , methods, architects: Aust	KENNEDY 80	7.3
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" , " , systems: USA	IMMROTH 71	(7.4)
" , methods	BATTEN 75	-
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" , "	FOCKE 67	-
" , " : architects	BULLIVANT 62	-
" , " : "	CALDERHEAD 72	8.6
" , " : future	LICHLIDER 65	7.2
" , " , methods: USA	WHITE 78	7.8
" , " , systems	SNEL 67/69	7.5
economics: GB	TUCKER 65	7.1
education: retrieval, methods	WALL 74	-
engineering: document, retrieval	HULME 74	-
feedback, methods: architects: Aust	MORIARTY 70	-
" : thinking	ASHBY 52/65	12.1
" : "	BIRCH + 51	2.7
innovation	Aslib 70	-
planning: decision, feedback	FOSKETT 79	7.8
politics	Aslib 78	7.2
"	KENT 78	7.8
" , behaviour	BUCHANAN 78	7.8
" : communication: Aust	GREENLEAF + 77	7.5
" : documents, classification	WEST 72	7.2
research, " , retrieval: Aust	MORAN 68	-
" , " , " , systems	JAHODA 70	7.2
retrieval: architects: USA	BURNETTE + 79	7.2
" , classification, methods	VICKERY 76	7.7
" , " , "	MALTBY 76	7.7
" , decision, methods: GB/KEHF	MORTON 78	6.10,7.5,7.8
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" : classification: systems	JOLLEY 73	7.12
" : feedback, problems	THOMPSON 70	-
" : problems: retrieval	WILSON 72	7.2
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innovation		
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outpatients: department: planning: methods: GB/DHSS	MOSS 71	2.7,4.7,9.6
planning: design: advice	GB DHSS 73	2.7

lighting		
comfort: design	HOPKINSON + 70	6.6
design: methods	HOPKINSON + 66	6.6
vision	HOPKINSON 69	6.3,6.6
" , comfort	TAYLOR 77	9.8
management		
behaviour	PETER + 69	4.3
" : performance: evaluation	CAREY 67	-
change	THOMAS + 72	-
communication, feedback	BEER 75	2.8,12.1
" : system	BEER 74	-
construction: communication: decision	CRICHTON 66	2.5
economics, politics	PARKINSON 58	2.1
information: feedback	PAISLEY 80	7.7
" : problems: GB	LEIGH 75a	2.1
" : " : GB	LEIGH 75b	2.1
" : systems: methods	ELDIN + 74	2.4,12
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problems, feedback: system	BEER 72/75	12.1
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offices		
architecture, behaviour: Aust	APRU 72	2.6
buildings, rooms: planning	DUFFY + 75	2.3
design, evaluation: methods: GB	MANNING 65a	2.3
" , " : " : "	PRU 65	6.4
environment: health: safety	RAND 79	9.8
layout: design: method	COWAN + 69	-
traffice, layout	TABOR 69	2.7
outpatients		
department: layout: computers: GB/MARU	BEATTIE 72	5.4
" : layouts: design: GB/MARU	THUNHURST 71	5.4
" : " : " : "	THUNHURST 73	5.2
planning: design: documents, retrieval	GREEN + 76	3.2
perception		
decision	ABERCROMBIE 60	7.1
performance		
evaluation: measurement, methods	HANSON + 71	9.10
planning		
change	ROSE 74	2.3
" : methods	JANTSCH 69	(2.3)
design, evaluation: procedure	CHEESMAN 74	6.2
" : methods, participation	PAGE 72	2.6,4.3
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planning		
education	AMOS 73	2.4
"	DIAMOND + 73	(2.4)
" , politics: future	TOFFLER 70	7.1
evaluation: problems, feedback: decisions	LEACH 68	2.7
" : procedures	PERRATON 74	2.1,6.2
" : procedures, methods	LICHFIELD + 75	(6.2)
" : system	BATTY 74	-
future	COWAN 73	-
information: classification, system	ARMEN 66	-
" : evaluation: methods	PERRATON + 74	2.1
" : documents, retrieval:Aust	DONALDSON 77	7.6
" : evaluation: research: GB	WILKIN 76	7.5
" : GB	WHITE + 74	
" : methods, research: GB	WHITE 70	7.2
" : systems	COWIE 74	2.1
" : " : computers	CATER 74	2.1
participation: Aust	ABC 75	1.2
politics: thinking	FALUDI 73	2.3
problems, briefing, design: methods	KAUFMAN 79	-
" : future	MICHAEL 68	7.1
science: change: method	BENNE + 76	2.1
terminology	COD 76	1.2
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decisions, methods	VICKERS 65	-
" , "	VICKERS 68	-
evaluation: research: USA	WEISS 75	6.1
planning: decision: methods	FRIEND + 69	2.1,2.3,2.4
rehabilitation		
engineering: Aust	NACH 77	11.2
equipment: design: research: children: Aust	GREEN + 79	11.2,13.3
evaluation: methods: handicapped	GOBLE + 71	-
information: survey: Aust	SCULL 81	7.7
requirements		
briefing, design	AJ 66	4.4
science		
information: advice: USA	REES 75	8.3
" : Aust	ANL 73	-
" : communication, feedback: USA	HAVELOCK 69	2.1
" : decision, feedback	GRAY + 75	7.5
" , management: systems	MITCHELL 68	7.2
" : research, systems	HIMSWORTH 70	-
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terminology	DESOUTTER 67	2.5

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terminology	Webster's 72	1.2
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methods	DE BONO 69	2.3
"	DEWEY 33	3.3
"	WALLAS 26	2.8
towns		
behaviour, politics, planning	SENNETT 73	2.7
planning, behaviour: users	GANS 69	2.7
" , information: research: GB	Uni Edin 74	1.1,7.6
" , " : retrieval: GB	WHITE 71	7.6
vision		
lighting	DUKE-ELDER 70	9.8
perception: thinking	GREGORY 72	9.8
wards		
comfort, supervision: design: world	L-DAVIES + 79	4.7
design: advice, documents	GB DHSS 68	4.7,5.6,10.1
" , evaluation: classification: staff	KENNY + 81	(6.9)
" , " , feedback: GB/SHHD	Health B 76	6.9
" , " : GB/MARU	Nursing Times 78	6.9
" , " : measurement: USA	FREEMAN 67	5.4
" , " : " : "	FREEMAN 68	6.9
" , " : methods: staff: Aust	SHINNICK 79	6.9,10.1
" , " : " : USA	REDSTONE 78	(6.9)
" , " : " : users: GB	SEARS 77	6.9
" , " , survey: methods	SEARS + 76b	6.3,6.5,6.9,9.3, 9.10
" , " , use: Aust	CABBAN + 77	6.9
" , use, evaluation	GB SHHD 69	5.8,6.9
" , " , " : GB/DHSS	TATTON-BROWN 78	(6.9)
" , " : method	OSMOND 57	6.8
economics: layout: lighting	COCKRAM 70/71	5.4,9.8
evaluation: research, methods	HEATH 80	6.9
health: safety: design	SMITH + 80	5.8,6.9
layout: design	CURRY 80	10.1
" : " , evaluation	GB Oxford 70	6.9
" : " , " : research: GB/MARU	NOBLE + 77	6.9,9.3,10.1
" : " , evaluation: USA	JACOBS 61	5.4,5.8,6.7

wards		
layout: design, evaluation: USA	McLAUGHLIN 64	5.4,5.8,6.7, 6.9
" : " , " : USA	McLAUGHLIN 69	5.4,6.9
" : evaluation: measurement: USA	PELLETIER + 60	5.3
" : " : methods: GB	SHC 67	6.5
" : " : USA	TRITES + 70	6.9
" , performance, privacy: USA	THOMPSON + 62	-
" , supervision: evaluation	STURDEVANT + 60	6.9
" , " , privacy: GB	WATKIN 78	6.9
" , traffic, evaluation: method	LIPPERT 71	5.4,6.9
management: evaluation, use: staff: GB	NPHT 53	6.9
" : methods: GB	LUCKMAN + 69	2.8
performance: measurement: staff: USA	THOMPSON 13	5.3
planning: design: advice	NZ DH 72	10.1
" : " : " : NSW	Hosplan 77	3.5,10.1
" : economics: layout	GB MoH 63b	4.7,5.3,5.4,6.7
" : " : "	GB MoH 65	4.2
" : layout: design	GB MoH 61d	6.9
" : " , space: use: USA	BOBROW 78	-
" : requirements: users	GREEN + 80	6.9,13.3
" : supervision: future: GB	METCALF 78	6.9
" : use: decisions, document	GB DHSS 69	4.7
privacy: evaluation: patients	HOPETOUN-SMITH 80	6.9
" : supervision: design: past	GREEN 80a	5.8
" : " : survey, design: NSW	GREEN 80b	(10.3)
rooms: evaluation: staff: USA	MACDONALD + 81	4.3
" : planning: privacy: GB	BURROUGH 76	10.1
" : privacy: patients	HHSR 81	5.8
" : space: evaluation: GB/DHSS	HOWARD 67	-
" : space: measurement: GB/MARU	ADAMS 71	6.9
safety, ventilation	BAGSHAW 78	6.9,6.10
sound, perception: measurement	OGILVIE 80	5.8
" , " : "	WHITFIELD 75	"
ventilation: research	BAIRD 66	6.9

APPENDICES

The nine sections of the appendices are arranged in alphabetical sequence of mnemonic codes as follows:-

A Key to abbreviations used in text & index to references

B Briefing guides and check lists

C Classification and indexing schemes

D Document retrieval systems and indexes

E Evaluation questionnaires, check lists and findings

F Framework for feedback

G Guidance documents - examples of headings and contents

H Hospital planning procedures and processes

I Information survey questionnaires and findings

The detailed contents of each appendix section are listed on the first page of the section.

APPENDIX A

KEY TO ABBREVIATIONS AND ACRONYMS USED IN TEXT AND IN REFERENCE INDEX

A&BN	Architect & Building News
ABC	Australian Broadcasting Commission
ABS	Australian Bureau of Standards
AD	Architectural Design
ADB	Activity Data Base
ADH	Australian Dept. of Health
ADH&C	Australian Depts of Health & Construction
AGPS	Australian Government Publishing Service
AHA	Australian Hospital Association
AHA(Chic)	American Hospital Association (Chicago)
AH&HSC	Australian Hospitals & Health Services Commission
AIA	American Institute of Architects
AIDA	analysis of interconnected decision areas
AJ	Architects' Journal
ANL	Australian National Library
API	Architectural Periodicals Index
APRU	Architectural Psychology Research Unit, Sydney University
ARC	Applied Research, Cambridge
Arch F	Architectural Forum
Arch R	Architectural Review (London)
Arch Rec	Architectural Record
ASLIB	Association of Special Libraries & Information Bureaux
ASSCSW	Australian Senate Standing Committee on Social Welfare
Bartlett	Bartlett School of Architecture, London University
BC	Bliss classification scheme
BDP	Building Design Partnership
BPRU	Building Performance Research Unit
BMJ	British Medical Journal
BRS	Building Research Station (now Establishment)
BSD	Building Systems Development
BSI	British Standards Institute

CAD	Computer Aided Design
CBC	Coordinated Building Communication
CHI	name of North American consultancy firm (after Greek letter)
CIB	Conseil International du Bâtiment (International Council for Building Research Studies & Documentation)
CICI	Current Information in the Construction Industry
CI/SfB	Construction Index SfB filing system (see SfB)
CIT	Construction Industry Thesaurus
COD	Concise Oxford Dictionary
CRS	Caudill, Rowlett & Scott, architects, Houston
CRSoc	Classification Research Society
CSIRO	Commonwealth Scientific & Industrial Research Organisation
CSR	Colonial Sugar Refiners, Sydney
DES	Dept. of Education & Science, UK (previously MoE)
DIF	Design Information File (operated by Australian Dept. of Construction)
DHS	Dept. of Health for Scotland (later SHHD)
DHHS	Dept. of Health & Social Security, UK (previously MoH)
DHEW	Dept. of Health, Education & Welfare, USA
DKI	Deutches Krankenhaus Institut, Dusseldorf
DoD	Dept. of Defense, USA
DoE	Dept. of the Environment, UK (previously MPBW & MHLG)
DSIR	Dept. of Scientific & Industrial Research, UK
EBS	Experimental Building Station, Sydney
ECORE	Expert Committee on Rehabilitation Engineering, Canberra
FID	Federation Internationale de Documentation, Paris
FPS	Facility Planning System (of HFSB)
FU	functional unit (for allocation of building costs)
GFA	gross floor area
GLC	Greater London Council
H&HSR	Hospital & Health Service Review
H&SSJ	Health & Social Service Journal

HARNESS	code name for hospital planning & building system developed by DHSS
HBN	Hospital Building Notes (by DHSS)
HDEU	Hospital Design & Evaluation Unit, Wellington, NZ
HERG	Hospital Evaluation Research Group, University of Surrey
HFSB	Hospitals Facilities Services Branch, Canberra
HIF	Hospital Information File (operated by HFSB)
HOSPLAN	NSW Hospital Planning Advisory Centre, Sydney
HPU	hospital planning unit (for measuring floor area & building costs)
IAAS	Institute of Advanced Architectural Studies, York University
IES	Illuminating Engineering Society, London
IFDH	Investigations in the functions and design of hospitals (by NPHT)
IHF	International Hospital Federation
ISS	inter-stitial space (for engineering services)
ITU	intensive therapy unit
KEHF	King Edward VII's Hospital Fund for London
KFC	King's Fund Centre, London
LC	Library of Congress classification
LDK	Llewelyn Davies, Kinhill, hospital planning consultants, Sydney
LUBFS	Land Use & Built Form Studies, Cambridge University
MARU	Medical Architecture Research Unit, Polytechnic of North London
MEDLARS	Medical Literature & Retrieval System,operated by NLM
MEDLINE	on-line version of MEDLARS
MeSH	Medical Subject Headings,as used in MEDLARS
MHLG	Ministry of Housing & Local Government, UK (later part of DoE)
MIES	Management Information & Evaluation System
Min Tech	Ministry of Technology, London
MIT	Massachusetts Institute of Technology
MJA	Medical Journal of Australia
Mod Hosp	Modern Hospital

MoE	Ministry of Education, UK (later DES)
MoH	Ministry of Health, UK (later DHSS from 1967)
MPBW	Ministry of Public Buildings & Works, UK (later DoE)
MSJ	McConnel, Smith & Johnson, architects, Sydney
NACH	National Advisory Council on the Handicapped, Australia
NBRI	National Building Research Institute, Pretoria, S.Africa
NBS	National Bureau of Standards, Washington, DC
NLM	National Library of Medicine, Washington, DC
NPHT	Nuffield Provincial Hospitals Trust, UK
NSW	New South Wales
NTIS	National Technical Information Service, USA
NUCLEUS	code name for hospital design system by DHSS
NZDH	New Zealand Department of Health, Wellington
Ont.MoH	Ontario Ministry of Health
PPC	progressive patient care
PRU	Pilkington Research Unit, University of Liverpool
PSA	Property Services Agency (part of DoE)
QS	quantity surveyor (now often termed Building Economist)
RAIA	Royal Australian Institute of Architects
R and D	research & development
RHA	Regional Health Authority, UK
RHB	Regional Hospital Board, UK
RIBA	Royal Institute of British Architects
SAA	Standards Association of Australia
SAUS	School for Advanced Urban Studies, University of Bristol
SfB	Samarbetscommitten for Bygnädsfragor (Swedish for Joint Working Committee for Solving Building Problems)
SFC	Subject Filing Code
SFD	Subject Facet Descriptor
SDI	selective dissemination of information
SHBC	Scottish Health Building Code
SHC(SHSC)	Scottish Hospital Centre (later Scottish Health Services Centre)

SHHD	Scottish Home & Health Department (previously DHS)
SMH	Sydney Morning Herald
SMM	standard method of measurement
SMP	Stone, Marraccini & Patterson, architects & planners, San Francisco
SPRI	Hospital Planning & Rationalisation Institute, Sweden
SSBRT	Social Services Buildings Research Team, University of Bristol
UDC	Universal Decimal Classification
UFA	usable floor area
UK	United Kingdom of Great Britain & Northern Ireland
UMWA	United Mineworkers' Welfare Association, USA
Uni Aston	University of Aston, Birmingham, UK
Uni Edin	University of Edinburgh, (Dept of Urban Design)
Uni Mich	University of Michigan, (School of Public Health)
UNSW	University of New South Wales
US or USA	United States of America
USEP	user survey evaluation package
USDHEW	United States Department of Health, Education & Welfare
USDHUD	United States Department of Housing & Urban Development
USGAO	United States General Accounting Office
USGPO	United States Government Printing Office
USNLM	United States, National Library of Medicine
VA	Veterans' Association, USA
VHCC	Victorian Hospital & Charities Commission (now Health Commission
YRM	Yorke, Rosenberg & Mardall, architects, London
YTI	Yale traffic index

APPENDIX B

BRIEFING HEADINGS AND CHECK LISTS

B1 St Thomas' Hospital Development, research headings, 1957-59 (St Thomas' Hospital Architect's Department)

B2 Wexham Park Hospital Slough, room data check lists, 1959-61 (Powell & Moya, architects)

B3 Ward design study, Ministry of Health 1961-63, factors affecting evaluation of design options (Ministry of Health, Architects Branch)

B4 Greenwich Hospital Development, Ministry of Health 1964-67, investigation headings (adapted from Green et al 1971)

B5 Comparison of sequence of headings in selected hospital departmental briefs 1971-77

B6 Outline for a 'programming report' (brief) (adapted from Peña et al 1977)

B7 Briefing check list for hospital departments based on Capricode stages A, B & C (adapted from MOSS 1975)

B8 NSW Public Works Department, hospital briefing check list (adapted from 'Guide to the Preparation of Development Briefs' 1973-74)

B9 A briefing method for health Centres (adapted from Cammock & Adams 1970)

B10 Model briefing procedure for building design (Green 1981)

B11 Requirements for 'foldability' for seating for handicapped children, excerpt from briefing proforma (Fewchuk 1980)

B1 ST THOMAS' HOSPITAL DEVELOPMENT, RESEARCH HEADINGS, 1957-59

1 General description of room

1.1 Function

1.2 Location

1.3 Layout

1.4 Population
- type, number
- movement
- duties
- timing

1.5 Accommodation
- size
- facilities
- equipment
- services
- finishes

1.6 Special characteristics

2 User requirements

2.1 Space
- activity
- equipment
- storage

2.2 Lighting
- sun/daylight
- artificial light
- colour

2.3 Thermal
- sun
- artificial
- insulation

2.4 Ventilation
- natural
- mechanical
- air conditioning

2.5 Sound
- insulation
- acoustics

2.6 Protection, safety
- fire
- health
- security
- damage
- privacy

3 Equipment details

3.1 Plant

3.2 Apparatus

3.3 Furniture

3.4 Fitments

3.5 Instruments

3.6 Sundries

3.7 Stationery

3.8 Clothing

3.9 Containers

3.10 Vehicles

Describe each in terms of:

a. function
b. type
c. maker
d. usage
e. storage
f. cleaning
g. services
h. size
i. weight
j. cost
k. special characteristics

4 Design aspects

4.1 Services

water
drainage
gases
electricity
heating
vacuum & suction
air
steam
telecom
clocks
electronics
mechanical

4.2 Materials

composition
surface: colour/texture
mechanical properties, strength, durability
thermal properties
acoustic "
electrical "
chemical "
unit sizes, thickness
jointing

4.3 Construction
- structure, frame
- floors
- walls
- ceilings
- doors
- windows
- fittings
- trim
- applied finishes

4.4 Costs
- materials
- components
- labour
- transport
- maintenance

4.5 Legislation
- bye-laws
- form, planning
- public utilities

These headings were used for the following purposes:

1. Recording details about existing rooms in the hospital
2. Listing requirements for departments in the new hospital
3. Agendas for site visits, meetings etc.
4. Filing information for reference.

B2 WEXHAM PARK HOSPITAL, SLOUGH, ROOM DATA CHECK LIST (summary) 1959-61

1. Use of room - describe activities.
2. Population - no. and types of people involved.
3. Storage - items to be stored, facilities required.
4. Daylight - sources, controls needed.
5. Artificial light - types, controls.
6. Surfaces - types, finish, colour.
7. Heating & cooling - range, controls.
8. Ventilation - type, rate, controls.
9. Sound - noise sources, controls.
10. Fire - hazards, controls.
11. Health - risks, safeguards.
12. Security - risks, protection.
13. Maintenance - damage sources, control measures.
14. Fixtures & fittings - number, type, size.
15. Sanitary appliances - no., type, location, size.
16. Special equipment - no., type, location, size.
17. Supply services - no., type, location, capacity
18. Extract services - no., type, location, capacity
19. Communication - no., type, location, capacity
20. Furnishing - types, sizes.
21. Finishes - materials, pattern, texture.
22. Other special considerations.

B3 WARD DESIGN STUDY, MINISTRY OF HEALTH, 1961-63

FACTORS AFFECTING EVALUATION OF DESIGN OPTIONS
(from Draft Hospital Building Note, Deep plan (Race track) Wards)

A. Major factors

flexibility in size of ward unit

centralisation of supply services

nursing supervision of patients & staff

utilisation of beds

suitability for barrier nursing

suitability for pre-operative segregation of patients

adaptability of layout for special wards

simplicity & reliability of engineering services

environment for staff

B. Minor factors

relationship of bed areas to:

toilets
utility areas
sluice/pan room

relationship of treatment room to:

utility areas
bed areas

relationship of kitchen to:

dining area
bed-fast patients

daylighting - sun, glare

view, outlook

privacy from overlooking, overhearing

control of visitors

security - theft, intruders

freedom from obstructions - visual, structural

noise control - plant, traffic, people

C. Indeterminate or variable factors

traffic - intensity, noise

type of nursing care

type of patients - specialty, dependency

staffing levels

staff movement patterns

climate, exposure, pollution

site, phasing

B4 GREENWICH HOSPITAL DEVELOPMENT, MINISTRY OF HEALTH, 1964-67
INVESTIGATION HEADINGS

A Preliminaries

0.1 Subjects of investigation

0.2 Purpose of investigation
- reasons
- objectives

0.3 Scope of investigation
- eg subdivisions
  - stages
  - extent
  - resources
  - feasibility

0.4 Organisation of investigation
- eg composition of team
  - tasks, responsibilities
  - program, coordination
  - methods, procedures
  - recording information, filing
  - meetings - times, places

B General information

1. Subject
   - definition, explanation
   - information sources

2. Purpose
   - history
   - existing situation
   - problems, purposes
   - trends, objectives

3. Scope
   - functions, items - included/excluded

4. Organisation
   - authorities
   - chain of command
   - roles of individuals
   - coordination
   - economics, resources
   - operational methods
   - control, supervision
   - facilities involved, eg transport

C Situation

5. Location
   - region covered - area, population, travel
   - climate
   - topography
   - social factors - occupations
   - surroundings

6. Site
   - characteristics - size, shape, features
   - restrictions
   - possible arrangements - layout

D Operation

7. Functions
   - used for - purpose
   - used by - people involved
   - used how - describe activities
   - used when - times of use, durations
   - used where - locations, movements
   - quantities involved - supplies, work loads
   - services used - supply, disposal
   - equipment used - furniture
   - relation to other functions
   - permanence, reliability

8. Population
   - description
   - distribution
   - characteristics

9. Accommodation
   - layouts, circulation
   - space, size, shape
   - structural implications
   - services plant implications
   - equipment implications

E Conditions

10. Perception
    - impressions conveyed - visual, auditory
    - responses - reaction, comprehensive

11. Protection
    - risks, hazards - fire, theft
    - controls, safeguards - security

12. Environment control
    - existing conditions
    - required conditions
    - control measures

F Facilities

13. Supplies
    - types
    - quantities
    - methods of use

14. Equipment
    - types
    - size, shape, location
    - methods of use

15. Services
    types, performance
    output, distribution
    control methods, outlets

G Limitations

16. Legal
    legislation, statutory regulations
    moral, social responsibility

17. Economic
    financial resources
    energy, labour

H Proposals

18. Recommendations
    on organisation, management aspects
    on function, operational aspects
    on design, construction aspects

19. Execution
    methods of implementation
    program
    contract administration

I Fabrication

20. Structure
    forms, materials
    loads, stresses
    environmental factors
    space, size
    joints, erection procedures

21. Construction
    components, materials
    form, assembly method
    environmental factors, durability
    maintenance costs

22. Engineering services
    type, loading, performance
    distribution methods
    control methods
    energy usage, operating costs

23. Equipment
    types, functions, usage
    size, shape, space needs
    services
    maintenance

J Assessment

24. Evaluation of
    - design methods
    - design proposals
    - construction methods
    - operational effects
    - costs of construction
    - costs in use
    - environmental conditions

(Adapted from Green et al (1971) Hospital Research & Briefing Problems pp137-139.)

B5 COMPARISON OF SEQUENCE OF HEADINGS IN SIX SELECTED AUSTRALIAN HOSPITAL DEPARTMENTAL BRIEFS 1971-77

1. King Edward Memorial Hospital for Women, Subiaco, Perth, Western Australia,1971, Departmental Brief

   1. Schedule of room areas
   2. Circulation diagram
   3. Departmental function - description
   4. Departmental location
   5. Objectives forecast
   6. Program
   7. Operational aspects
   8. Siting
   9. Facilities required
      types of spaces
      engineering services
      transport
      amenities
      supplies
      security and protection
   10. Sub-functions analysis

2. Royal Prince Alfred Hospital, Sydney, Functional Brief,1971

   1. General
   2. Functional relationships to other depts.
   3. Functions
   4. Space allocations
   5. Internal relationships
   6. Basic plan features
   7. Special facilities

3. Belconnen Health Complex, Canberra,1972, Departmental Brief

   1. General introduction to functions
   2. Space function data sheets, including the following data:
      departmental name
      space name
      floor area
      function - description
      location
      occupancy
      activities
      equipment

4. Wagga Wagga Base Hospital,
   Functional Brief,1974

   1. Present usage
   2. Future needs
   3. Design features
   4. Size
   5. Essential facilities
   6. Organisation & staffing

5. Westmead Hospital, Sydney,
   Departmental Brief,1975

   1. Scope & function
   2. Organisational principles
   3. Design requirements
   4. Organisational planning principles
   5. Accommodation schedules

6. Queen Victoria Medical Centre, Melbourne,
   Department Brief, 1977

   1. Concept
   2. Scope of service
   3. Functional content & area
   4. Relationships
   5. Building requirements & environment
   6. Organisation & staffing
      patients
      students
      staff
      records
      food service
   7. Activity sequence
   8. Schedule of accommodation

B6 OUTLINE FOR A PROGRAMMING REPORT (BRIEF)
(from PEÑA W et al Problem Seeking (1977) p181-182)

1. Introduction

   background
   work performed
   participating client group
   organisation of report

2. Goals

   project goals
     mission
     goals & objectives
     policies
   operational goals

3. Facts
   summary of statistical projections
   staffing requirements
   user description
   evaluation of existing facilities
   site analysis
     urban context
     catchment area
     vicinity land use
     views from/to site
     location
     site size/shape
     accessibility
     walking distances
     traffic intensity
     topography
     trees, planting
     vacant areas for building
     existing buildings
     potential for land acquisition
   climate analysis
   zoning requirements
   building regulation requirements
   cost limitations
   timing

4. Concepts

   organisation
   functional relationships
   priorities
   description of functions
   operational policies

5. Needs

   space requirements - indoor/outdoor
   parking space
   land requirements
   phasing of construction/occupation
   budget
     renovation
     new work

6. Problem statement

   design aspects
   operational aspects

Appendices

   statistical data
   workloads - present, anticipated
   workspace projections
   existing accommodation, size & use
   evaluation of existing department functions
   potential for re-use of existing accommodation
   cost analysis
   definitions

B7 BRIEFING CHECK LIST FOR HOSPITAL DEPARTMENTS BASED ON CAPRICODE STAGES A, B & C
(adapted from MOSS (1975) Report to MARU/KEHF Committee on Training of Health Facility Planners)

STAGE A. Departmental considerations

Functional Aspects

Objectives

Scope

Organisation

Services - needed
existing

Links to other depts.

Trends

Workforce available

Other proposals

Workload estimate - consider cost implications

Sharing services

Management - design implications

Staffing - cost

Amenities - design

Design Aspects

Sites available
topography
aspect/prospect
nuisances

Building shape - construction, cost implications

Siting - " "

Floor area estimate - cost implications

Layout - engineering & cost implications

Construction Aspects

Engineering services - cost implications

Contracting methods - cost implications

Economic Aspects

Capital costs

Operating costs

Resources available/obtainable?

STAGE B. Inter-departmental & whole hospital considerations

Functional Aspects

Organisation review - cost implications

Supporting services

Teaching & research

Clinical services

Staff review estimate - cost implications

Administration

Design Aspect

Timing - construction implications

Growth & change

Proposals - functional implications

Shape, traffic - constructional implications

Economic Aspects

Capital cost review

Operating cost review

Management Aspects

Review program - timing, completion

Review project - feasibility, cost implications

STAGE C. Departmental and room considerations

Functional Aspects

eg Reception
Consultation
Investigation -design implications
Treatment
etc

Movement
Organisation
Supporting services -design implications
Supervision
Communications
Safety

Design Aspects

Facilities, rooms required

Room layouts
Circulation -operational & cost implications

Construction Aspects

Equipment needed
Services needed -cost & management implications
Structural systems

Economic Aspects

Capital cost review

Operating cost review

Management Aspects

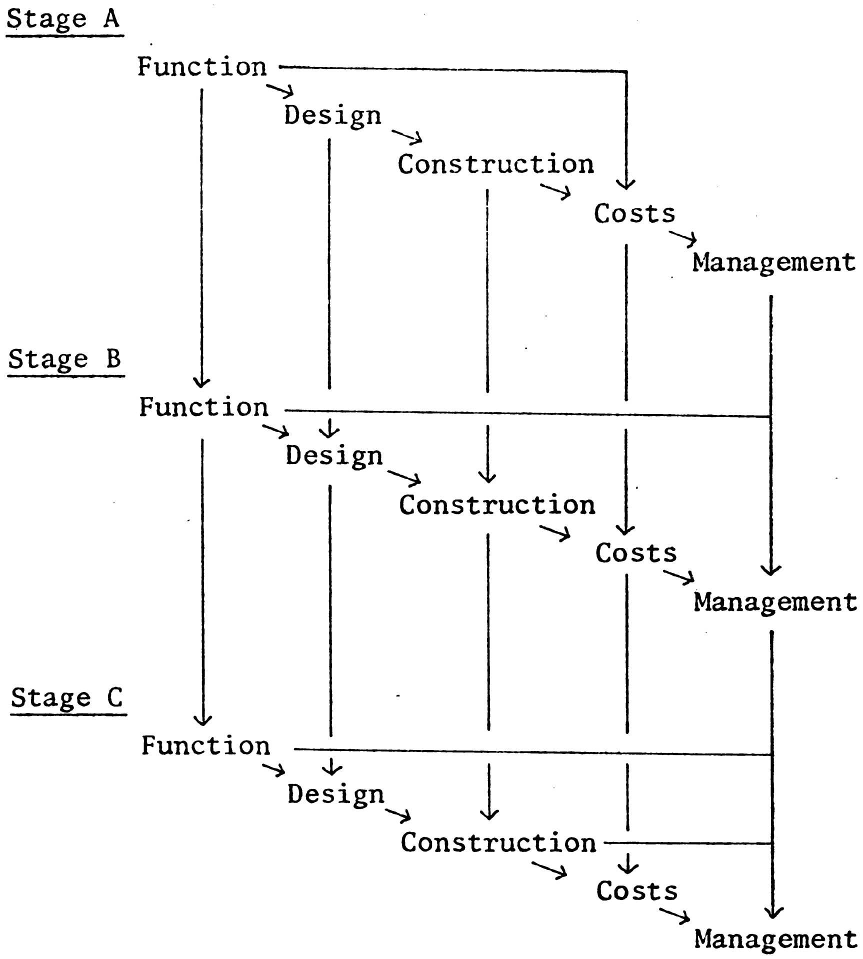
Starting date

Completion date

Contracting arrangements

Commissioning program

A simplified form of the briefing structure could be expressed thus:



B8 NSW PUBLIC WORKS DEPT., HOSPITAL BRIEFING CHECK LIST
(adapted from 'Guide to the Preparation of Development Briefs 1973-4)

1.	BACKGROUND	- history, organisation, planning team members etc.
2.	TERMS OF REFERENCE	- information sources, definitions, limitations
3.	SITE	- location, area, topography, services available, access etc.
4.	CATCHMENT	- area served, population served, effect of other projects in the area
5.	DEMOGRAPHY	- present population - age, structure, occupations, morbidity, likely trends, effects on project
6.	NEED	- justification for project in terms of role, size and mix
7.	ORGANISATION	- <u>FOR WHOLE PROJECT</u> : management structure, operational policies, work methods, communications, staffing outline
8.	CONTENT	- <u>FOR EACH DEPARTMENT</u> : functions, personnel, management concept, key rooms, circulation, outline of services and facilities required
9.	ACCOMMODATION	- for each <u>department</u> list rooms giving: name/function floor area number of users services needed equipment special features
10.	ANY SPECIAL FEATURES	- eg equipment, services, safety hazards
11.	MATERIALS	- finishes for floors, walls, ceilings, doors
12.	ENGINEERING	- requirements for airconditioning, heating and ventilation, water supply, gas, air steam, electricity, communications, safety, lighting, maintenance
13.	PROJECT DEVELOPMENT	- 'master plan', phasing of construction, expansion
14.	COSTS	- rate per unit of floor area for building, engineering, external works
15.	PROGRAM	- networks or bar charts for planning, design, construction, commissioning
16.	RECOMMENDATIONS	- summary of brief, action proposal, by whom and when.

B9 A BRIEFING METHOD FOR HEALTH CENTRES
(adapted from Cammock & Adams 1970)

1. The planning team should include both user representatives, such as doctors, dentists, nurses, welfare workers, clerks and cleaners, and designers such as architects, engineers and quantity surveyors. Without a full range of users on the planning team the building can fail to allow for foreseeable changes in working methods. Engineers and quantity surveyors are essential to advise on matters affecting cost of provision and operation.

2. Formulate and record policies which constitute the brief. Policies are "statements about what people will do in relation to building, how goods will be handled, and what standards of fabric and environment will be maintained". Together these statements "give a picture of the clients' intentions against which...proposals can be judged".

3. Accept the need for an early assessment of overall size and cost of the health centre building based on numbers of staff and clients likely to be using it. This is so that "suitable sites (can) be considered, funds made available, and rents for potential tenants advertised".

4. Determine priorities for types of service and accommodation to be provided. In practice there are likely to be disputes or conflicts of interests, but it is better to resolve these at the outset rather than to leave them to boil over later when the design is far advanced.

5. Once the range of facilities to be provided is agreed the required floor areas of rooms can be estimated from design guides and from previous similar buildings. The building and running costs however may vary considerably depending on standards of materials and methods of construction proposed. The variable interrelationship between building space and costs should be made clear to the client representatives so that design policies can be formulated in the knowledge of their likely operational effects.

6. The need for adaptable use of space should be considered, eg sharing rooms at different times of the week by various members of the health centre team. This can considerably reduce overall space requirements and hence capital and running costs. It also allows for experiments and changes in use of space over the building's lifetime and helps to reduce premature obsolescence.

7. As soon as cost estimates and funding have been approved the schedule of accommodation "should be thrown away and forgotten if a function-based building is to be achieved". This "highly irrational act" is necessary to avoid the temptation for staff to get down to detail physical planning before the operational concepts have been properly developed.

8. Interrelationships between general policies and detailed policies should be made evident. General policies are on topics such as staffing, maintenance, siting and privacy, while detailed policies are concerned with catering, waiting, chiropody, toilet facilities, etc.

9. Consider all available design and operational options and make choices based on resources available and constraints imposed. Precision is needed in stating performance standards to be achieved, eg in sound reduction levels between adjoining consulting rooms.

10. Service catchment areas, and hence estimates of populations to be served, should be regarded as provisional. Allowances should be made for increases or decreases due to unpredictable factors, such as changes of bus route or traffic congestion.

11. Consider the organisational, social and economic pros and cons of being part of a larger building or institution such as a hospital. The advantage of sharing the same facilities may be offset by the overpowering medical image of a large hospital. On the other hand the presence of a health centre could help focus the hospital staff's interests on community health rather than medical technology.

12. Once policies are settled the team's attention should focus on detailed aspects of function. These are best developed by using 'functional diagrams' which explain the chronological sequence of events or activities which together make up a function such as 'consultation'. Functional diagrams are useful, 1) as a means of discussing ideas about functions upon which decisions have to be made, 2) to record decisions on operational methods for later reference in evaluating design proposals, and 3) as a basis for developing operational manuals and staff job descriptions.

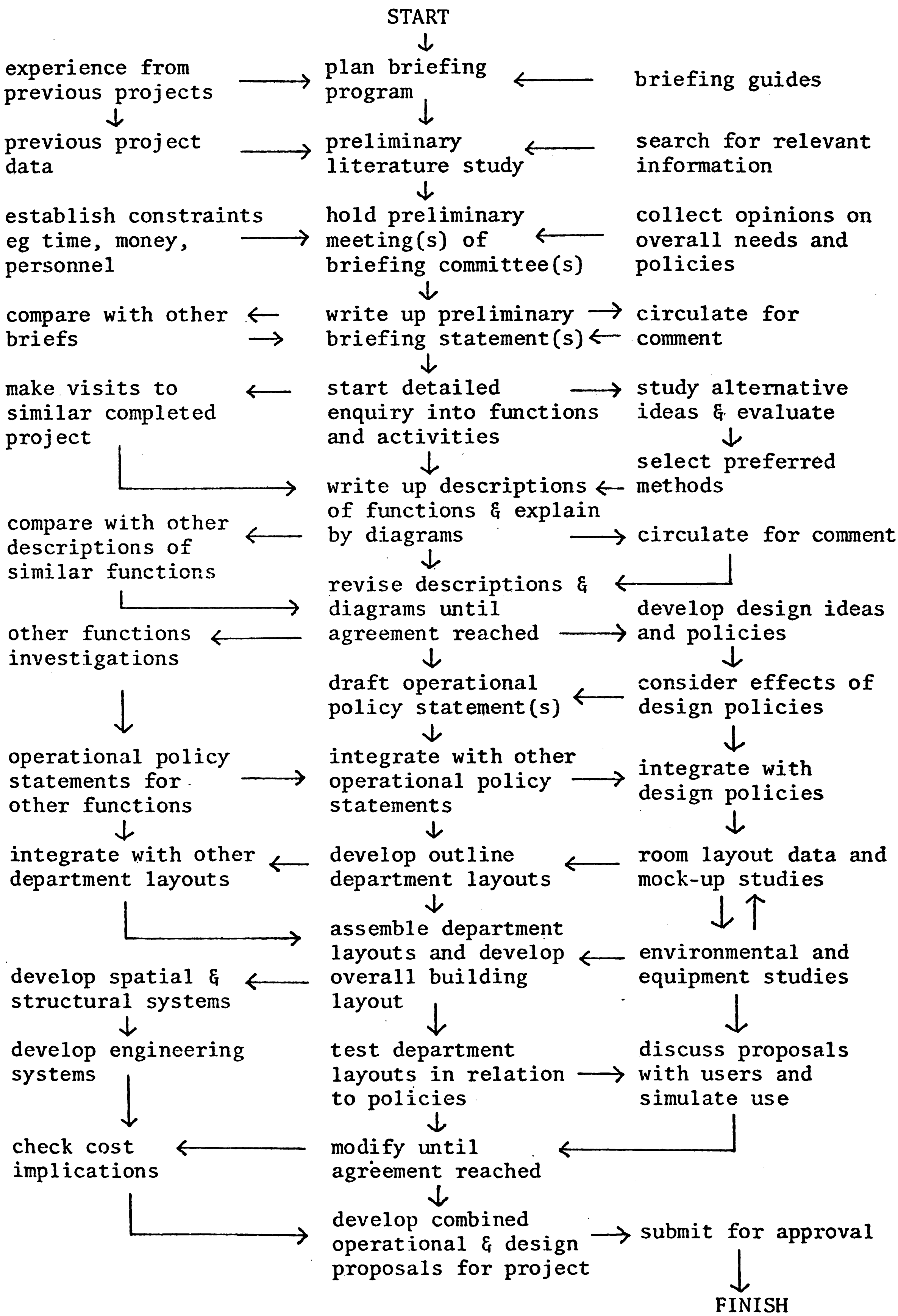
13. When all functions have been defined their spatial and equipment implications can be explored using 'activity data method'. It is essential to complete all functional diagrams before starting the activity data sheets, otherwise functions tend to reflect assumptions about spatial arrangements of equipment rather than being based on functional needs.

14. Activity data is not directly related to 'rooms', ie only when all activity data sheets have been prepared is it possible to see how activities can be grouped or combined into rooms and spaces. Room data also depends on environmental data which relates to the building as a whole. (In this briefing method activity and room data sheets are appropriate tools only towards the end of the briefing process. In some other methods they are regarded as the starting point.)

15. Much of the information appropriate to a particular health centre can be derived from previous health centre and other building designs, and from published design guidance. Nevertheless such data shuld not be treated uncritically but should be reviewed in the light of local or unusual circumstances.

16. The final stages of this briefing process involve assembling all the policy statements, together with the functional, activity, room and equipment data, and integrating them with the whole design so that the design team can prepare building contract documents.

B10 MODEL BRIEFING PROCEDURE developed from the writer's experience on a number of hospital planning projects, and which could be applied on any building design project.



B11 REQUIREMENTS FOR FOLDABILITY FOR SEATING FOR HANDICAPPED CHILDREN
(Excerpt from briefing proformae)

FOLDABILITY

What is needed-requirement	Reasons why/evidence	Conceptual Implications
F1 It should be possible to reduce the overall dimensions of the unoccupied aid.	-so that little room is taken up when out of use or when being transported. -to reduce effort and awkwardness when carrying and placing full-size aid.	-aid should be able to fold/collapse into compact shape/size. AND/OR -outer parts of aid should be removable.
F2 It should be easy for attendant to fold/collapse and re-erect the aid.	-to avoid frustration of attendant due to task taking too long, being too strenuous or too complicated. -to minimise delay in preparing aid to load into transport and/or re-erecting for use.	-means of unlocking and controlling mechanism should be easy to see and be few in number. -folding operations should not involve any extra tools, parts, or involve disassembly. -operations to unlock, fold/collapse and re-erect should require little effort.
F3 Aid should stay securely fixed in its folded/collapsed state until re-erected for use.	-to avoid sudden opening while being carried, causing inconvenience. -to enable aid to be carried in one hand leaving the other free.	-aid should be able to be secured/locked in folded/collapsed state by attendant. AND/OR -aid should 'self-lock' in the folded/collapsed state.
F4 Aid should stay fixed in its "erected" state.	-to avoid sudden collapse and subsequent injury to occupant. -to avoid inconvenience of attendant having to re-erect aid frequently	-aid should have locking devices to maintain in erected state. AND/OR -aid should 'self-lock' once erected, e.g. by effect of downward pressure or spring.

APPENDIX C

CLASSIFICATION AND INDEXING SCHEMES

C1 HO Division of Bliss Bibliographical classification scheme as adapted for the King's Fund Library, London.

C2 SfB classification tables applicable to health facility planning and design.

C3 Design Information File (DIF) classification scheme and Plowden scheme on which DIF was based.

C4 Hospital Information File (HIF) showing examples of sub-divisions and coding.

C5 Abstracts of Health Service Management Studies classification scheme (excerpt).

C6 Subject Filing Code (SFC), with examples of document classific- ation.

C7 Subject Facet Descriptors (SFD). Content descriptors, application specifiers and identifying concepts.

C8 Subject headings used for indexing photographic slides.

C9 Select list of facets and keywords for indexing health facility planning documents.

C10 Logical and hierarchical list of notes for students in health facility planning and design subjects.

C11 Alphabetical lists of general and specific topics in health facility planning and design.

C1 HO DIVISION OF BLISS BIBLIOGRAPHICAL CLASSIFICATION
(as adapted for the King's Fund Centre Library, London)

The main divisions of the modified HO section in Bliss are summarised below:

HO	Hospitals in general	
HOA	Hospitals in Great Britain	
HOB	Hospitals overseas	
HOC	Planning, design and construction (see below)	
HOD	Engineering services	
HOE	Equipment, fittings and furniture	
HOF	Staff - general	
HOG	Staff - special classes	
HOH	Organisation and administration	
HOI	Finance	
HOJ	Supplies	
HOK	Catering and dietetics	
HOL	Laundries and linen service, incl. domestic services	
HOM	Hygiene	
HON	Accidents and safety measures	
HOO	The patient	
HOP	Special departments)	used as means
HOQ	Special units in hospitals)	of subdividing
HOR	Special hospitals)	section HOC (see below)

Section HOC, 'Planning, design and construction' is subdivided as follows:

HOCA	Determining size of hospital and bed needs
HOCB	Determining catchment areas
HOCC	Site selection
HOCD	Land acquisition
HOCE	Building costs
HOCF	Construction methods
HOCG	Design
HOCH	General layout
HOCI	Orientation for daylight
HOCJ	Design of individual projects (arranged by location and name)
HOCK	Extensions and reconstruction
HOCL	Extensions and reconstruction of individual projects
HOCM	Design of special departments
HOCN	Design of special units in hospitals
HOCO	Wards and patient's rooms
HOCP	Corridors and stairways
HOCQ	Residential accommodation
HOCR	matrons' quarters
HOCS	nurses' homes
HOCT	doctors' quarters
HOCU	domestic staff accommodation
HOCW	Guiding, signposting
HOCY	Gardens and grounds

The subdivisions of sections HOCM and HOCN correspond to kinds of department, although the basis of allocation to 'departments' and 'units' in each of these sections is somewhat arbitrary.

HOCM Design of special departments
- :PA administrative offices
- :PB admission units
- :PC waiting areas
- :PD operating suites
- :PE anaesthetic and recovery rooms
- :PF chapels
- :PG mortuaries
- :PH pharmacy
- :PI laboratories
- :PJ pathology
- :PK bacteriology
- :PL biochemistry
- :PM physics
- :PN haematology, blood banks
- :PO eye, bone, skin banks
- :PP diagnostic x-ray
- :PQ radiotherapy
- :PR photography and illustration
- :PS radioisotopes
- :PU rehabilitation
- :PV physiotherapy
- :PW occupational therapy
- :PY special therapy, eg burns

HOCN Design of special units in hospitals
- :QA outpatients clinics
- :QB accident and emergency
- :QC occupational health
- :QD day hospitals
- :QE chest
- :QF infectious diseases
- :QG children
- :QH geriatrics and long-stay
- :QI cancer
- :QJ neurology, neurosurgery
- :QK ear, nose and throat
- :QL cardiology
- :QM rheumatism
- :QN orthopaedics
- :QO urology
- :QP VD
- :QQ surgery
- :QR thoracic surgery
- :QS plastic surgery
- :QT maternity
- :QU gynaecology
- :QV dermatology
- :QW ophthalmology
- :QX dentistry
- :QY psychiatry, mental illness
- :QZ social and community medicine

C2 SfB CLASSIFICATION TABLES applicable to health facility planning and design

SfB subdivisions affecting health facility planning and design are underlined in table 0 & table 4 below:

Table 0 PHYSICAL ENVIRONMENT - types of buildings

02 National planning
03 Regional planning
05 Rural, urban planning
12 Road transport
20 Industrial facilities
30 Administrative facilities, offices
40 Health & welfare facilities
41 hospitals
42 other medical facilities
44 welfare homes
70 Educational facilities, schools, universities
80 Residential facilities, hostels, homes
90 Facilities for common activities
91 circulation, corridors, lifts
93 rest, work, staff rooms
94 sanitary, toilet spaces
95 cleaning, maintenance, workshops etc.

Table 4 ACTIVITIES - aids

(A) Activities, aids to management
eg (Ah) preparation of documentation
(Am) personnel, roles
(An) education
(Ao) research, development
(Ap) standardisation
(Aq) testing, evaluation
(A1) Organising offices & projects
(A3) Designing, planning
(A4) Cost planning
(A5) Production planning, progress control
(A8) Feedback, appraisal
(B) Construction plant, tools
(D) Construction operations

REQUIREMENTS - properties

(E) Composition of products
(F) Shape of products
(G) Appearance of products
(H) Context, environment
(J) Mechanical properties
(K) Fire, explosion properties
(M) Thermal properties
(P) Acoustic
(Q) Electrical, radiation properties
(U) Users, resources
(W) Operational, maintenance factors

C3 DIF AND PLOWDEN CLASSIFICATIONS

The Design Information File (DIF) was originally developed by McDowell and Kimstra in 1972 for use by the Commonwealth Department of Housing and Construction. The system was based partly on the work of Plowden (1966, 1968) a research librarian in Britain who had developed a faceted classification system as an improvement on SfB and CBC. Miss Plowden's system consisted of seven facets:

1.	Building types	0000 - 9999
2.	Building elements	000 - 999
3.	Products	
	shapes	00 - 99
	materials	AO - ZO
	formats	00 - 99
4.	Fixings, plant accessories	AAA - ZZZ
5.	Trades	01 - 21
6.	Pervasive factors	AO - ZO
7.	Office Management	A - Z

The Plowden system was mainly for use in project documentation and had originally been developed for use by Building Design Partnership, a firm of architects who had designed several large hospital projects.

McDowell and Kimstra's system followed a rather similar method of faceting to the Plowden scheme:

1. Address of the work
2. a) Construction works
   b) Functional spaces
3. Parts of construction
   Parts of construction, extended
   Joints between parts
4. Materials
   Materials, extended
5. Agents, equipment and operations
6. Pervasive factors

C4 HOSPITAL INFORMATION FILE (HIF) showing examples of subdivision and coding for buildings, department, spaces, organisational aspects and equipment

The HIF system is based largely on DIF but with some modifications to the rules for coding. The HIF facets are summarised below:

Table 1.	Address	
	environments	0000 - 0399
	locations in Australia	0000 - 1999
	outside Australia	2000 - 7999
2.	Structures and spaces	
	functions	A to Z
	spaces	00 to 99
3.	Building parts and joints between parts	00 to 99
4.	Materials incl. shape or form, and treatment	AOA to Z9Z
5.	Agents, operations, equipment, users and activities	AAO to ZZ9
	(agents are building operatives, users are building occupants, operations are performed by agents, activities are performed by users, equipment is used by agents & users)	
6.	Pervasive factors	AA to ZZ
	eg concepts in planning & design management & personnel manufacture requirements disciplines processes & effects properties finance	

The coding system is complex but provides for a high degree of specificity in analysing data from many points of view. Considerable time is involved in classifying and coding each item of information, but with the use of computers once an item reference is indexed its recall in a printout or VDU display is very quick.

HIF table 2 'Structures and Spaces' covers health and welfare buildings at NOO:

00	in general
01	other than
03	sites
04	child minding centres
05	clinics
06	blood banks
07	early childhood development centres
08	day hospitals
09	health centres
10	hospitals in general
11	up to 100 beds
12	200
13	400
14	500+
15	medical centres
16	mobile health units
17	nursing homes
20	refuges
21	rehabilitation centres
22	sheltered workshops
23	shopfront and drop-in centres
29	villages and homes
30	activity areas in general
32	accident and emergency
34	allied health
35	anaesthetic
36	bio-medical
37	cardiology
38	cardio-thoracic
39	coronary
41	day area
42	dental
43	dermatology
44	dietetic
46	ENT
49	geriatric
50	gynaecology
53	inpatient
54	intensive care
56	isolation

and so on in an alphabetical order of topic descriptions arbitrarily assigned to numerical codes.

A 'stack' code of one alpha symbol is also used as a means of identifying medical service units within the divisions 00 to 29 above.

Another table 2 division WOO covers 'Health and Welfare Areas' in a similar fashion, ie an alpha sequence of topic names spread out over a 2 digit series from 00 to 99:

00	activity groups in general
02	abreaction (areas)
03	acoustic
04	activities of daily living
05	admission
07	bier
08	blood donation
10	chiropody
	and so on

Health as a general topic is covered in HIF in table 6 'Pervasives':

GK	Health
Ø	Health in general
D	Disease
H	Health screening
M	Illness
N	iatrogenic
O	pathogenic
P	psychogenic
R	Injury

'Hospitalisation' occurs under Sociology at HRH.

Health care organisation is included in table 5 'Agents, Users, etc.' at WAO together with 'Treatment', 'Health care personnel' and 'Health care service'. The latter for example is subdivided:

06	Health care in general
B6	Basic care
C6	Counselling
F6	Family planning
G6	Group therapy
J6	Infant welfare
	and so on

Specialised equipment or supplies are also classified under table 5 at NAO

01	medical and surgical equipment,in general
A1	medical and surgical equipment,other than
C1	cryosurgical equipment
D1	diatherapy equipment
	and so on

C5 ABSTRACTS OF HEALTH SERVICE MANAGEMENT STUDIES CLASSIFICATION SCHEME (excerpt)

DA-DATA PROCESSING

Subject areas: systems analysis; programs and software; equipment, automated systems.

See also: MN, Management Science and Operations Research; excludes data processing for single department or single purpose data processing—see department involved.

DE-DESIGN AND CONSTRUCTION

Subject areas: design criteria and evaluation; examples of hospital design.

See also: AR, Areawide Planning; CO, Community Attitudes; excludes design and construction for single department—see department involved.

DI-DIETARY SERVICES

Subject areas: food processing and service; menu planning; purchasing and supplies.

See also: HU, Housekeeping; and PU, Purchasing, Storeroom, and Central Supply.

ED-EMERGENCY SERVICES AND TRANSPORTATION

Subject areas: emergency rooms, mobile units, ground and air transport.

EN-ENGINEERING AND MAINTENANCE

Subject areas: equipment maintenance; equipment and facilities; excludes limited use equipment—see individual departments.

FM-FINANCIAL MANAGEMENT AND ACCOUNTING

Subject areas: payment to health care institutions; planning, budgeting and control; working capital management (including business office); investment decisions; sources of financing; accounting standards relating to health services; auditing; financial information systems.

See also: DA, Data Processing; PE, Personnel Administration; and PU, Purchasing, Storeroom, and Central Supply.

HC-HEALTH CARE COSTS

See also: AR, Areawide Planning; IN, Insurance and Prepayment; MD, Medical Staff and Medical Care; MP, Manpower; and RE, Regionalization, Shared Services, and Satellites.

HE-HEALTH SERVICES: GENERAL

See also: MD, Medical Staff and Medical Care; MP, Manpower; and RE, Regionalization, Shared Services, and Satellites.

HF-HEALTH CARE FACILITIES AND SERVICES

Subject areas: utilization, need and supply.

See also: AR, Areawide Planning; MD, Medical Staff, and Medical Care; MP, Manpower; and RE, Regionalization, Shared Services, and Satellites.

HU-HOUSEKEEPING

Subject areas: cleaning; waste disposal.

See also: DI, Dietary; EN, Engineering and Physical Plant; IC, Infection Control; LD, Laundry; and MD, Medical Staff and Medical Care.

IC-INFECTION CONTROL

Subject areas: hospital sanitation; environmental sanitation.

See also: HU, Housekeeping; MD, Medical Staff and Medical Care; NU, Nursing Service; OR, Operating Room and Recovery Room; and PU, Purchasing, Storeroom, and Central Supply.

C6 SUBJECT FILING CODE (SFC)

SUBJECTS or pervasive topics used for primary classification

A Administration
B Building, construction (can use SfB for subdivision)
C Culture, art
D Design
E Engineering
F Finance, economics
G Geography, geology (also by LOCATION)
H History (also by DATE or PERIOD)
I Information (also by FORMAT)
J Justice, law
K Knowledge, science
L Life, health
M Medicine
N Nursing (see example of subdivision below)
O Organisation
P Planning
Q Equipment (also by FUNCTION)
R Research
S Society
T Teaching
U Use, function, activity
V Environment, safety
W Wares, waste (also by MATERIAL)
X Production, manufacture
Y Supply, storage
Z Special subject eg HEALTH FACILITIES

Information may also be classified by LEVEL & PHASE using SFC as follows:-

LEVELS of decision or application

1. International, world
2. National, country
3. Regional, city
4. Local, community
5. Project, building
6. Firm, department
7. Family, home
8. Group, room
9. Person, workspace
10. Limb, equipment
11. Organ, component
12. Cell, material

PHASES of planning, design and building

- I CONTEXT
- II REQUIREMENTS
- III OUTLINE PROPOSALS
- IV DETAIL PROPOSALS
- V DOCUMENTATION
- VI TENDER/CONTRACT
- VII CONSTRUCTION
- VIII COMMISSIONING
- IX OPERATION
- X ASSESSMENT

The Special Subject coded Z is allocated to the user's own subject specialty. In the case of the writer this is 'health facility planning and design'. It can either be used in conjunction with other filing codes A to Y, 1 to 12 or I to X, or can be subdivided using lower case letters a to z followed by small numbers 0 to 9 for fine subdivision. The main subject 'Health Facility Planning and Design' is split into 25 services/departments as follows, z being reserved for specific projects:

Za	administration
b	staff amenities
c	casualty
d	day hospitals
e	rehabilitation
f	catering
g	general practice, including health centres
h	clinical investigation
i	information, library
j	children, crêche
k	pharmacy
l	linen
m	medical records
n	nursing
o	outpatients
p	pathology
q	housekeeping
r	radio-therapy
s	surgery
t	teaching
u	enquiries, shops
v	social work, religion
w	works, maintenance
x	x-ray (diagnostic radiology)
y	central supply and disposal
z	PROJECTS by location and/or name

A document on say 'Evaluation of nursing units' would therefore be coded:

X	for assessment/evaluation - phase of planning
6	for department - level of application
Z	for health facility planning
n	for nursing service

and written 'Zn 6X' in the facet sequence SUBJECT : topic : LEVEL : PHASE.

A document on 'Evaluation of Geriatric Nursing Care' would however be coded 'Ng X' (Nursing care : geriatric : evaluation). Subdivisions of 'N nursing care' are coded as follows:

Na	first aid
b	bed allocation
c	movement of patients
d	dental nursing
e	medical nursing
f	care of disabled, handicapped
g	geriatric care
h	physical rehabilitation
i	isolation
k	child care
l	domiciliary care
m	mental nursing
n	counselling
o	midwifery
p	progressive patient care
q	dependency grouping
r	intensive care, resuscitation
s	surgical nursing
t	care of blind, deaf, mute
u	special nursing (see Medical specialties)
v	retraining, resettlement
w	after care
x	relief from hunger, poverty
y	outpatient care
z	welfare

Using the SFC system for titling folders in a section of the writer's filing system dealing with RESEARCH, for example, produced filing codes as follows:

RESEARCH generally	R
Building research	RB
Design methods research	RD
Hospital design research	RDZ
Articles on hospital design research	RDZ/Ic
Outpatient department design research	RDZo/6
Architectural research	RDa
Architectural research indexes	RDa/Ii
Human sciences research index	RKs/Ii
Hospital and health service research	RZ
Simulation methods	Ri
Research methods	Rj
Operational research - generally	Ro
Operational research in hospital design	RoDZ
Operational research in nursing services	RoN
Survey methods, questionnaires	Rs
Work study	Rw

C7 SUBJECT FACET DESCRIPTORS (SFD)

Information content can firstly be described in terms of subjects and topics such as the following:-

actions - lifting, pulling
activities - examining, filing
aspects - construction, perception
building types - hospitals, offices
clinical services - surgery, pathology
components - bricks, tiles
criteria - safety, tidiness, cost
departments - administration, nursing
design - layout, space, colour
elements - roof, walls, doors
engineering - gas, electrical, heating
equipment, furniture - baths, chairs, desks
environment - sound, light
material, substance - steel, paper
means, methods - natural, artificial
operations, tasks - checking, cleaning
phase, period - briefing, evaluating
problems - decay, disease
rooms, spaces - office, reception
shape, forms - square, flat
stage of approval - feasibility, completion
supplies - fuel, food
support - supply, clerical

The application and purpose of information can be specified in the following terms:-

audience to whom information applies
field of application, eg. health, politics
focus, eg. general or specific
interest, ie profession, occupation (see p C 7.3)
level of decision, eg. national, local
location of project to which information applies
scale of application, eg. regional, room

value of information eg. important, urgent
viewpoint of information eg. user, designer

Information can be identified in terms of the following concepts:-

Article title
Author(s)
Client
Date of publication, production
Designer
Editor
Format eg. book, film
Language, notation
Nationality, race
Place of origin
Product name, type
Project name
Publication name, title
Publisher, printer
Series title
Source of information
Sponsoring organisation
Translater, transcriber

Lists of descriptive terms can be compiled for each facet. The following is a typical list for the application facet 'INTEREST'.

administrator
architect
building contractor
catering officer
demographer
designer
domestic
economist
educator
electrical engineer
engineer (general)
equipment officer
information officer (librarian)
landscape architect
lawyer
legislator
manager
manufacturer
mechanical engineer
medical specialist
medical record officer
nurse
organisation and methods
planning officer
politician
psychologist
public
public servant
research officer
safety officer
scientist
social worker
sociologist
statistician
structural engineer
supplies officer
therapist
urban planner
voluntary worker

C8 SUBJECT HEADINGS USED FOR INDEXING PHOTOGRAPHIC SLIDES

1. HOSPITALS (external and general views)
   - in Europe (excluding UK)
   - in UK (excluding London)
   - in London A/Z by name
     - eg Guy's
       - St. Thomas'
       - St. Thomas' wards
   - Llewelyn Davies, Weeks (architects)
   - Powell and Moya (architects)
   - Hospital Design Partnership (architects)
   - DHSS - by name, eg Best Buy, Nucleus
   - in North America - by name
   - in Australia
     - arranged geographically by states
     - then by hospital name
     - then by departments for specific projects
2. INFORMATION
   - libraries and documents
   - classification schemes
3. PLANNING and design (generally)
   - process
   - regional
   - landscape
   - briefing
   - evaluation
   - cost planning
   - architectural design
   - architectural history
   - layout
   - location
4. ENVIRONMENT (and ergonomics)
   - lighting
     - light and shade
     - daylight
     - glare
     - artificial light
     - display lighting
     - ward lighting
   - colour
   - safety
   - signs
     - lettering
     - symbols
     - external signs
     - corridors, lifts
     - enquiry
     - maps
     - notices
     - Prince of Wales hospital
     - Royal North Shore hospital
   - sound

5. BUILDING and construction
- materials
- doors
- engineering
- fittings
- stairs
- windows

6. EQUIPMENT and furniture
- hospital equipment
  - bedside lockers
  - beds
- aids
  - handicapped
  - furniture
  - play/toys
  - seating
  - posture
  - wheelchairs

7. BUILDING TYPES (excluding health facilities)
- administration
- commercial
- cultural
- education
  - schools
  - universities
    - NSW
    - UK
    - USA
  - student housing
- housing
  - schemes
    - Australia
    - UK
    - Europe
    - North America
  - private houses
- industrial

the above may be subdivided by
- construction
- exterior
- car parks
- courtyards
- engineering
- entrances etc

8. HEALTH FACILITIES

- health centres
  - Australia
  - UK
  - USA
- hospital departments (excluding wards)
  - administration
  - casualty
  - catering
  - car parking
  - children
  - geriatrics
  - laboratories
    - pathology
      - UK
      - USA
    - benching
  - laundries
  - outpatients
  - operating (surgery)
  - pharmacy
  - rehabilitation
  - staff accommodation
  - stores
  - supply
  - works

9. WARD PLANNING

- early wards
- ward layouts
  - UK
  - Europe
  - Australia
  - New Zealand
  - USA
- ancillary rooms
- bed rooms
- day rooms
- nurses stations
- toilets

C9 SELECT LIST OF FACETS AND KEYWORDS FOR INDEXING HEALTH FACILITY PLANNING DOCUMENTS

The following ten facets were used to generate the keywords:-

1. ACTIVITY performed: in room/by person
2. ASPECT of design: construction, environment
3. COMPONENT: composition, form, part of building
4. FORMAT: of document, information, object
5. FUNCTION: of department, building, service
6. INTEREST: of people, involved, affected
7. LEVEL: of application, decision
8. PLACE: location of application or origin of information
9. QUALIFYING term: focus, size, type
10. TIME: phase, period, stage

The twenty two keywords listed under 'activity' were:-

cleaning	repairing
dressing, undressing	resting
driving	retrieving
eating	sitting
filing	sleeping
lifting	standing
making	talking
observing	toiletting
operating	travelling
parking	walking
playing	working
reading	writing

A total of about 300 keywords was found to be sufficient for most general indexing purposes.

C10 LOGICAL & HIERARCHICAL LIST OF NOTES on health facility planning and design

0 INTRODUCTION
- 1 arrangement of notes
- 2 guide to study
- 3 assignments
- 4 definitions of terms used

1. INFORMATION
- 1 guide to information sources
- 2 list of organisations
- 3 list of publications
  - guides, indexes
  - monographs
  - articles
  - folders for loan
- 4 filing and retrieval
- 5 readings

2. PLANNING
- 1 methods and approaches
- 2 logic, problem solving
- 3 processes and procedures
- 4 organisation and roles
- 5 needs and conditions

3. DEVELOPMENT
- 1 historical
- 2 future
- 3 regional, local
- 4 health and social services
- 5 relief and welfare

4. DESIGN
- 1 aesthetics, creativity
- 2 briefing, analysis, synthesis
- 3 documentation and communication
- 4 evaluation of options
- 5 evaluation of effects

5. LOGISTICS
- 1 location and siting
- 2 layout and shape, growth and change
- 3 space allocation
- 4 traffic
- 5 supply and disposal
- 6 energy

6. ENVIRONMENT
- 1 ergonomics
- 2 vision, light, colour
- 3 sound and acoustics
- 4 fire protection
- 5 hygiene and infection control
- 6 comfort and climate
- 7 safety and security

7. CONSTRUCTION
   1 building and engineering systems
   2 equipping
   3 cost control, project management
   4 contract administration, supervision
   5 commissioning
   6 maintenance

8. FACILITIES in general - by level
   1 buildings
   2 departments
   3 rooms, spaces
   4 equipment
   5 supplies

9. FACILITIES for particular functions
   1 nursing - by types eg general
      children
      geriatric
      maternity
   2 diagnosis and treatment
      eg surgery
      pathology
      radiology
   3 consultation and emergency
      eg outpatient clinics
      accident services
      health centres
   4 research and education
      laboratories
      teaching
   5 administration
      eg offices
      medical records
      information
   6 staff amenities
      eg dining
      residence
      changing
   7 supply services
      eg catering
      linen
      pharmacy
   8 works services
      eg energy
      maintenance
      transport

C11 ALPHABETICAL LISTS OF GENERAL AND SPECIFIC TOPICS IN HEALTH FACILITY PLANNING AND DESIGN

GENERAL TOPICS - facility planning and design

- Briefing and user requirements
- Building construction and materials
- Comfort and climate
- Commissioning and operational policies
- Contract administration
- Cost planning and control
- Design, aesthetics
- Disaster relief planning
- Documentation, communication
- Engineering services and installations
- Equipment selection
- Energy conservation
- Ergonomics
- Evaluation
- Fire protection and prevention
- Hygiene, cleaning
- Information for planning
- Landscape design
- Layout and shape
- Lighting, vision and colour
- Location and siting
- Maintenance
- Noise control, acoustics
- Planning processes and procedures
- Project management
- Regional planning
- Safety and security
- Space allocation and utilisation
- Supply and disposal systems
- Traffic
- Ventilation and air conditioning

SPECIFIC TOPICS - types of facilities

- Administration
- Catering
- Education
- Health centres
- Hospitals - Community
  - General
  - Teaching
- Laboratories (pathology)
- Linen supply
- Nursing - aged
  - children
  - general
  - intensive care
  - maternity
- Pharmacy
- Radio-diagnosis and treatment
- Rehabilitation
- Residential
- Staff
- Sterile supply
- Surgery
- Works

APPENDIX D

DOCUMENT RETRIEVAL SERVICES - Abstracts, Bibliographies, Indexes etc.

D1 Hospital Abstracts, DHSS Library, London
List of contents and sample entry

D2 Hospital Literature Index, AHA Library, Chicago
Instructions and sample entries

D3 Health Buildings Library Bulletin, DHSS, London
Sample entries

D4 Health Buildings Library Bibliography on Design & Evaluation of Hospitals, headings & sample page, DHSS, London

D5 Architectural Periodicals Index, RIBA, London
Section of alphabetical subject headings and sample entries

D6 Bibliography on Lighting, Design in Health Service Buildings (Heath & Green 1974). Sample entry

D7 Bibliography on Planning and Design of Outpatient Departments (Green & Heath 1976). Sample entry

D1 HOSPITAL ABSTRACTS, DHSS LIBRARY, London
List of contents and sample entry

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Planning, design and construction	351
Determining size of hospital and bed needs	351
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Design of individual general hospitals	351
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Communication systems	352
Transport in general	352
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Ventilation and air-conditioning	354
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Governing bodies, committees	367
Economics of hospital management	367
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Finance	372
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Catering, dietetics, kitchens	374
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Hygiene in the hospital	375
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Prevention and control	376
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Home care, after-care	380
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Psychiatry	398
Author index	v
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DESIGN OF SPECIAL DEPARTMENTS

See also Abstract No. 897

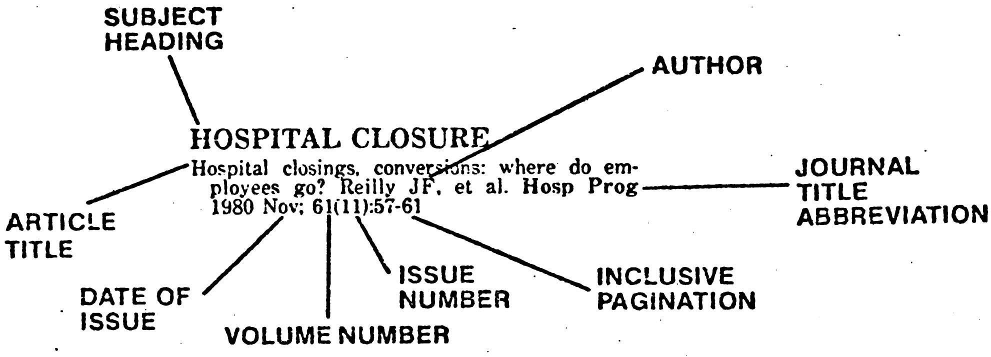
807. MOSEL, H. A. von der. Common mistakes in planning intensive care units. *Hospital Engineering*, London, 1977, June, vol. 31, no. 5, pp. 11, 14-16.

This paper discusses the 10 most common mistakes in the design of intensive care units (ICUs): (i) creation of an ICU for a specialty which is not otherwise represented in the hospital; (ii) incorrect number of intensive care beds; (iii) wrong location; (iv) wrong size; (v) insufficient floor space; (vi) wrong physical layout of the patient area; (vii) wrong physical arrangement of the area around the bed and of the bed itself; (viii) insufficient electrical outlets; (ix) use of fluorescent lights; and (x) over-instrumentation.

D2 HOSPITAL LITERATURE INDEX, AHA library, Chicago
Instructions and sample entries

SUBJECT SECTION

Many articles in *Hospital Literature Index* appear under more than one subject heading. Under each subject heading, the articles are arranged alphabetically by journal title abbreviation. Bibliographic information is given in the following order: title, first author (if more than one), journal title abbreviation, date of issue, volume number, issue or part number, inclusive pagination. For example:



HOSPITAL DESIGN AND CONSTRUCTION

This old laundry: the rebirth of a laundry [interview] Humes J. Am Laund Dig 1981 May 15; 46(5):24-5, 28-30, 32-3
The art and the science of OR management. Hinshaw JR. Bull Am Coll Surg 1981 May;66(5):6-9
Planning hospital nursing units for patient care. Chin YH. Bull NY Acad Med 1981 Mar;57(2):144-8
Supplies systems: taking the top off storage. Grayson H. Health Soc Serv J 1980 Dec 12; 90(4723):1590-1
Food trolley bay and records storage. Lough AW. Hosp Eng 1981 Apr;35(3):15
Peterborough thinks electric. Hosp Health Serv Rev 1981 May;77(5):144-5
Devolution in action: the development of Monklands District General Hospital. Nunn C. Hosp Health Serv Rev 1981 May;77(5):137-40
Using value analysis to increase savings. Horan JJ Jr. Hosp Purch Manage 1981 Apr;6(4):3-7
Major addition plus courtyard provided on constricted site. Hospitals 1981 May 16; 55(10):40, 44-5
ICU features open plan and step-down units. Carroll JJ. Hospitals 1981 Jun 16;55(12):39-40
Hospital warehouse management can ensure better use and service. Kowalski JC. Hospitals 1981 Jun 16;55(12):109-12
The story of 'Dear John' and Washington's Sibley Hospital. Lebensohn ZM. Hospitals 1981 May 1; 55(9):86
Update in Neuilly: an addition to the American Hospital in Paris maintains a celebrated international reputation. Planck R. Inter Des 1981 Apr;52(4):264-5
Primary care nursing: the 'how-to' of transition. Perlick N. J Neurosurg Nurs 1981 Feb; 13(1):7-11
Architect emphasized teaching with university hospital's modular design [news] Franz JL. Mod Health Care 1981 Apr;11(4):70-1
Circular patient flow highlights facility expansion program [interview] Breen PC. Same Day Surg 1981 Apr;5(4):49-51
How to set up an efficient outpatient recovery room [interview] Edwards B. Same Day Surg 1981 May: 5(5):60-2

STANDARDS

Health care technology standards: medical gas systems. LaVecchia LM. Dimens Health Serv 1981 Feb;58(2):28-9

HOSPITAL DRUG DISTRIBUTION SYSTEMS see MEDICATION SYSTEMS, HOSPITAL

HOSPITAL ECONOMICS see ECONOMICS, HOSPITAL

HOSPITAL EMERGENCY SERVICE see EMERGENCY SERVICE, HOSPITAL

HOSPITAL ENGINEERING see MAINTENANCE AND ENGINEERING, HOSPITAL

HOSPITAL EQUIPMENT AND SUPPLIES see EQUIPMENT AND SUPPLIES, HOSPITAL

HOSPITAL FOOD SERVICE see FOOD SERVICE, HOSPITAL

HOSPITAL GROUNDSKEEPING see MAINTENANCE AND ENGINEERING, HOSPITAL

HOSPITAL HOUSEKEEPING see HOUSEKEEPING, HOSPITAL

HOSPITAL INFECTIONS see CROSS INFECTION

HOSPITAL LAUNDRY SERVICE see LAUNDRY SERVICE, HOSPITAL

HOSPITAL MAINTENANCE see MAINTENANCE AND ENGINEERING, HOSPITAL

HOSPITAL MATERIALS MANAGEMENT see MATERIALS MANAGEMENT, HOSPITAL

HOSPITAL MEDICAL RECORDS DEPARTMENT see MEDICAL RECORDS DEPARTMENT, HOSPITAL

HOSPITAL MEDICAL STAFF see MEDICAL STAFF, HOSPITAL

HEALTH BUILDINGS LIBRARY BULLETIN, DHSS, London
Sample entries

HOSPITALS

ET4/64 McFARLANE, Jean, RICHARDS, Kay and WELLS, C.J. Hospitals in the NHS. London, King's Fund Centre, 1980, 67pp. (Project Paper No. RC15)
Based on working papers of the Royal Commission on the NHS.

ET4/65 WARD, G.H. and WEST, P.A. What price the London Hospital Plan. British Medical Journal, 1981, March 14, vol.282, no.6267, pp.922-923.

Hospitals - energy conservation

ET4/66 MITCHELL, F. Hospital energy management. Health and Social Service Journal, 1981, March 20, vol.91, no.4735, p.325.
Notes from the USA.

ET4/67 SKEGG, V.E. Energy management: developments and trends: Part 2. Hospital Development, 1981, March/Apr., vol.9, no.2, p.39.
In hospitals.

Hospitals - equipment, fittings and furniture

ET4/68 HILL, D.W. and WATSON, B.W. editors. IEE medical electronics monographs 13-17. Stevenage, Peter Peregrinus, on behalf of the Institution of Electrical Engineers, 1975, 182pp.

ET4/69 INDUSTRIAL GASES COMMITTEE. Code of practice for supply plant and pipelines distributing gases and vacuum services to medical laboratories. Paris, IGC, 1980, [iv],22pp. (IGC Document 12/80/E)

ET4/70 INDUSTRIAL GASES COMMITTEE. Code of practice for supply equipment and pipelines distributing non-flammable gases and vacuum services for medical purposes. Paris, IGC, 1976, [iv], 41pp. (IGC Document 5/75/E)

ET4/71 STIEFEL, R.H. and WELKER, P. A computerized system for equipment control and preventive maintenance. Medical Instrumentation, 1981, Jan./Feb., vol.15, no.1, pp.24-26.
Of approximately 6000 items of patient-care and laboratory equipment at Strong Memorial Hospital, University of Rochester Medical Center, USA.

Hospitals - hygiene

ET4/72 Humidifier fever. Building Services, 1981, March, vol.3, no.3, pp.35-36.
CIBS briefing.

ET4/73 Leigonnaires' disease. Building Services, 1981, March, vol.3, no.3, p.35.
CIBS briefing.

D4 HEALTH BUILDINGS LIBRARY, BIBLIOGRAPHY ON DESIGN AND EVALUATION OF HOSPITALS, headings and sample entries. DHSS, London

SELECTED REFERENCES ON THE DESIGN AND EVALUATION OF HOSPITALS, PARTICULARLY WARDS - SEPTEMBER 1981

Compiled by I Cameron MA ALA

General - hospitals ... Nos HB61/1 - HB61/94

General - wards ... Nos HB61/95 - HB61/186

Single v. multi-bed rooms ... Nos HB61/187 - HB61/200

Design and its effect on organisation and management of nursing care .. Nos HB61/201 - HB61/238

General - hospitals

HB61/1 ALLEN, R.W. and KAROLYI, I.von Hospital planning handbook. New York & London, Wiley 1976. 242pp.

HB61/2 AMERICAN ASSOCIATION OF HOSPITAL CONSULTANTS. Functional planning of general hospitals, edited by Alden B. Mills. New York and Maidenhead, McGraw-Hill, 1969. x, 353pp.
One of the 4 parts is on patient care facilities.

HB61/3 AMERICAN HOSPITAL ASSOCIATION. Hospital design check list. Chicago, AHA, 1965. iii, 48pp.
Set out, by department, the architectural features found in a hospital. It is intended for use in the evaluation of a design.

HB61/4 ARCHITECTS' JOURNAL and MINISTRY OF HEALTH. Hospital planning and design guide. London, AJ 1967. [189]pp.
Includes ward planning. Illustrated by numerous plans etc. and has a bibliography.

HB61/5 Basingstoke DH main development. Building, 1976, Nov.26, vol.231, no 6962, pp. 87-94.
Building dossier on Basingstoke Distrct Hospital includes plans, photos and a cost analysis.

D5 ARCHITECTURAL PERIODICALS INDEX, RIBA London
Section of alphabetical subject headings and sample entries

High buildings: law
High buildings: management
Historic buildings
Historic buildings: demolition
Historic buildings: finance
Historic buildings: law
Historic buildings: preservation, restoration
Historic buildings: societies, organisations
History
Holiday homes
Holiday resorts
Hong Kong architecture
Hospitals
Hospitals: alterations & additions
Hospitals: children
Hospitals: children's
Hospitals: convalescent
Hospitals: convalescent: competitions
Hospitals: dental departments or units
Hospitals: intensive therapy units
Hospitals: interior design
Hospitals: mental
Hospitals: military
Hospitals: out-patients' departments
Hospitals: wards: planning
Hostels
Hostels: for disabled
Hostels: mountain, ski
Hostels: nurses'
Hostels: students': competitions
Hostels: women
Hostels: youth

Hospitals: dental departments or units: US: Miami Beach (Fla): Mount Sinai Medical Center

H0103 Unusual clinic and coffee shop take odd space: dental clinic at the outpatient pavilion of Mount Sinai Medical Center; archts Smith Korach Hayet Haynie Ptnrship.
Article, plans, photos.
Hospitals, vol 54, no 10, 1980 May 16, pp36–42

Hospitals: GB: Leeds: Saint James Hospital: Clinical Sciences Bldg

H0104 Fit for a hospital: Clinical Sciences Building for the University of Leeds; archts Bldg Design Ptnrship.
Article, photos.
Bldg Design, no 100, 1980 Jun 13, pp22–23

Hospitals: GB: London: Lambeth: Royal Waterloo Hospital for Children & Women

H0105 Waterloo's Longford Castle: the Waterloo Hospital, Lambeth, London; archts Waring & Nicholson, 1903–05.
Article by Marcus Binney; photos.
Country Life, vol 167, no 4323, 1980 Jun 26, pp1503

Hospitals: Hungary: Budapest

H0106 Hospital of the Council of the County of Pest; archts Laszlo Fodor, and others.
Article in Hungarian by Janos Scultety; plans, secns, photos.
580 beds.
English summary, pix-x
Magyar Epitomuveszet, no 1, 1980, pp13–17

Hospitals: intensive therapy units

H0107 Intensive care units.
Article in German by Wolfgang Rohm; plans, diagrs, photos, refs.
English summary, p1061
Deutsche Bauzeitschrift, vol 28, no 7, 1980 Jul, pp1061–1068

Hospitals: Netherlands: The Hague: Westeinde Ziekenhuis

H0113 Be sick, get better The threatened Rudolf Steiner Clinic and the new Westeinde Hospital compared; archts (Steiner Kliniek) Jan Buys, (Westeinde Ziekenhuis) Wiegerinck [Buro].
Article in Dutch, plans, photos.
Steiner Kliniek has 120 beds; Ziekenhuis, 593 beds.
Architect (The Hague), vol 10, no 5, 1979 May, pp107–112

Hospitals: Netherlands: The Hague: Rudolf Steiner Kliniek

H0114 Be sick, get better The threatened Rudolf Steiner Clinic and the new Westeinde Hospital compared; archts (Steiner Kliniek) Jan Buys, (Westeinde Ziekenhuis) Wiegerinck [Buro].
Article in Dutch, plans, photos.
Steiner Kliniek has 120 beds; Ziekenhuis, 593 beds.
Architect (The Hague), vol 10, no 5, 1979 May, pp107–112

Hospitals: Norway: Forde: Sentralsykehuset for Sogn– og Fjordane

H0115 Central Hospital for Sogn and Fjordane municipalities in Forde, Norway; archts Atelier 4 A/S, project archt Arne Pettersen, landscape archt Arne O Moen.
Article in Norwegian by Arne O Moen; plans, models, photos.
English summary, p72
Landskap, no 3, 1980, pp60–61

Hospitals: out-patients' departments: US: Essex (Conn): Shoreline Clinic

H0116 Building types study: 544. The well-being of design in the health-care world. Shoreline Clinic, Southwinds, Essex, Connecticut; archts Payette Assocs Inc.
Article, plans, photos.
Archtl Record, vol 167, no 5, 1980 May, pp110–111

BIBLIOGRAPHY OF LIGHTING DESIGN IN HEALTH SERVICE BUILDINGS
(Health & Green 1974). Sample entry

ILLUMINATING ENGINEERING SOCIETY (NORTH AMERICA): 5 Lt
SUB COMMITTEE ON HOSPITAL LIGHTING

B 1

Lighting for Hospitals

New York
Illuminating Engineering Society (North America)
1966
Pamphlet 32 pp
Adm. Arch. Des. Elec. Engr. Illum. Med. Nur. Plan. U.S.A.
JG

1 Interior
2 Imperial
3 Artificial Light
Elec. Light-Emerg.
-Normal
4 Lt Ftgs-Adjust.
-Fixed
-Portable
-Ceiling
-Low level
-Wall
P.S.A.L.I.
5 Color Rendering
Flicker
Glare

6.1 Commercial
Educational
General
Health Care
6.2 Corridors
Dental Clinic
Dining
Kitchen
Laboratory
Nursing Unit
Nurses' Station
Offices
Outpatients
Reception
Surgical
Teaching
X-Ray

6.4 Day
Night
6.5 Examination
Observation
Surgery
Treatment
7 Cleaning
Maintenance
Safety
8 North America
9 Colour in design
Patient comfort
Staff Comfort
Staff efficiency
Vision

BIBLIOGRAPHY ON PLANNING AND DESIGN OF OUTPATIENTS' DEPARTMENTS (Green & Heath 1976). Sample entry

SCOTTISH HOME & HEALTH DEPARTMENT

Hospital Planning Note No. 6: Organisation & Design of Outpatient Departments

Edinburgh, H.M.S.O., 1967

Book, 85 pp

Summary

This study was undertaken because of dissatisfaction with current conditions and accommodation in outpatient departments. Complaint was widespread of crowded waiting areas, lack of privacy, tiresome movement from one facility to another, patients kept waiting for unreasonably long periods and treated impersonally. Information was needed on the amount of accommodation required to meet expected loads of work.

The study team consisted of a doctor, nurse, architect and administrator, with an engineer and surveyor available as consultants. In the Note, the team recommends designs of a consulting/examination room arrived at after a study of full-scale mock-ups. Descriptions and illustrations are given of the recommended design for a consulting suite providing from 4 to 8 standard rooms for a clinic. A layout of an outpatient department is shown, designed after analysis of the frequency of use of various facilities. A diagram demonstrates the relationship of the outpatient department to the main hospital entrance, the sharing by the outpatient and accident departments of the short-stay ward and outpatient and other treatment facilities, and relationships with other departments of the hospital.

The Planning Note is in 3 sections. The first states the requirements thought to be important, and lists shortcomings observed in the clinics which were surveyed. The second section deals with methods and rates of working in the department, leading to recommendations for improved organisation and the necessary scale of accommodation. The third deals with the design and layout of the accommodation, and requirements for engineering services. Detailed information is grouped in the Appendices.

The following plans are given in the text:-

(1) The standard combined consulting/examination room.
(2) The consulting suite.
(3) Outpatient theatre and endoscopy rooms.
(4) Short-stay ward.
(5) An outpatient department.
(6) Clinics at Gartnavel District General Hospital
(7) Proposed outpatient, accident, X-ray etc. departments at Falkirk Royal Infirmary.
(8) Relationships between departments.

APPENDIX E

EVALUATION QUESTIONNAIRES, CHECK LISTS AND RESULTS

E1 Draft check list of data relevant to user satisfaction, Building Research Station, Watford, 1962

E2 Evaluation check list for Vale of Leven Hospital Design in Use Study, Scottish Home & Health Department, Edinburgh, 1963

E3 Hospital evaluation check list, South Western Regional Hospital Board, Bristol, 1967

E4 Evaluation topics suggested for Greenwich Hospital, London, by Dept. of Health & Social Security, Hospital Design Unit Staff, 1969

E5 Comparison of features used in four evaluation studies of Hospital Wards, Departments and Rooms, 1971 to 1978

E6 Hospital design in use survey questionnaire (for three hospital surveys by Green 1978/79)

E7 Description of ward (proforma used by Green in NSW teaching and country hospital ward design surveys, 1979/80)

E8 Questionnaires used in teaching hospital ward design survey

1. Staff questionnaire (part 1)
2. Patient questionnaire (part 1)
3. Staff & patient questions on importance and adequacy of 25 specified design features

E9 Questionnaires used in country hospital ward design survey

1. Staff questionnaire
2. Patient questionnaire

E10 Teaching hospital ward evaluation.
Respondents ratings for importance and adequacy compared

1. Patients' and staff ratings for importance
2. Patients' ratings for importance and adequacy
3. Staff ratings for importance and adequacy

E11 Country hospital ward evaluation.
Staff ratings for adequacy in new and old wards

E12 Survey of medical, nursing and administrative policies affecting ward design

1. Proforma for respondent particulars
2. Interview check lists
3. Options on operational and design policy (questionnaire)

E13 Survey on furniture aids for disabled children (excerpts from survey questionnaire)

E14 Evaluation of selected furniture aids
Examples of proformas used in tests

E1 DRAFT CHECKLIST OF DATA RELEVANT TO USER SATISFACTION, Building Research Station, Watford, 1962

A) General particulars on the building

1. Identifying details
   dates, owner, location etc.
2. Purpose of building
3. Departments included
   define purpose of each
4. List of rooms included
   define purpose of each
5. Details of any changes since completion of building
6. Details of building occupants
7. Details of other building users
8. Floor areas allocated to each user group
9. Local climatic conditions
10. Constructional details
11. Outstanding features of design
12. Special engineering or equipment features likely to affect users

B) Experience and views of building occupants

13. In relation to location, orientation, appearance
14. Space allocation, siting, layout
15. Heating - day/night, winter/summer
16. Ventilation - control, rate of air change etc.
17. Hot water supply - temperature, control etc.
18. Daylighting and sun control
19. Artificial lighting
20. Sound transmission and acoustics
21. Electrical supply
22. Sanitary facilities
23. Lifts
24. Refuse disposal
25. Catering facilities and equipment
26. Laundry facilities
27. Special purpose accommodation

28. Walls and partitions
29. Ceilings
30. Floors
31. Stairs
32. Doors
33. Windows
34. Communication systems, safety services
35. Entrances
36. External works and equipment
37. Cleaning
38. Costs

The above list exemplifies the problem of duality in building appraisals, ie to describe precisely the building environment which is being evaluated, and to relate this description to users' perceptions of the environment. The emphasis in that section of the above list concerned with users' views was almost exclusively related to building and design elements rather than to the concepts users use to describe their environment. These concepts were however included in some of the detailed headings. Under 'daylighting and sunlighting', for example, were listed:

general effectiveness in relation to task or other requirement
intensity of lighting) at different seasons and
glare) different times of day
overheating)
method of control (blinds, curtains, canopies, special glass etc.)

Under 'windows' the sub-headings were mainly concerned with hardware:

general acceptability of type (materials, methods of opening, security, safety, appearance)
positions
dimensions (overall size, height of head/cill, pane size)
window fittings
blinds and curtains - fixing methods

E2 EVALUATION CHECK LIST, Vale of Leven Hospital, Design in Use Study
Scottish Home & Health Department, Edinburgh, 1963

1. function - intended/as operated
2. departments served/included
3. accommodation - list rooms
4. workload - occupancy, maximum and minimum loads
5. equipment - related to uses
6. staffing - types, numbers, hours
7. communications - links to other departments
8. control - who directs operations
9. monitoring - means of control/feedback
10. procedures within department - movement, sequence of activities
11. other departments serving this department - list
12. source of supply services
13. frequency of service
14. method of ordering supplies
15. means of delivery
16. usage of service
17. other points

This checklist, by comparison with some of the general ones referred to in the previous section, had a strong bias towards work study, traffic and supplies, with barely anything relating to building, environment or user satisfaction.

E3 HOSPITAL EVALUATION CHECK LIST, South Western Regional Hospital Board, Bristol, 1967

An example of a systematically arranged evaluation checklist by the South Western Regional Hospital Board (quoted in Baynes et al 1969). The evaluation check list was split into four sections corresponding to levels:

1. hospital site
2. main hospital buildings
3. hospital departments
4. rooms and spaces

Each section followed a similar sequence of headings. For departments the headings were:

1. location
2. entrances and exits
3. area
4. layout
5. environment and engineering services
6. fire fighting and protection

Section 4 above, for example, was then further sub-divided:

- 4.1 arrangement of rooms
- 4.2 traffic flow
  - patients - walking
    - stretcher
  - staff
  - visitors
  - supplies
  - disposal
- 4.3 flexibility and growth
- 4.4 simplicity of plan form
- 4.5 compactness
- 4.6 character

The list was intended to be used for evaluation based on observation; no mention was made of users' opinions or attitudes.

E4 EVALUATION TOPICS SUGGESTED FOR GREENWICH HOSPITAL, London, by DHSS Hospital Design Unit Staff, 1969

After completion of the first phase of construction of Greenwich District Hospital in 1969 an evaluation program was discussed in detail.

A list of specific evaluation topics was compiled as a result of a questionnaire survey of DHSS architectural, engineering, quantity surveying, nursing, medical and administrative staff. The topics were divided into the following broad categories:

1. Planning process - briefing
   commissioning
   production management
2. Whole hospital planning and design - layout, shape
3. Construction design, especially interstitial space
4. Finishes generally
5. Engineering services
6. Nursing units (wards)
7. Maternity units
8. Departments - entrances
   outpatients
   pharmacy
   medical records etc.
9. Traffic and communications, especially escalators and hoists
10. Supplies system, especially supplies delivery system
11. Equipment and furniture
12. Environment
13. Safety
14. Economics

The 'hospital as a whole' was subdivided into the following specific topics for study:

1. Utilisation of building flexibility, in planning and in use.
2. Local inhabitants' attitudes to the new hospital.
3. Adequacy of provision of toilet facilities for patients, staff, visitors, public.
4. Degree to which intended policies were being followed.

5. Causes of accidents/injuries to staff and patients.
6. Adequacy of maintenance.
7. Causes of deterioration or damage.
8. Use of space and equipment.
9. Relation of department size to workload.
10. Space needs for particular activities.
11. Problems of nursing administration.
12. Use of standard construction components.
13. Benefits of 'open space' planning with long space beams and few vertical shafts.
14. Benefits of external walkways for window cleaning, and external sunblinds for thermal control.
15. Floor finishes - maintenance, cleaning, appearance, slipperiness, noise control.
16. Wall and ceiling finishes - durability, appearance noise control.
17. Fittings - maintainence, damage, appearance
18. Engineering - access, reliability, costs in use, adaptability.

Evaluation topics in 'wards' were listed as follows:

1. bed spacing in single and multi-bed rooms
2. effectiveness of housekeeping system
3. nursing supervision, especially the call system in relation to staffing
4. bed occupancy
5. level of care assessment
6. staff allocation
7. use of treatment room
8. space needs for particular activities
9. use of shared rooms eg seminar room
10. progressive patient care - movement of patients
11. use of day spaces - especially day space in five bed rooms compared with large day space at end of ward
12. admission procedures and location of patients' records - in maternity wards.

(The above lists are based on 'Evaluation of Greenwich - Proposed Program' and 'list of suggested methods and topics' (Green 1969, 5 Dec, typescript). The lists were used as the basis for planning the three hospital evaluation undertaken in 1978/79 and reported in chapter 9.)

E5 COMPARISON OF FEATURES USED IN FOUR EVALUATION STUDIES OF HOSPITAL WARDS, DEPARTMENTS & ROOMS

RONCO (1971) (patients' rooms)*	SEARS & AULD (1976) (wards)+	NOBLE & DIXON (1977) (wards)+	GREEN (1978) (hosp. depts & room)
space	spaciousness/ storage	space	SPACIOUSNESS
convenience	convenience/ movement	convenience/ walking	CONVENIENCE
quietness	noise/disturbance	noise/disturbance	QUIETNESS
cleanliness	cleanliness	cleanliness	CLEANLINESS
temperature	temp. control		TEMPERATURE
efficiency	layout/shape		-
ventilation	vent. control		VENTILATION
cheerfulness	brightness/ stimulation	cheerfulness	STIMULATION
tidiness		tidiness	TIDINESS
lighting			
day	natural light		DAYLIGHT
artificial	artificial light		ARTIFICIAL LIGHT
maintenance	flooring/maint.	maint./reliability	SURFACE FINISHES
attractiveness	freshness	appearance/ attractiveness	(stimulation)
comfort	comfort	comfort	(temperature)
smell	stuffiness/smell		(ventilation)
colour	colour	colourful	COLOUR
privacy	special treatments/ conversation/ screening	privacy - toilets talking examin.	PRIVACY
adaptability		flexibility	ADAPTABILITY
safety		safety	SAFETY
security		security	SECURITY
	patient attract nurse attention	contact with nurses	(supervision)
		access to toilets	(convenience)
		finding the way	FINDING WAY
	observation, layout	supervision	SUPERVISION
	simplicity	simplicity in use	RELIABILITY
	things to do	interest	(stimulation)
	social atmosphere	friendliness/ sociability	HOMELINESS SOCIABILITY
	toilet facilities	toilet facilities	(convenience)
	view out		VIEW

*words are adapted from semantic differentials selected by respondents in survey to determine words which best described patients' rooms

+words are adapted from terms used in Likert scales, semantic differentials and interview questions

E6 HOSPITAL DESIGN IN USE
SURVEY QUESTIONNAIRE

office use	HOSP	date	NO. RESP
	Dept	time	
	Room	weather	
	Eqpt	place	

1. HOSPITAL/ facility — size — layout
2. DEPARTMENT/unit — size — layout
   floor level — zone — built
3. ROOM/space — size — layout
   internal/external, periphery/court, outlook
   decor — height — lights
4. EQUIPMENT/furniture — type/finish

5. Like LEAST about design of;

HOSPITAL	DEPARTMENT	ROOM	EQUIPMENT

6. Like MOST about design of:

HOSPITAL	DEPARTMENT	ROOM	EQUIPMENT

7. GENERAL COMMENTS about the hospital design:

8. RESPONDENT DETAILS M / F S / P / O age gp. occup.

Type STAFF: med / nur / admin / tech / dom / wks /
snr / mid / jnr

PATIENT: ward /consult / emer / diag / rehab /
med / sur / ger / psy / paed / mat /
amb / chair / bed / aid short / long stay

OTHER: visit / escort / local /

Experience THIS HOSPITAL: what — how long
where — when

OTHER HOSPITALS: which — when
what — old / new

Education: subject — stage — completed

Domicile: now — originally

Interests:

9. DEPARTMENT/unit you are/were in ______________

ROOM/space occupied ______________

EQUIPMENT/furniture most used ______________

10. For the whole HOSPITAL (outside and inside), and for the DEPARTMENT, ROOM and EQUIPMENT nominated, rate each FEATURE listed below by putting a number in the columns provided thus:-

4 = very adequate
3 = adequate
2 = don't know or not applicable
1 = inadequate
0 = very inadequate

11. RING the marks for the TWO MOST IMPORTANT FEATURES in each column

FEATURE	HOSPITAL out	HOSPITAL in	DEPARTMENT	ROOM	EQUIPMENT
a finding the way					
b stimulation					
c cleanliness					
d colour					
e homeliness					
f tidiness					
g adaptability					
h convenience					
i quietness					
j reliability					
k safety					
l security					
m artificial light					
n daylight					
o privacy					
p sociability					
q spaciousness					
r supervision					
s surface finish					
t temperature					
u ventilation					
v view					
w other..........					
x					
TOTAL					
percentage					
most important					

E7 DESCRIPTION OF WARD

To be completed by 'observer' (NAME please)____________________ Date_______

1. HOSPITAL(name)________________________ (location)__________
2. WARD(name/number, floor)__________________ (specialty)__________
3. LAYOUT type (tick relevant boxes):-
   open ward ☐ subdivided into bays ☐ separate bedrooms ☐
   single corridor ☐ double corridor ☐ other ☐ (describe)__________
4. BEDS, number in ward unit:- total(available)______ (occupied)______
   in single rooms ______
   in 2 bed rooms/bays ______
   in 3-4 bed rooms/bays ______
   in 5-6 bed rooms/bays ______
   in larger rooms/bays ______
5. OBSERVATION: number of patients' heads clearly visible from:-
   nurses' station (sitting)______ (standing)______
   walking along corridor/aisle______
   standing in entrances of rooms/bays______
6. CALL SYSTEM type:- none ☐ buzzer ☐ talk one way ☐ talk 2 ways ☐
7. NURSES' STATION, location:- ward entrance ☐ centre of ward ☐
   other (please describe)____________________
   enclosure:- open ☐ glazed in ☐ separate room ☐
8. TOILETS, location:- ensuite ☐ across corridor ☐ end of ward ☐
   if ensuite: off corridor ☐ between bedrooms ☐ on external wall ☐
9. Is there a TREATMENT/PROCEDURE room?__________
   If yes, where?______________________________
   and is it used for:
   all procedures on patients ☐ some procedures on patients ☐
   all procedures on patients (other than single room patients) ☐
   only for difficult/unpleasant procedures ☐
10. Is there a DAY/TV ROOM?__________ If so, where?__________________
11. Type of FLOOR finishes: corridor/aisle__________ bedrooms/bays_______
12. VIEW: how many patients in bed can see:- the nurses station______
    the sky______ other buildings etc. nearby______
    people outside______
13. Form of PRIVACY SCREENING between beds:____________________
14. Type of BED__________________ BEDHEAD LIGHT______________
    WARDROBE__________________ BEDSIDE LOCKER______________
15. NURSING METHODS usually adopted:- day night day n
    job assignment ☐ ☐ patient assignment ☐ ☐
16. NURSING STAFF on duty (give number of senior and junior)
    morning shift ☐ s. afternoon shift ☐ s. night shift ☐
    ☐ j. ☐ j. ☐

STAFF QUESTIONNAIRE ON WARD DESIGN

A. What HOSPITAL are you in? ______________________

B. What WARD(s) are you working in now? ______________________

C. What SPECIALTY(ies)? ______________________

D. Your OCCUPATION: medical ☐ nursing ☐ other ☐ (specify) ____________

E. GRADE/position ______________________

F. Your AGE? ________ SEX? ________ MARITAL STATUS? ________

G. How long have you worked at this hospital? ________

in what position(s)? ______________________

in what departments/wards? ______________________

H. What other hospitals have you worked in? ______________________

____

I. in what department(s)/ward(s)? ______________________

____

J. in what type of ward(s)? (tick one or more).

open 'Nightingale' ☐ subdivided/bays ☐ separate rooms ☐

other (specify) ______________________

K. What DESIGN FEATURES do you like most about the ward you are working in now?

L. What DESIGN FEATURES do you like least about the ward you are working in now?

M. What TYPE OF WARD DESIGN would you most like to work in e.g. open, subdivided?

N. Why?

O. What do you think is the ideal number of beds in an acute adult ward unit? ____

P. Why?

Q. Any other COMMENTS on ward design? (There is more space on the back page)

.2 PATIENT (and VISITOR) QUESTIONNAIRE ON WARD DESIGN

VISITORS are invited to answer all questions except O, P & Q
Optional questions are marked *

A. What HOSPITAL are you in? (Name please) ____________________

B. What WARD are you in now? (Name/number) ____________________

C. What SPECIALTY? (medical, surgical etc.) ____________________

D.* What room/bed do you occupy? (number) ____________________

E. How many beds in your room/bay? ____________________

F.* What is your OCCUPATION? ____________________

G.* What level of EDUCATION have you attained? (tick relevant box)
secondary ☐ technical ☐ university or professional ☐

H.* What SUBURB/district do you live in? ____________________

I.* What is your AGE? ________ SEX? ________ MARITAL STATUS? ________

J.* Your COUNTRY of birth? ____________ How long in AUSTRALIA? ______ yrs.

K. How many days have you been in this ward: as a patient? _______
as a visitor? _______

L. How many times have you been an inpatient previously: in this hospital? ____
in other hospitals? ____

M. Which other hospital(s)? ____________________

N. In what type(s) of ward? open ward ☐ subdivided/bays ☐ separate rooms ☐
(tick one or more)

O. Are you able to get out of bed: no ☐ with help ☐ unaided? ☐

P. How many other patients can you see clearly while lying in bed? ________

Q. What view of the outside can you see while lying in bed? ________

R. What DESIGN FEATURES do you <u>like most</u> about the ward you are in now?

S. What DESIGN FEATURES do you <u>like least</u> about the ward you are in now?

T. What TYPE OF WARD DESIGN would you <u>most like</u> to be in, eg open, subdivided?

U. Why?

V. What do you think is the <u>ideal</u> number of beds in a patient bedroom/space? ___

W. Why?

X. Any other COMMENTS on ward design? (There is more space on the back page).

8.3 WRITE 4 for very important/very adequate
3 for important/adequate
1 for unimportant/inadequate
0 for very unimportant/very inadequate

If UNCERTAIN, or question not applicable, please WRITE 2

Add COMMENTS if you wish

FEATURES	IMPORTANCE in ideal ward		ADEQUACY in your ward	
	rating	comment	rating	comment
PRIVACY for patients:				
a personal space/territory				
b personal belongings				
c treatments/examinations				
d using bed pan/urinal				
e using WC/shower				
f washing/being washed				
g dressing/undressing				
h talking with visitors				
i watching TV				
j listening to radio/tapes				
k undisturbed sleep/rest				
l being alone				
SUPERVISION of patients:				
m nurses able to see patients				
n nurses able to hear patients				
o nurses able to help each other				
p nurses able to move around ward easily				
q patients able to attract nurses' attention				
r patients able to summon nurse by call system				
s patients able to talk with nurse by call system				
t patients able to help each other				
CONVENIENCE for patients:				
u use of call system				
v access to locker				
w access to wardrobe				
x access to WC/shower				
y access to day/TV room				

STAFF QUESTIONNAIRE ON WARD DESIGN

A. What HOSPITAL are you in? (name please) ____________

B. What WARD(S) do you work in? (name and type) ____________

C. What is your PROFESSION/OCCUPATION?

medical ___ nursing ___ other (specify) ___

D. What is your GRADE/POSITION? ____________

E. Your AGE? ________ SEX? ________ COUNTRY OF BIRTH? ________

F. EDUCATION

Secondary ___ technical ___ professional/university ___

G. How long have you worked in this hospital? ____________

in what position(s)? ____________

in what departments/wards? ____________

H. What other hospitals have you worked in? ____________

____

in what capacity? ____________

in what departments/wards? ____________

in what TYPE of wards? (tick one or more)

open 'Nightingale' ___ subdivided into bays ___

separate rooms ___ other (specify) ___

I. What do you like MOST about the DESIGN of the ward you are in now?

Why?

J. What do you like LEAST about the DESIGN of the ward you are in now?

Why?

K. Describe the type of ward you would most like to work in?

Why?

L. How many beds do you think is ideal for a typical general ward

20 or less ___ 21-25 ___ 26-30 ___

31-35 ___ 36 or more ___

M. How many beds do you think is ideal for a typical multi-bedded patients room? (tick one)

2 ___ 3 ___ 4 ___ 5 ___ 6 ___ 7 to 9 ___

10 to 14 ___ 15 to 20 ___ 20 to 30 ___

Staff questionnaire (contd)

OW GOOD IS EACH FEATURE LISTED BELOW IN THE WARD YOU ARE IN NOW?

lease tick one column. Add comments if you wish.

EATURE	VERY GOOD	GOOD	POOR	VERY POOR	COMMENT
RIVACY for patients					
personal seclusion					
personal space					
storage of belongings					
conversation					
clinical examinations					
using bed pan/urinal					
using toilet facilities					
dressing/undressing					
radio/tv					
undisturbed sleep/rest					
UPERVISION of patients					
nursing station location					
observation					
audibility					
co-operation					
in emergency					
accessibility					
call system					
ONVENIENCE for patients					
layout					
spaciousness					
storage					
toilets					

lease say which THREE of the features listed above you think are the OST IMPORTANT in an ideal ward design - and why?

1.

2.

3.

ny OTHER COMMENTS on WARD DESIGN? (There is more space on the back p

.2 PATIENT QUESTIONNAIRE ON WARD DESIGN

A. What HOSPITAL are you in? (name please)? ____________

B. What WARD are you in now? (name or number) ____________

C. What ROOM or BED do you occupy? (number) ____________

D. How many BEDS in your room or bay? ____________

E. What is your OCCUPATION/PROFESSION? ____________

F. What level of EDUCATION have you reached?

secondary ___ technical ___ university/professional ___

G. What is your AGE GROUP?

under 20 ___ 21-35 ___ 36-50 ___

51-65 ___ 65+ ___

H. What is your SEX? ____________

I. Your COUNTRY OF BIRTH? ____________ How long in AUSTRALIA?

J. What is your 'PATIENT CLASSIFICATION' ? (tick one)

Hospital ___ Private ___ Workers Comp. _

Third Party ___ Repat. ___

K. How long have you been in this ward? ____________

L. How many times have you been an inpatient in this hospital? _____

in which ward(s) ____________

M. How many times have you been an inpatient in other hospitals? ____

which hospitals? ____________

N. What type(s) of ward were you in before? (tick one or more)

open ward (Nightingale) ___

subdivided into bays ___

separate rooms ___

other type (describe) ___

O. Which type of ward did you prefer? ____________

P. Why?

Q. Are you able to get out of bed?

No ___ with help ___ unaided ___

R. How many patients' beds can you see from your bed? ____________

S. What outside view can you see when lying in bed? ____________

T. Have you been given medication to make you sleep? Yes / No

how often? ____________

Patient questionnaire (contd)

What do you like MOST about the DESIGN of the ward you are in?

Why?

What do you like LEAST about the DESIGN of the ward you are in?

Why?

What type of WARD DESIGN do you think is IDEAL? Why?

e.g. number of beds in rooms
open/subdivided bays/separate rooms
location of toilet facilities
type of nurse call system

. Do you feel that the design of this ward gives you sufficient PRIVACY?

Yes / No

If 'no' in what way could it be improved?

. Do you feel that the design of this ward allows good SUPERVISION of patients by staff? Yes / No

If 'no' please say how you think it could be improved.

. Do you feel that the design of the ward is CONVENIENT for patients?

Yes / No

If 'no' please say how it could be improved.

If 'yes' what are the things you like about it?

---

7. Do you feel that the design of this ward is sufficiently COMFORTABLE for patients? Yes / No

If 'no' please say how it could be improved.

If 'yes' what are the things you like about it?

Patient questionnaire (contd)

PLEASE TICK (✓) THREE OF THE FEATURES LISTED BELOW WHICH YOU THINK WOULD BE THE MOST IMPORTANT IN AN IDEAL WARD.

1. personal seclusion from other patients ___
2. adequate storage space for belongings ___
3. privacy when being examined by doctors/nurses ___
4. conversations with visitors not being overheard ___
5. easy access to toilets and washing facilities ___
6. undisturbed sleep/quietness at night ___
7. not being overlooked when dressing/undressing
8. nurses able to see patients easily ___
9. nurses able to hear patients call out ___
10. nurse call system easy to use ___
11. able to talk to nurse on call system ___
12. sufficient space around beds ___
13. opportunity to converse with other patients ___
14. a good view of the outside ___

THANK YOU FOR YOUR HELP IN COMPLETING THE QUESTIONNAIRE

E10 TEACHING HOSPITAL WARD EVALUATION

Patients & staff percentage ratings for importance in both ward types

feature group*	features in order of importance for patients	importance rating % patients(p)	staff(s)	difference(p-s)
S	patients able to attract nurse	95	92	3
S	patients able to call nurse	95	88	7
S	nurse able to move easily	94	93	1
P	undisturbed sleep/rest	92	95	-3
S	nurse hear patients	90	93	-3
C	use of call system	90	87	3
P	treatments/examinations	87	84	3
S	nurse able to see patients	87	97	-10
C	access to toilets	87	87	0
P	personal belongings	86	79	7
P	using toilet	84	90	-6
S	nurses help each other	83	94	-11
P	using bed pan	82	90	-8
P	washing	82	87	-5
C	locker access	81	89	-8
P	dressing	75	85	-10
P	visitors talking	74	77	-3
P	personal space	73	87	-14
S	patients help each other	68	68	0
C	access to day room	64	74	-10
C	access to wardrobe	61	68	-7
S	patients talk to nurse	57	48	9
P	listening to radio	46	53	-7
P	being alone	46	66	-20
P	watching TV	38	56	-18

*Key to symbols

S = supervision
P = privacy
C = convenience

Patients' percentage ratings for importance and adequacy

features	new wards importance (i)	new wards adequacy (a)	new wards difference (i-a)	old wards importance (i)	old wards adequacy (a)	old wards difference (i-a)
Privacy	72.8(mean)	64.2	7.9	69.0	63.3	5.7
space	75	66	9	70	78	8
belongings	71	72	-1	81	66	15
treatment	87	79	8	86	87	-1
bed pan	84	68	16	80	75	5
toilet	84	68	16	83	64	19
washing	84	66	18	77	78	-1
dressing	77	66	11	72	69	3
visitors	71	68	3	77	75	2
TV	43	57	-14	33	48	-15
radio	56	47	9	36	47	-11
sleep	90	68	<u>22</u>	94	69	<u>25</u>
alone	52	54	2	40	40	0
Supervision	84.8(mean)	68.6	16.1	84.5	66.8	17.8
see	82	65	17	91	56	<u>35</u>
hear	88	68	20	92	73	19
n.help	96	74	<u>22</u>	89	88	1
move	96	74	<u>22</u>	92	88	4
attention	94	84	10	95	70	25
call	94	81	14	95	72	23
talk	59	38	21	55	20	<u>35</u>
p.help	69	65	4	67	67	0
Convenience	79.6(mean)	73.2	6.2	73.2	63.0	10.2
call	86	83	3	94	63	<u>31</u>
locker	84	70	14	78	83	-5
wardrobe	70	76	-6	52	42	10
toilet	92	73	<u>19</u>	81	72	9
day	66	64	2	61	55	6

Staff percentage ratings for importance and adequacy

features	new wards importance (i)	adequacy (a)	difference (i-a)		old wards important (i)	adequacy (a)	difference (i-a)
Privacy	81.8	62.4	19.4	(mean)	77.4	60.1	17.3
space	87	65	22		87	57	30
belongings	78	65	13		80	68	22
treatment	98	69	29		86	64	22
bed pan	88	65	23		91	66	25
toilet	92	67	25		88	60	17
washing	87	65	22		86	69	17
dressing	82	71	11		88	71	17
visitors	78	63	15		76	67	9
TV	64	68	-4		47	60	-13
radio	62	51	11		44	63	-19
sleep	98	47	<u>51</u>		92	49	<u>43</u>
alone	68	53	15		64	27	37
Supervision	74.6	36.75	37.9		83.0	69.0	14.0
see	99	15	<u>84</u>		95	80	15
hear	94	33	61		92	80	12
n.help	94	57	37		93	80	13
move	94	50	44		92	78	14
attention	90	37	53		93	76	17
call	90	74	16		86	71	15
talk	47	24	23		48	19	<u>29</u>
p.help	70	49	21		65	68	-3
Convenience	83.6	70.6	13.0		77.6	54.2	23.4
call	89	78	11		84	72	12
locker	90	70	<u>20</u>		87	79	8
wardrobe	72	63	9		63	32	31
toilet	88	70	18		86	49	<u>37</u>
day	79	72	7		68	39	29

E11 COUNTRY HOSPITAL WARD EVALUATION

Staff percentage adequacy ratings in new and old wards

features	percentage adequacy ratings new wards	old wards	difference new-old
privacy	53.5	28.0 (mean)	25.5
clinical examination	69	29	40
conversation	62	44	18
using toilets	62	23	39
dressing/undressing	62	29	33
using bed pan	60	35	25
personal seclusion	58	25	33
personal space	58	29	29
for radio/TV	56	19	37
storage of belongings	53	35	18
undisturbed sleep	49	12	37
supervision	47.6	34.9	12.7
call system	69	25	44
cooperation	67	52	15
accessibility	62	44	18
audibility	58	40	18
in emergency	56	29	27
n.station location	47	23	24
observation	42	31	11
convenience	61.2	24.5	36.7
layout	67	31	36
spaciousness	64	29	35
storage	58	21	37
toilets	56	17	39

E12 SURVEY OF MEDICAL, NURSING and ADMINISTRATIVE POLICIES AFFECTING WARD DESIGN

1. HOSPITAL

2. Date of interview   3. Interviewer

---

1. RESPONDENT PARTICULARS

Obtain before interview

4. Title (Dr./Professor etc.)

5. Name

6. Role/position (occupation/status)

7. Length and type(s) of experience at this hospital
   - administrative
   - clinical
   - planning
   - research
   - teaching
   - other

Obtain after interview

8. Previous hospital experience in Australia
   (hospitals, role, length of experience)

9. Previous experience overseas
   (country, hospitals, roles, length of experience)

10. Details of any planning experience
    (roles, projects, courses attended)

11. Principal professional qualifications

12. Age group (→29, 30-44, 45+)?

SURVEY OF POLICIES AFFECTING WARD DESIGN (contd)

2. INTERVIEW CHECK LISTS

Policies in this hospital affecting wards

a) medical
b) nursing
c) administrative

Policy variations due to types of ward - what? why? effects?

a) old/open Nightingale
b) upgraded/subdivided bays
c) modern/separate rooms,
d) other

Factors influencing design preference

a) efficiency - use of staff, time, energy, cost
b) adaptability - nursing methods, workload, bed grouping
c) supervision - patients, staff, visitors
d) privacy - visual, auditory, smell
e) convenience - access to toilets, movement
f) comfort - thermal, ventilation, visual, noise
g) safety - falls, lifting, fire, infection
h) security - drugs, records, valuables

Factors affecting requirements:

a) hospital type - teaching, rural, public/private
b) ward type - general/special, male/female/mixed
c) nursing methods - job/patient assignment, team, primary care
d) teaching methods - medical, nursing, other
e) specialty - medical, surgical, obstetric, isolation, intensive
f) dependency - high, intermediate, low
g) age grouping - children, adolescents, adults, aged, terminal
h) activities - clinical, administrative, domestic, amenity
i) design - layout, construction, services, finishes, equipment
j) environment - climate, surroundings

Trends affecting methods of patient care

past

present

future - short term/long term

a) political - federal, state, local
b) social, cultural
c) education, training
d) economic, insurance
e) living standard, affluence / poverty
f) clinical developments
g) consumer involvement/knowledge/rights
h) technology, computers
i) employment, unions
j) administrative, organisational
k) other?

Good examples of ward designs elsewhere

a) in Sydney
   NSW
b) Australia
c) overseas: N. America
   UK/Europe

particular features

effects, benefits

Topics for investigation - priorities, importance

a) management methods
   medical
   nursing
   general administrative
b) means of supervision - staff/patients
c) privacy, confidentiality - staff/patients
d) adaptability, versatility - methods/layout
e) convenience - movement, toilets
f) efficiency - staffing, costs, energy, patient stay
g) infection - control, prevention
h) environment - thermal, auditory, visual
i) building - finishes, services
j) equipment - beds, lockers, lifting aids
k) other?

3. OPTIONS ON OPERATIONAL AND DESIGN POLICIES

What policy do you prefer in respect of the following operational aspects

a) Method of nursing care for morning shift

job assignment
patient assignment
team nursing
primary care
combination
other

b) Method of nursing care for afternoon shift | for night shift

job assignment
patient assignment
team nursing
primary care
combination

c) Where clinical procedures are performed

	examinations	treatments
single bed room		
multiple bed room		
central treatment suite		
treatment room		
other		

d) Method of patient transport

	to other departments	to treatment rooms
on mobile beds		
on trolleys		
by wheelchair (if suitable)		
other		

e) Should 'up-patients' be encouraged to dress in ordinary clothes

all day
part of day only
to go outside ward
to go to day room

f) Should 'up-patients' have their meals

by their bed
in sitting space in bed room
in dining area in ward
in patients' cafeteria

g) Where and how should bedpans and urinals be washed/'sterilized'/disposed of

washer for each sub-unit
washer/sterilizer for each unit
sterilizer for each unit
sterilizer for each floor
use disposable liner/urinals

h) Where and how should bed linen be supplied, stored and disposed of

trolley exchange
top-up/imprest
to order
fixed shelving in store/in corridor
mobile shelving in corridor
'nurserver' units for each room

i) Should patients be obliged to use earphones/headphones when listening to

radio	earphones
personal TV	headphones
general TV	no hearing device
tape player	

j) Visiting times and the number of visitors at one time

restricted to one hour or so per day	1 or 2 only
several hours per day	more than 2
no restrictions	children?

k) Smoking by patients and staff

no restrictions
restricted to certain areas of ward
restricted to certain times of day
no smoking at all anywhere

l) Location and method of safe storage of dangerous drugs

central/decentralised

lockable cupboard
lockable compartment on trolley
other

m) Location of medical/nursing teaching activities

in bed areas - single room
multiple bed room
in treatment/procedure room in unit
in shared demonstration room for 2 units
central teaching suite

n) Where should patients' records be kept

at staff base
at sub-stations
by bed
on trolley

o) Where should patients have sitting space

by bed
in bed room/bay
sitting room for sub-unit
sitting room for unit

p) Any other policies affecting operation?

clerical
communications
cleaning
catering
rest periods
death
interviewing
safety

What policy do you prefer in respect of the following design aspects

a. Number of nursing units (of 25 to 30+ beds) grouped together on one floor level

1
2
3/4
5/7
8+

b. Number of sub-units (of 8 to 16+ beds) in a nursing unit

1
2
3
4

c. Number of beds in a typical sub-unit

4-6
7-10
11-15
16+

d. Number of beds in a typical multi-bed room

2
3/4
5/6
7/8
10/12
14+

e. Number of single rooms in a typical nursing unit of 30 beds

3
4
5
6
7
8+

f. Extent of direct observation of patients from a central area in the unit

all patients
at least 75%
at least 50%
at least 25%
at least 10%
not necessary

g. Type of call system

buzzer
talk 1 way
talk 2 ways
other

h. Location and kind of staff base(s)

central to pair of units
central to unit
central to high dependency beds
decentralised to each sub-unit
mobile
none

used by all staff
clerical separate from nurses/doctors
nurses separate from doctors

i. Location and arrangement of treatment room(s)

1 per sub-unit
1 per unit
1 per 2 units
2 per 2 units
central suite for floor

j. Location and arrangement of utility areas

shared between 2 units
central to unit
central to sub-unit
for each pair of rooms
in each room

k. Location and design of patient toilet areas

ensuite to bedroom
separate from bedroom
across/along corridor

between corridor & bedroom
between bedrooms
on outside wall

l. Should multi-bed rooms have doors? If so, what type?

doors, no doors
solid, part glazed
sliding, hinged
single leaf, 1½ leaf, 2 leaf

m. Method of storage of patients' belongings

fixed locker, fixed wardrobe
mobile locker, fixed wardrobe
combined mobile locker/wardrobe unit

n. Any other policies concerning design?

lighting
ventilation
temperature control
sun shading
cubicle curtains
floorings
telephones

E13 SURVEY ON FURNITURE AIDS FOR DISABLED CHILDREN

(excerpts from survey questionnaire)

This questionnaire seeks information on requirements of furniture aids (such as chairs and tables) for physically disabled children.

Please answer the questions very briefly so as to give a person who is unfamiliar with the problems of disablement some idea of what is needed to help reduce the problems.

PART A. INFORMATION ABOUT YOU AND YOUR CLIENTS

1. What is your OCCUPATION?......................................
   (eg. therapist, teacher, parent, nurse........)

2. In what SITUATION are you concerned with the disabled?
   (using appropriate words)
   At home, hospital, school, hostel, day centre................
   other (please state)..................

3. Describe the CLIENTS whose interest you represent.
   own child(ren), hospital patients, foster children...........
   other....................

4. In what AGE GROUP are your clients? (please circle)
   0-1 year, 1-3 yrs, 3-5, 5-8, 8-12, 12 + yrs.

5. What kind of DISABILITIES do(es) your client(s) have?
   Cerebral palsy /spina bifida/injury/........................
   other (please state)....................

14. What does your child/client need in order to MAINTAIN SATISFACTORY POSTURE whilst engaging in an activity? head support, trunk control, foot support, flexion of hips,...........

PART B. YOUR IDEAS ON REQUIREMENTS

21. What to you are the most IMPORTANT REQUIREMENTS in the following list? (Please mark 1, 2, or 3 against each item. 1 rates highest, 3 rates lowest:)

COST TO PURCHASE
DURABILITY, DAMAGE RESISTANCE
SAFETY from injury, overbalancing etc.
EASE OF ADJUSTMENT
RANGE OF ADJUSTMENT, height, angle
AVAILABILITY OF ATTACHMENTS
MOBILITY
CLEANABILITY
APPEARANCE
COMFORT
COLLAPSABLE, FOLDABLE
TRANSPORTABILITY e.g. in car, on bus
OTHER (please state)............................

PART C. DESCRIPTION OF AIDS AND HOW USED

31. What KINDS OF FURNITURE AIDS do you currently use?
    e.g. chair, table, mobile seat, trolley board, standing frame....................

32. Where did you OBTAIN the aids?
    e.g. hospital, manufacturer, therapist, shop..................
    ....
    (Please identify by NAME if known).

33. How did you come to HEAR ABOUT THEM?
    e.g. advertisement, journal article, friend, professional advice....................

34. Please give the MAKE, TYPE and COST of aids used.
    (up to 6 only)
    (for 'homemade' put HOME, for 'specially made' put SPECIAL)

	MAKE	TYPE	COST (approx)
1.			
2.			
3.			
4.			
5.			
6.			

PART D. ASSESSMENT OF AID(S) YOU PREFER MOST

Please select not more than TWO aids from those described above and answer the following:-

41. WHICH AIDS ARE PREFERRED (give numbers used in Part C)
(Identify each aid by number in the following questions)

42. What are the FEATURES you have found MOST USEFUL? Why?

43. What are the FEATURES you have found LEAST USEFUL? Why?

44. What FEATURES would you most want to ALTER? Why?

45. What FEATURES are OMITTED which you would want to include? Why?

46. Would you RECOMMEND the aid(s) to another person in the same situation as yourself?
unreservedly / with some reservations / with caution / no.

47. How well do you RATE the aid(s) on the six point scale below for each feature indicated? (Mark with nos. as above)

(GOOD)	6	5	4	3	2	1	(BAD)
COST							
DURABILITY							
SAFETY							
ADJUSTMENT							
ease							
range							
ATTACHMENTS							
MOBILITY							
CLEANABILITY							
APPEARANCE							
COMFORT							
FOLDABILITY							
TRANSPORTABILITY							
OTHER(S)							
....							
....							

48. ANY GENERAL COMMENTS e.g. on problems of obtaining suitable aids, advice on sources of supply of aids, problems in use, and need for research into particular problems.

E14 EVALUATION OF SELECTED FURNITURE AIDS
Examples of proformae used in tests

______________________ Item

MOBILITY Occupied chair M2

______________________ (Tester) ______________________ Child

HOW EASY IS THIS CHAIR TO MOVE BY YOURSELF IN EACH SITUATION?

TYPE OF MOBILITY		smooth rigid floor	carpet	doorway	upstairs	downstairs	grass	sand/gravel/stone	COMMENTS
	very easy								
	mod. easy								
	difficult								
	very difficult								
	impossible								
	very easy								
	mod. easy								
	difficult								
	very difficult								
	impossible								
	very easy								
	mod. easy								
	difficult								
	very difficult								
	impossible								
	PREFERENCE								

_____________ Item

SUITABILITY FOR ACTIVITIES SA 1

_____________ Subject

WHAT DOES THE CHILD DO IN THIS CHAIR / AT THIS TABLE?	How satisfactory is it for this purpose: poor	fair	good	excellent	EXPLAIN, SUGGESTING IMPROVEMENTS IF YOU CAN.
Food					
Play					
Education					
Other					

IF THE CHAIR/TABLE WAS IMPROVED TO MAKE MORE ACTIVITIES POSSIBLE, WHAT WOULD YOU LIKE TO HAVE AVAILABLE?

______________ Item

ADJUSTABILITY : CHECKLIST

AD1

______________ Subject

ADJUSTMENT	YES?	RANGE	INCREMENTS
SEAT			
height from ground			
orientation to base			
angle to ground			
width			
length			
shape			
SAFETY BELTS			
length			
position			
mounting point(s)			
BACKREST			
height above seat			
length			
width			
shape			
angle to seat			
HEAD SUPPORT			
height			
width			
angle			
shape			
ARMREST			
height above seat			
angle to seat			
length			
width			
FOOTREST			
height above seat			
angle to floor			
width			
strap			
OTHER			

APPENDIX F

FRAMEWORK FOR FEEDBACK

F1 Agenda headings:- description of topics and aspects to consider in briefings, design and evaluation

F2 Detailed check list for using with agenda heading 13 'Limitations'

F3 Questionnaire for briefing investigation/report (based on agenda headings)

F4 Questionnaire for evaluating a department (based on agenda headings)

F1 AGENDA HEADINGS - description of topics and aspects to consider in briefing, design and evaluation

Each of the thirteen main headings and thirty nine sub-headings is described below:

AIMS refers to PURPOSES and SCOPE of a project and includes APPLICATIONS of experience to and from other projects

1) PURPOSE describes the project objectives, and past and possible future trends which might affect the objectives or implementation of the project, eg politicalinfluences, economic trends, industrial developments, technological changes, social attitudes and educational policies.

2) SCOPE means the range of functions to be included. This is sometimes better explained by specifying exclusions.

Types of things to be listed under SCOPE could include:

Services eg health, education
Facilities eg health centres, schools
Departments eg administration, catering
Processes eg cooking, storage
Activities eg filling, washing

3) APPLICATIONS refers to information sources from outside a project, potential information needs of the project, information already available, information of use to other projects which may be generated from own project, and how the project can be used to add to knowledge.

CONTEXT is derived from the objectives specified under PURPOSE, and is described by stating NEEDS, CONDITIONS AND CONTENT

4) NEEDS to be met are described as problems to be solved, demands expected (or already evident), and predicted workloads in particular service areas.

5) CONDITIONS modify the NEEDS to be met. They may be legal requirements, economic limitations, political pressures or social factors. The conditions may need to be adjusted according to objectives already defined. For example, the stated objectives may not be met unless the conditions are altered, and a balance achieved. Objectives and conditions should not be regarded as absolute. Possible effects should be considered in achieving a compromise between meeting ideal needs and accepting the prevailing conditions.

6) CONTENT is a statement of the services and facilities considered adequate for the needs, subject to conditions imposed or assumed. Content can be described in terms of work capacity (eg sessions per week), places (eg students, beds, seats), and rooms or space units. A statement of content does not describe a means of meeting the needs, nor should it assume a particular solution. It should allow comparisons to be made between alternative ways of meeting needs. Labour and financial requirements should be estimated for each alternative.

ECONOMICS includes RESOURCE allocation, financial EXPENDITURE, and social and other BENEFITS obtained.

7) RESOURCES include money, people, experience, time, existing facilities, organisational skills, and information. Allocation of resources to a project may depend on political factors rather than objective evaluation of likely effects. Efficient use of available resources is, nevertheless, a presumed aim in all project planning.

8) EXPENDITURE is allocated to capital costs, running costs, or development costs. Interactions between these three categories should be examined to establish areas for economising. Decisions on design detail, operational methods or project timing will affect rates of expenditure on facilities or services. Utilisation, and hence running costs, may depend both on design and on operational factors.

9) BENEFITS and outcomes may be measured in terms of profit and loss, social effects, political advantages, health status or user satisfaction. Evaluation of options may take some or all of these measures into account. Actual benefits may not be known until the project is complete and in operation.

OPERATION includes determination of METHODS to be used in performing the functions to meet the needs with the available resources, patterns of ORGANISATION of the services provided, and the types and numbers of PEOPLE involved.

10) METHODS describes functions performed to meet needs. Existing practices may be used as a basis for describing the functions. Alternatively, new processes may need to be developed, either by modifying existing practices, or by experimental means. Methods are best described in terms of sequences of activities using arrow diagrams coupled with a narrative description.

11) ORGANISATION describes roles and relationships of PEOPLE and processes. While the METHODS described previously may imply a particular organisational pattern, this may also influence the working methods. Organisations, once established, influence the way they work. The main purpose of organisation is to effect control. Ease of control may be affected by degree of centralisation or dispersion of facilities, and also by spatial LAYOUT.

12) PEOPLE are involved in processes, either as suppliers or receivers of services. Responsibilities of individuals need to be explained, and their roles defined. Types of people can be described in terms of tasks, professional interests, qualifications, residency status and hours of work etc. Numbers of people influence the amount of SPACE required, EQUIPMENT needed and TRAFFIC implications.

PROVISION is affected by physical, economic and legal LIMITATIONS, by the type of ACCOMMODATION required, and by the SPACE needs of the PEOPLE, activities and EQUIPMENT to be accommodated.

13) LIMITATIONS include shape, size and topography of sites; building and town planning regulations; financial allocations for building, equipping and operation; and constructional constraints. The likely effects of limitations need to be considered before finalising statements of CONTENT. If alternative SITES are being considered, the limitations and possibilities of each need to be evaluated before deciding feasibility of the project. (See appendix F2 for detailed check list of items to consider.)

14) ACCOMMODATION is defined in terms of the types of activity space needed, eg open space, sub-divided, compartmentalised etc. Accommodation requirements should not presume a particular form of building LAYOUT, rather they should provide the basis for evaluating alternative forms of layout to meet criteria such as observability or ease of access. The type of occupancy, and the number of people and items of equipment to be accommodated, also need to be specified.

15) SPACE requirements are based on the ACCOMMODATION needed, but the quantity of floor area may vary according to the intensity of space utilisation, the standards of spaciousness, and type of LAYOUT proposed. SITE limitations will also influence the shape and size of building, and hence the amount of space allocated to vertical and horizontal circulation. Size and shape of individual rooms in relation to the structural and dimensional system will affect efficiency in the use of space, and hence the total amount of space required.

SITUATION encompasses LAYOUT possibilities, SITING implications and preferred LOCATIONS. This citation order is based on the principle that the location cannot properly be decided until the type of site ideally required is known, and this in turn depends on the type of building layout preferred for the accommodation and activities proposed.

16) LAYOUT is described in terms of height (number of floors), horizontal extent, and degree of cohesiveness or discontinuity. A preferred layout will be one which meets the various requirements with the least amount of conflict or compromise. Provision for growth and change should also be allowed for, even if not specifically stated as a requirement.

17) SITING is influenced by access, sun angles, wind direction and intensity, ground contours, soil conditions, planting, existing buildings etc. The site may need to be zoned to isolate incompatible activities from each other, or to separate noisy and quiet areas, for example. Sufficient space should be allowed for expansion, and for carparking.

18) LOCATION may not be able to be finally decided until accurate estimates have been made of SPACE requirements, traffic flows, and cost implications of alternative sites. Accessibility to the population served, and the costs of access, may also determine preferences for particular sites.

LOGISTICS concerns the use, movement and storage of commodities, including PEOPLE. It also includes various kinds of SUPPORT activities, such as supply, cleaning and disposal, as well as TRAFFIC and TRANSPORT services.

19) SUPPORT services depend on the needs of 'primary' services and activities. Once these have been determined, and their supply, disposal and communication needs established, the extent of support service requirements can be estimated. These in turn will affect SPACE needs, workforce requirements, building LAYOUT, and organisational patterns.

20) TRAFFIC loads depend on the interaction of two main factors: activities and building LAYOUT. Estimates of traffic loads, routes and frequencies can only be made after a layout has been proposed, and activities have been described in sufficient detail to infer traffic implications. The type of TRANSPORT system proposed will affect the extent of use of the system, and the LOCATION of departments and activities will also influence the frequency of trips. The aims will generally be to minimise unnecessary movement, and to make essential journeys as easy and economical as possible.

21) TRANSPORT refers to the means of movement of different kinds of traffic. Vehicles, lifts, conveyors, stairs, corridors, chutes, tubes and wires are alternative means of transporting commodities. Preferred routes for transport systems will be influenced by the origins and destinations of trips, by building LAYOUT and by constructional considerations. SAFETY and cost may also affect decisions on preferred forms of transport.

ERGONOMICS considers man in relation to his working environment, and includes ENVIRONMENTAL aspects such as heat and light, PERCEPTION in terms of comfort and vision, and the RESPONSES which these generate in the form of performance and comprehension.

22) ENVIRONMENT is considered in terms of the physical characteristics such as lighting, shape, temperature, air movement, humidity etc. Both the existing environmental conditions will need to described, and the desired conditions which the design is intended to provide for.

23) PERCEPTION describes how people interpret their environment through visual, auditory, tactile and olfactory senses. Visual perception includes consideration of light intensity, glare, colour, texture, pattern, movement and flicker. Hearing will be conditioned by the quantity and quality of sound, but also by the mental and physiological characteristics of the perceiver, and by the acoustic qualities of the physical surroundings. Touch and smell are similarly affected by both individual sensitivity to environmental stimulae, and by the macro- and micro-climatic conditions.

24) RESPONSE deals with the effects of ENVIRONMENT upon PEOPLE through PERCEPTION. Pleasure, performance and understanding describe how response can be evaluated. Desired levels of performance, for example, need to be defined as the basis for decisions about the physical environment, and how it may influence people's behaviour and opinions.

SECURITY includes consideration of the HAZARDS which require SAFETY measures to give PROTECTION to PEOPLE and to BUILDINGS, INSTALLATIONS and EQUIPMENT.

25) HAZARDS describes threats to life, health and property, such as fire, infection, storm, and theft. Types of risk need to be defined and suggestions made for means of reducing the risks without unduly increasing costs, reducing efficiency, or adding to design complexity.

26) SAFETY defines the requirements of a suitable ENVIRONMENT for PEOPLE without undue exposure to the HAZARDS which could affect health, welfare, performance and comfort. Standards of safety need to be defined in terms of degrees of resistance to the most likely hazards.

27) PROTECTION refers to the means of providing safe working conditions and how to protect buildings from damage and deterioration. Aspects to consider include isolation, insulation, alarms, standby services and means of escape. Protection requirements affect CONSTRUCTION, INSTALLATIONS and EQUIPMENT.

PLANT refers to EQUIPMENT, INSTALLATIONS and BUILDINGS which result from design proposals on how to meet ENVIRONMENTAL needs of PEOPLE, and the functions they perform.

28) EQUIPMENT includes furniture, furnishings and fittings, as well as more specialised equipment and supplies such as scientific apparatus, instruments, vehicles and containers. Design and selection of equipment is governed by the geometry of activities as well as by the ACCOMMODATION in which it may be used.

29) INSTALLATIONS are considered under the three headings of environment control, supply services and communications. Each type of installation depends on users' requirements, environmental conditions and standards of safety considered necessary. Methods of integrating the INSTALLATIONS into the CONSTRUCTION should be considered before finalising the LAYOUT design.

30) BUILDING means the physical structure of the building rather than the process of fabrication, although both should be considered together. The type of building structure depends on SPACE, SAFETY, ENVIRONMENTAL and TRANSPORT requirements. Materials and finishes will be determined by considerations of PERCEPTION, SAFETY and PROTECTION.

CONSTRUCTION deals with the process of building and is considered under the headings of PRODUCTION, PROGRAMMING and MAINTENANCE.

31) PRODUCTION covers the manufacture of building materials, elements and components, the assembly of components on or off site, and their erection and completion to conform with the design intention. Production methods affect building shape and structure, but the precise methods of construction may not be known until after the contractor is appointed.

32) PROGRAMMING includes control of manufacture and building processes, particularly in respect of time, costs, workforce and quality. Cost and quality depend on the type of construction and materials used, while time required for construction may be affected by methods of assembly, and by ease of access to INSTALLATIONS and EQUIPMENT.

33) MAINTENANCE should be considered in the design of EQUIPMENT, service INSTALLATIONS, and BUILDING structure and components. Choice of building materials will have an important effect on ease of maintenance, on the life of finishes before replacement is necessary, and on the attitudes of building users to looking after the building.

INTEGRATION is the process of coordinating all the foregoing aspects into a coherent whole at each PHASE of planning, for each FUNCTION being planned for, and at each SCALE of application.

34) PRIORITIES should be determined for the various NEEDS in relation to economic, ethical, logical, political or technical considerations. Methods of determining priorities will vary from project to project, but the design outcome will mainly be based on the order of importance given to the requirements by the users, or by those who represent their interests.

35) CONFLICTS should be identified between requirements of design, construction, or methods of operation. Experience derived from evaluation studies of design in use may help to resolve some of the apparent conflicts, or to suggest a basis for compromise without undue sacrifice.

36) RELATIONSHIPS between and within functional and constructional elements will depend on the patterns imposed as a result of operational and design decisions. Interactions between function and design may be determined by logical analysis. Coordination of the various elements aims to avoid misfits between them, both in terms of operation and of geometry.

EXECUTION includes COMMUNICATION of the design intentions, IMPLEMENTATION of the constructional proposals, and CONTROL of the overall process of planning and management.

37) COMMUNICATION includes consideration of means of describing the proposals, specifying the operational and design details, and checking that the results correspond with the intentions. Methods of documentation and recording decisions need to be established early in the planning process.

38) IMPLEMENTATION describes how the design decisions are to be put into effect. Tasks have to be described, and sequences of events and activities worked out to give the most economical procedure for achieving the desired results.

39) CONTROL and feedback can be considered from three viewpoints: results, effects and implications. Progress is monitored, and feedback systems developed to ensure that decisions are correctly carried out, and any necessary changes made to correct faults or misfits.

F2 DETAILED CHECK LIST for using with agenda heading 13, LIMITATIONS

13. LIMITATIONS ON PROVISION

consider: Site Limitations
eg. location
size
shape
contours
existing buildings
trees, planting
water level
services
access
soil conditions/types
bearing capacity
adjoining owners
rights of way
covenants
planning restrictions
zoning
view
exposure
insolation - winter/summer
nuisances - noise, pollution

Regulations
eg. building
fire
planning
water/drainage
electricity
employment
factories, workplace
health
safety
local government
roads
railways
air traffic
maritime
parks, wild life
ancient buildings, monuments
police
Acts, ordinances

Financial
eg. capital allocation
site acquisition
site clearance, development
fees, charges - legal, design
tendering climate
building labour rates
materials costs
transport costs
form of tender/contract
operating costs - energy, staffing
supplies, maintenance.

F3 QUESTIONNAIRE FOR BRIEFING INVESTIGATION

A. IDENTIFICATION

PROJECT name

DEPARTMENT or FACILITY

INFORMANT(S) designation, name and position

B. INFORMATION

CONTENTS of briefing report - list section headings

REFERENCES to sources of information. Consider other projects, organisations, individuals, publications, advice, etc.

INDEX to topics - arrange alphabetically

AIMS (by planning team)

1. What are the main purposes of the department or facility - eg. social welfare, education, research, etc?

   How are the purposes likely to alter in future?

2. What is the scope of services to be provided by the department/facility (list main functions included; indicate exceptions)?

3. What other departments provide good examples of application of design principles? Give details.

   What (if any) are the principal planning or design mistakes evident in existing department? How can they be avoided in future?

CONTEXT (by planning team)

4. What is the population to be served by the department/facility? (Indicate total number of population, age range, sex ratios etc.)

   Is the catchment population likely to increase/remain static/shrink in future?

   What is the present workload of the department (indicate number of patients/units 'processed' per week or day)? Give details of types of units eg. major/minor, medical surgical, new/old etc.

   What is the anticipated workload in future?

   What use can be made of existing facilities in the short term/long term?

5. What conditions might cause a change in kind or quantity of service offered by the department in future (eg. economic, employment, education)?

6. What is the existing content of the department (eg. no. of beds, rooms, units of provision)?

   What do you think it should be in future?

ECONOMICS (by planning team)

7. What resources are available for provision of departmental facilities, eg. finance, time, knowledge, existing facilities?

   How can they best be utilised?

   Are they sufficient to meet the needs? If not, what additional resources are needed?

8. What expenditure is considered reasonable for provision of facilities, ie. capital expenditure:- fees, equipment, site acquisition; revenue expenditure:- staff, energy, supplies, services?

   How much do equivalent departments cost to provide/operate?

9. What benefits are sought by providing new facilities?

   Who will benefit - public, patients, staff?

   Can the benefits be achieved by other means - improve existing facilities, increase staffing, reduce wastage?

OPERATION (by user team)

10. What methods of operation are likely to be followed by the department in future?

    Describe what ought to happen, why, who is involved, when it occurs, where it occurs (in general terms, not particular rooms).

    Indicate policies for administrative, information, domestic, medical, nursing, research, social, educational, safety, and/or supply functions.

    (This policy statement can be expanded as operational and organisational details for the department become clearer.)

    Explain methods using diagrams of sequences of activities. Show relationships between activities and functions.

11. What kind of organisational structure is likely to be adopted in the department in future?

    Indicate means of control and coordination, roles and responsibilities, and patterns of centralisation or grouping.

12. What personnel are needed to achieve the workload and operational policies?

    Are the numbers, types and grades of staff needed likely to be available? If so, are economic and employment factors likely to affect recruitment?

    What alternatives are there to meeting functional needs (eg. mechanisation, simplification, reduction of quality of service)?

PROVISION (design team)

13. What limitations affect provision and design of the facility? Consider site availability and size, legislation, finance, time, personnel, environmental conditions?

    How flexible is their application to this facility?

14. What accommodation is appropriate for the functions and workload proposed?

    Consider needs of expansion, flexibility, phasing and decanting of existing accommodation, environmental conditions, provision for engineering services etc.

15. What space is needed?

    Consider floor area, shape and dimensions of rooms, degree of subdivision, circulation area, provision for plant and storage etc.

SITUATION (design team)

16. What kind of layout is considered appropriate for the functional and environmental requirements?

    Consider linear or deep plan; natural or artificial light and ventilation; arrangement of spaces for convenience, compactness, flexibility, structural suitability; economy of circulation space.

17. Where should the facility be sited?

    Consider accessibility for pedestrians, disabled people, vehicles, goods deliveries; proximity to other services for sharing or support; avoidance of nuisances such as noise, vibration, dust etc; overlooking from other buildings, walkways or vehicles; suitability for phasing of development and future expansion.

18. Where should the facility be located?

    Consider local climate, transport services, relation to other facilities, topography and landscape, urban and regional planning policy (eg. decentralisation), other proposed developments in the area.

LOGISTICS (user team and design team)

19. What supporting services are needed for the department to operate satisfactorily?

    Consider supplies, clerical, cleaning, catering etc.

    Indicate likely consumption or production rate per unit of time eg. meals per main meal time, cubic metres of linen per day etc.

20. What are the traffic implications of the functions and activities proposed?

    Indicate types of traffic, peak hours and maximum traffic intensity, origins and destinations of journeys.

    Consider people, goods, information, waste.

21. What kinds of transport system are appropriate for the traffic loads described?

    Indicate means of transportation, routes, control methods.

    Consider walkways, stairs, ramps, conveyors, lifts, trolleys, vehicles, tubes, telecommunications.

ERGONOMICS (design team with user advice)

22. What <u>environmental</u> conditions are appropriate for the department?

    What existing environmental problems are there?

    Consider noise, pollution, vibration, heat, humidity, radiation.

23. What <u>perception</u> criteria are suitable for the department.

    Consider intensity or level, duration, character, frequency etc. for lighting, acoustics, thermal control, ventilation.

    Indicate degree of control required, suitability for manual or automatic adjustment, response rate to varying conditions, provision for emergencies such as power failure etc.

24. What psychological or physiological <u>responses</u> are intended?

    Consider comprehension, pleasure, efficiency, acquisitiveness, admiration, awe.

    How are responses to be monitored?

    How are environmental conditions to be adjusted to achieve optimum response?

SECURITY (design team and user advisers)

25. What <u>hazards</u> are involved in providing suitable conditions for intended functions and activities?

    Consider infection, fire, flood, pests, theft, explosion, damage, injury, fumes, radiation, decay.

26. What standards or levels of <u>safety</u> are considered adequate for intended working conditions?

    Consider degree of risk, frequency and time of occurrence (day, night, weekends, holidays), costs of protection, legal requirements, insurance conditions, codes of practice, etc.

27. What means of <u>protection</u> or prevention are appropriate to provide safe working conditions and to maintain the facilities in working order?

    Consider insulation, isolation, standby services, supervision, alarm, extinction, barriers, locks, escape provision, chemical means, irradiation etc.

PLANT (design team with user advice)

28. What equipment is needed to enable users to perform the functions and activities described?

    Consider furniture, fixed and loose apparatus, fittings, furnishings, specialised and mobile equipment etc.

    What are the electrical, structural and mechanical implications of the equipment proposed, eg. power loadings, weight and movement?

    What are the cost implications?

29. What installations are required for environment control, supply and communication services?

    Consider type of medium, i.e. water, electricity, gas, steam, air, mechanical or hydraulic power, fuel (liquid, solid).

    What kind of distribution system is considered appropriate, eg. ring circuit/spur, centralised/decentralised, single/dual etc.?

    What methods of control are considered suitable, eg. manual, mechanical, automatic, automated?

    What are the cost implications?

30. What building methods are considered appropriate for the accommodation, environment control conditions, safety standards and installations proposed?

    Consider foundations, structure, cladding, partitioning, floor, ceilings, windows, doors, internal fittings and finishes.

    What are the most suitable materials, shapes, dimensions, surface treatment, quality, methods of fixing, strength, weight or thickness, colour etc.?

    What are the cost implications?

CONSTRUCTION (design team - applies to whole project)

31. What methods of production are proposed?

    Consider demolition; site works (roads, fencing, paths, walling, paved areas, carparks); building assembly (offsite or onsite assembly, transportation and lifting, placing and fixing, finishing and protecting, testing and remedial work); completion and handover (cleaning, inspection, alterations, installations).

32. What programming and control methods are to be adopted?

    Consider financial control, time program, manpower, quality control, supervision, incentives, forms of contract, tendering procedures etc.

33. How are the construction, engineering services and equipment to be maintained?

    Consider inspection, repair, replacement, cleaning, repainting, re-surfacing, etc.

INTEGRATION (planning team - for whole project)

34. What are the priorities in relation to available resources?

    What gap is there between needs and resources?

    How can demands on resources be reduced?

35. What are the conflicts between needs, functional methods and/or methods of fabrication?

    What factors are likely to influence choice of options?

    How are conflicts best resolved?

36. How are relationships between functional or design elements established?

    What combination of options is likely to be feasible, desirable, acceptable, most beneficial?

EXECUTION (planning team - for whole project)

37. What means of communication of proposals and intentions are appropriate?

    Who should be informed/involved?

    Consider reports, meetings, drawings, schedules, models, mock-ups.

38. How is the project to be implemented?

    What tasks are to be performed?

    What sequence of tasks is most suitable?

    How is the project to be phased?

    How are tasks to be allocated?

    What actions are required to execute the project, eg. what, by whom, when, how, where?

39. How are control and feedback of results to be effected?

    Consider social, economic and technical aspects.

    Consider visits, conferences, reports, guidance, standards.

F4 QUESTIONNAIRE FOR EVALUATING A DEPARTMENT

The questionnaire may be used to evaluate either a design proposal or a new department.

The evaluation report introduction should indicate the following:-

A. IDENTIFICATION

Location of department i.e. Name of Hospital.
Dates of design, construction and completion.
Authorities and individuals responsible for design and approval.
Names and responsibilities of members of the evaluation team.
Date and duration of the evaluation visit.
Aims of the evaluation study and the evaluation methods used.

B. INFORMATION

Acknowledgments for assistance given in carrying out the evaluation.
Sources of information used in making the evaluation and/or writing up the report.
Format and contents of the evaluation report.

AIMS

1. PURPOSE of department - What are the stated objectives of department studied? How were the objectives established? Have objectives changed? If so, how? How do staff (and patients) see the objectives? Are they achieved? Identify reasons for failures to achieve objectives.

2. SCOPE: list functional elements of department being studied e.g. records and reception,
   diagnosis and treatment,
   waiting and circulation,
   staff amenities,
   supply and disposal etc.

3. APPLICATION: Could functional methods studied apply in other hospitals or departments? If yes, how? If no, why not?

CONTEXT

4. NEED/DEMAND/WORKLOAD: What 'need' was department planned for? What is current demand? What is potential workload capability? Is it being effectively utilised?

5. CONDITIONS: What existing conditions influenced the operational policies of the department? How? (eg. staff availability, finance).

6. CONTENT: What 'content' was proposed to meet the stated need? What is current content as provided/used? Is it sufficient? If no, what extra is needed? If over provided, what is spare capacity?

ECONOMICS

7. RESOURCES: What resources were available to the planning team - time, financial, knowledge, experience etc? How were they utilised? Were they considered sufficient? If not, why not? What effect did the deficiencies have?

8. EXPENDITURE: What are the capital and running costs of the department? How do these compare with intended/actual costs of other comparable departments? Could savings be made without reducing standards of service? How? Is the department being operated efficiently? How could improvements in efficiency be made?

9. BENEFITS: What have been the benefits of the department as seen by planner ,users (staff, patients, public)? Could these have been achieved by other means at less expense of resources?

OPERATION

10. METHODS: For each function of the department describe typical sequences of activities. (Use process charts where appropriate: indicate WHAT, WHO, WHEN, WHERE etc.)

11. ORGANISATION: Describe the organisation of the department studied (eg. hierarchy, centralisation, roles, control and coordination methods, performance evaluation methods (if any).

12. PEOPLE: List types and numbers of people involved in running department (f.t./p.t.). Are there any problems with staffing eg. recruitment, training, etc.? If so, what?

    Indicate types and numbers of people using the department at a peak period on a typical day. Any 'user' problems, eg. waiting time, lack of information etc.? If so, what effect do they have?

PROVISION

13. LIMITATIONS: What restrictions were imposed on the design of the department (eg. site, existing buildings, capital, finance)?

14. ACCOMMODATION: List main room types and numbers. Indicate provision for growth and change, phasing, decanting.

15. SPACE: State overall area of department in square feet/metres. Give sizes of each room type. Analyse space allocation by types of function or space.

SITUATION

16. LAYOUT: Draw diagrams of department layout. What factors influenced layout - known/assumed? Are there any problems caused by layout? If so, what (eg. congestion, inflexibility, security etc.)?

17. SITING: Where is department sited in hospital in relation to access points/other departments? (Draw simple diagram to explain). Are there any particular problems caused by siting? If so, what?

18. LOCATION: What factors influenced location of department? How well is department located in relation to locality/population served?

LOGISTICS

19. SUPPORT: What supporting services are provided (eg. clerical, supply, catering, cleaning)? Are they satisfactory? If not, why not? Could they be improved? How?

20. TRAFFIC: What types of traffic are involved (eg. people, goods, information)? Are they operating satisfactorily? If not, why not? Could they be improved? How?

21. TRANSPORT: What types of transport system are used (eg. manual, mechanical)? What routes are used? Are there are problems? If so, what? Can they be remedied? How?

ERGONOMICS

22. ENVIRONMENT: What are the surrounding environmental conditions (indicate any particular problems eg. overlooking, noise, pollution etc)? How have these conditions affected the design?

23. PERCEPTION: How do users perceive the environmental conditions in respect of vision, hearing, touch, temperature, air conditions?

24. RESPONSE: How do the users react to the environment? Are they comfortable, efficient? Is it pleasing, interesting? If not, why not?

SECURITY

25. HAZARDS: What hazards (such as fire, infection, flood) had to be designed for? How did they affect the design? What risk situations have had to be met (describe worst cases)?

26. SAFETY: What safety standards were imposed on the design? Have they been met? If not, why not?

27. PROTECTION: What means were employed to provide protection? Have they been effective? If not, why not?

PLANT

28. EQUIPMENT: What types of equipment are used in the department (eg. trolleys, couches, treatment tables etc.)? Are they satisfactory? If not, why not? Could they be improved? If so, how?

29. INSTALLATIONS: What kind of engineering services are provided (eg. water, drainage, gas, electricity, telecommunication)? Are they satisfactory? If not, why not? Could they be improved? If so, how?

30. BUILDING: What forms of building construction and materials are used (eg. structural frame, walls, ceilings, windows, doors, floors)? Are they satisfactory in use? If not, why not? Could they be improved? In what way?

CONSTRUCTION

31. PRODUCTION: What methods of manufacture, assembly and erection were used? Were they effective? If not, what were the problems? How were they overcome?

32. PROGRAM: What methods of project control were used (eg. network planning, cost control, supervision, quality control)? Was the project completed on time? Was it completed within the budget? If not, by how much were the cost and time limits exceeded? Is the standard of workmanship and materials satisfactory? If not, in what way deficient?

33. MAINTENANCE: What methods of maintenance were intended (eg. cleaning, inspecting, repair)? Have they been adopted? If so, have they been effective? If not, why not? What repairs have had to be carried out and why?

INTEGRATION

34. PRIORITIES: What were the priorities in planning, in design, in operation? How were they decided? What are the priorities as seen by users now? How do they compare with the original order of priorities?

35. CONFLICTS: What conflicts were evident to the planning team, the design team, the builders, the users? What factors influenced the range of options available? How were conflicts resolved?

36. RELATIONSHIPS: How were interrelationships between elements determined? Have the elements been coordinated satisfactorily? If not, why not?

EXECUTION

37. COMMUNICATION: How were the design and operational requirements communicated to the planning team? How was the project documented? What deficiencies in communication were evident? With what effects?

38. IMPLEMENTATION: How were the planning proposals and decisions implemented? Who controlled the program? How effective was the program? Were the objectives achieved in terms of time, cost, quality?

39. CONTROL : How are the results perceived by users, designers, planners, public? How have the effects been monitored or measured? How do they compare with other departments/projects? What proposals exist for use of evaluation findings?

APPENDIX G

GUIDANCE DOCUMENTS, EXAMPLES OF FORMAT

G1 Scottish Home & Health Department, Planning Note No 1, Wards, Summary of headings (1963)

G2 Department of Health & Social Security, London, Hospital Building Note No 4, Ward Units, Summary of headings (1968)

G3 New Zealand Department of Health, Hospital Design and Evaluation Unit, Report No 1, Ward Planning, List of headings (1971)

G4 New South Wales, Health Commission and Dept. of Public Works, Joint Guidelines Committee, Guidelines on Ward Planning, List of headings used (1974-78)

G5 New South Wales, Hospitals Planning Advisory Centre, Planning Note No. 1, Ward Units, List of headings (1977)

G6 Department of Health & Social Security, London, Harness Hospital, Design Policy Data Sheets, List of headings (1969)

G7 New South Wales Hospitals Planning Advisory Centre, 'Feedback' data sheets, sample items (1981+)

G1 SCOTTISH HOME & HEALTH DEPARTMENT
PLANNING NOTE NO 1, WARDS, Summary of Headings (1963)

1. Introduction
2. Functions of a ward
   - broad analysis of functions
   - environmental factors
   - diagnostic and treatment facilities
   - reception of inpatients
   - relatives and visitors
   - teaching requirements
   - economy
3. Factors affecting design
   - policy factors
   - size of hospital
   - size of ward units
   - intensive care
   - self-care
   - flexibility in use
   - observation of patients
   - cross infection
   - supply and disposal
4. Examination of functions and development of accommodation requirements
   - detailed functions
   - accommodation for patients
   - accommodation for functions related to patient care
   - accommodation for other functions
   - communications
5. Design considerations
   - general
   - arrangement of accommodation
   - noise
   - room design
   - bedrooms
   - maintenance
6. Engineering considerations
   - eg heating and ventilation
     - lighting
     - electrical services
     - fire alarms

Summary of accommodation requirements

G2 DEPARTMENT OF HEALTH & SOCIAL SECURITY (London)
HOSPITAL BUILDING NOTE NO 4, WARD UNITS, Summary of Headings (1968)

1. Scope
2. General considerations
   - aims
   - medical needs
   - nursing needs
   - patient needs
   - pattern of patient care
   - progressive patient care
   - the problem of infection
3. Planning considerations
   - communications
   - orientation, prospect and external noise
   - need for flexibility and size of ward floor
   - interchange beds
   - ward access and day spaces
   - internal noise and privacy
4. Room relationship and room provision
   - derivation of provision
   - notes on scheduled areas and room heights
   - SCHEDULE OF ACCOMMODATION
5. Room planning data
   - for each room listed in the schedule of accommodation under the following sub-headings:
     - functions and activities
     - location
     - dimensions
     - serviced equipment affecting layout
6. Engineering Services eg mechanical services, lighting etc
7. Terminology
8. References

G3 NEW ZEALAND DEPARTMENT OF HEALTH
HOSPITAL DESIGN & EVALUATION UNIT, REPORT NO 1
WARD PLANNING, Summary of Headings (1971)

1. Introduction

2. Policies affecting planning
   eg size of ward
   versatility
   bed areas
   supply and disposal systems
   equipment
   patients' clothes
   engineering services
   checklist of policy decisions

3. Room relationships
   cycle of nursing activity
   rational arrangement function of nurse working rooms
   patient areas

4. Room design
   each of 15 room types considered briefly for access and layout; simple sketch layouts showing equipment

5. General considerations
   eg fire
   window design
   protection from damage
   wash hand basins

6. Appendices
   glossary
   methods of study
   bibliography and references (25 items)

G4 NEW SOUTH WALES, HEALTH COMMISSION & PUBLIC WORKS DEPT.
JOINT GUIDELINES COMMITTEE, GUIDELINES ON WARD PLANNING
List of Headings used (1974-1978)

P009 Planning principles (children's wards)

R000 Room layouts, Ward General 30 bed
- Basic requirements
  - size of ward
  - patient rooms
  - number of patient rooms
  - concept of progressive patient care
  - team nursing
  - nurses station
  - ward clerk
  - utilities..... and 11 other rooms and spaces

cross reference to HOSPLAN Planning and Design Note No. 1, and HOSPLAN Information Sheet on Dirty Utility Room

- Functional relationship
  - (diagrammatic layout of spaces for single and double corridor layouts)

- Patient bed rooms - general data
  - dimensions, 4 bed and single room
  - observation panels
  - curtain track
  - wardrobes
  - doors
  - corridors

R001 Room layouts - ward single bed room etc
- floor layout with equipment and basic dimensions
- (no cross section or heights shown)

R005 Room layouts - ward sanitary facilities
- centralised facilities
- ensuites
- ensuites for multi-bed rooms
- ratio of facilities per patient
- handicapped facilities

R017 Room layouts wards, general (nominal 30 bed)
- basic ward zone relationships (diagram)
- philosophy
- patients rooms, 1, 2 and 4 bed
- surgeon basins
- psychosecurity
- linen and utility
- ward clerk
- servery
- equipment etc....

G5 NSW HOSPITALS PLANNING ADVISORY CENTRE
PLANNING NOTE NO 1, WARD UNITS, List of Headings (1977)

General Introduction

Foreword

1. Introduction

2. Scope

3. Functions of a ward
   - purpose
   - description of ward activities
   - activity duration
   - people involved
   - sequence of ward events
   - staff and patient movement

4. Accommodation requirements (20 sub headings)
   - eg ward size
     - patients' rooms
     - sitting space
     - sanitary facilities
     - surgeons wash basins
     - dispersed serving and supply
     - corridors

5. Operational policies - checklist (33 headings)
   - eg ward size
     - type of care
     - nursing policy
     - catering service
     - maintenance
     - visitors etc.

6. General design considerations (12 headings)
   - eg general
     - location of wards
     - room relationships
     - observation
     - doors
     - change and flexibility

7. Schedule of accommodation
   - basic
   - additional
   - alternative level of provision
   - shared accommodation

8. Selected bibliography (31 citations)

9. Appendix
   1. Operational policies (on which the note was based)
   2. Patient dependency categories

G6 DEPARTMENT OF HEALTH & SOCIAL SECURITY (London)
HARNESS HOSPITAL DESIGN POLICY DATA SHEETS
List of Headings (1969)

- Scope and workload
  - service provided
  - workload
  - specific exclusions
- Organisation
  - patient element
  - admission to department
  - discharges from department
  - movement of patients
  - pattern of care
    - high dependency patients
    - intermediate/minimal care
  - technical care: treatment
  - basic care needs
    - sleeping accommodation
    - rest and relaxation
    - WCs (excretion)
    - washing, baths, showers
    - clothing personal possessions
    - feeding
  - medical element
    - administration
    - medical service
    - changing/cloakroom accommodation
    - rest/refreshment
    - education
  - nursing element
    - administration
    - staff categories/numbers
    - nursing service
    - changing/cloaks
    - rest/refreshment
    - education
  - domestic element
    - administration
    - service
    - catering
    - flowers
  - relatives/visitors
    - reception/care
    - cloakrooms
    - hours of visiting
    - communications
    - overnight stay
  - other staff
    - categories and requirements
    - physiotherapy
    - radiography
    - pathology
    - pharmacy
    - medico-social worker
    - chaplain

supply (see whole hospital policy)
storage
disposal (see whole hospital policy)
catering

Design data
departmental relationships
activity spaces (in the form of 'activity data')
for sub-unit of 72 beds
for 30 bed section
for 12 bed section

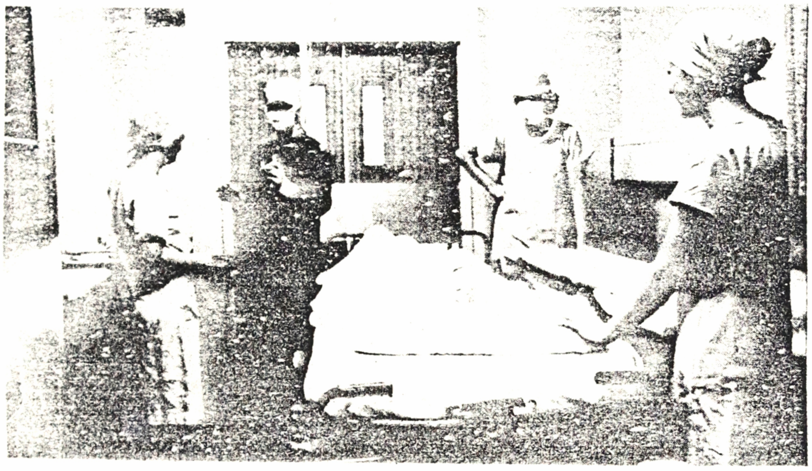
G7 NEW SOUTH WALES, HOSPITALS PLANNING ADVISORY CENTRE (HOSPLAN), FEEDBACK DATA SHEETS, Sample items (rearranged) (1981+)

TOPIC: ANAESTHETIC ROOM CODE: P1. 1. 1

Room size at 3200 x 4100 is too small for three staff and patient on trolley bed. The space is particularly cramped when drawers are pulled out from bench and during transfer to operating table which is wheeled into this area.

RECOMMENDATION:

Health Building Guidelines recommends 3500 x 4000 which is just adequate.



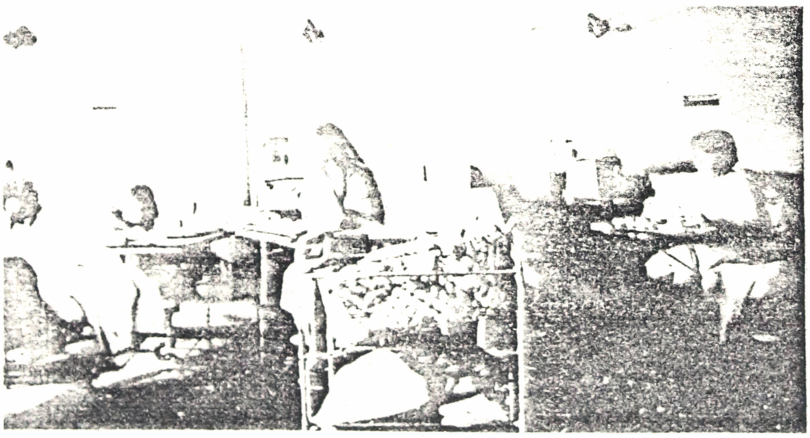
TOPIC: POST-NATAL WARDS CODE: P1. 1. 1

The current trend in post-natal accommodation is towards "rooming-in" of the baby in the mother's ward to facilitate the mother/child bonding process. Present post-natal wards are frequently too small to accomodate rooming-in.

RECOMMENDATION:

Increase post-natal ward sizes to allow rooming-in.

See HOSPLAN Planning and Design Note: Maternity Units.



APPENDIX H

HEALTH BUILDING PROCEDURES

H1 Department of Health & Social Security (London) Health Building Procedure Stages,(Capricode)(1969)

H2 RIBA Plan of Design Team Work Stages compared with the NSW Health Commission Hospital Planning Procedure Stages (1965 & 1969)

H3 Inter-Regional Hospital Board Communications Study Group (Gt Britain MoH), Proposals for Building Planning Process (1963)

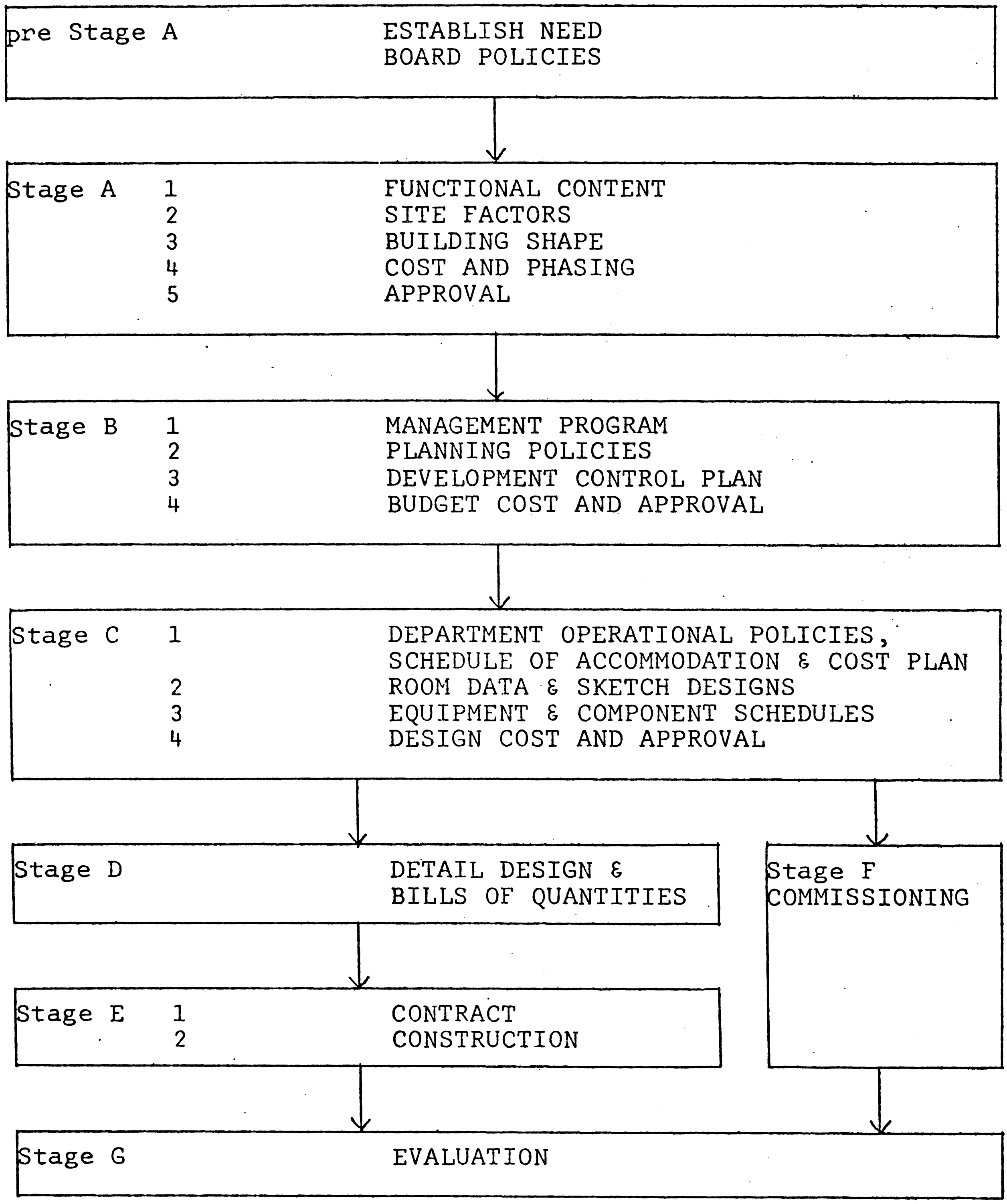
H4 Department of the Environment, Property Services Agency, Plan of Work (1976) compared with RIBA Plan of Work Stages

H5 Building Systems Development and Stone, Marraccini & Patterson (San Francisco), Integrated Building System Procedure for Veterans' Administration Hospitals (1972)

H6 Hardy & Lammers, Process of Planning and Design (1977)

1 DEPARTMENT OF HEALTH AND SOCIAL SECURITY

HEALTH BUILDING PROCEDURE STAGES (CAPRICODE)(1969)



H2 ROYAL INSTITUTE OF BRITISH ARCHITECTS, PLAN OF DESIGN TEAM WORK STAGES, compared with NSW Health Commission Hospital Planning Procedure Stages (1965 & 1969)

RIBA	NSW	
A	1	Inception of project - outline requirements, appoint design team, establish briefing organisation
B	2	Feasibility of project - appraise functional, technical and financial viability, prepare outline brief
C	3	Outline proposals - general layout and construction proposals - outline cost of plan
D	4	Scheme design - complete brief, develop proposals, obtain approvals, outline specification (Brief not to be modified after this time)
E	5	Detail design - final decisions on design, specification, cost plan
F	6	Production information - location, assembly and component drawings, detailed specification
G	7	Bills of quantities - preparation of tender documents, final cost check
H	8	Tender action - obtain tenders and award contracts
J	9	Project planning - plan construction program using networks, bar charts etc
K	10	Site operations - supervise work of contractors, check quality and cost, issue variation orders
L	11	Completion - hand over completed buildings, settle accounts, prepare owner's handbook
M	12	Feedback - analyse management, construction and performance of the building - report back on findings

H3 INTER-REGIONAL HOSPITAL BOARD, COMMUNICATIONS STUDY GROUP (Gt Britain MoH) Proposals for Building Planning Process (1963)

Main points: 1) the need to systematise the design process with the aid of network planning, 2) the importance of inter-professional collaboration between members of the design team, 3) the need to develop briefing methods and agendas for design team meetings, and 4) the stages to be followed in planning and building a hospital. The last mentioned split the planning and building process up into five main stages:

1. Outline of functions

2. a. Operational policies and development plan
   b. Scheme details, subdivided for cost-in-use analysis of alternatives*

3. Sketch drawings
   a. feasibility investigation
   b. preliminary design with further cost-in-use† analysis of alternatives*

4. Completion of drawings
   a. constructional design
   b. production information
   c. manufacture and site fabrication

5. Bring into use

* underlined by writer to emphasise the importance placed on evaluation of design alternatives.

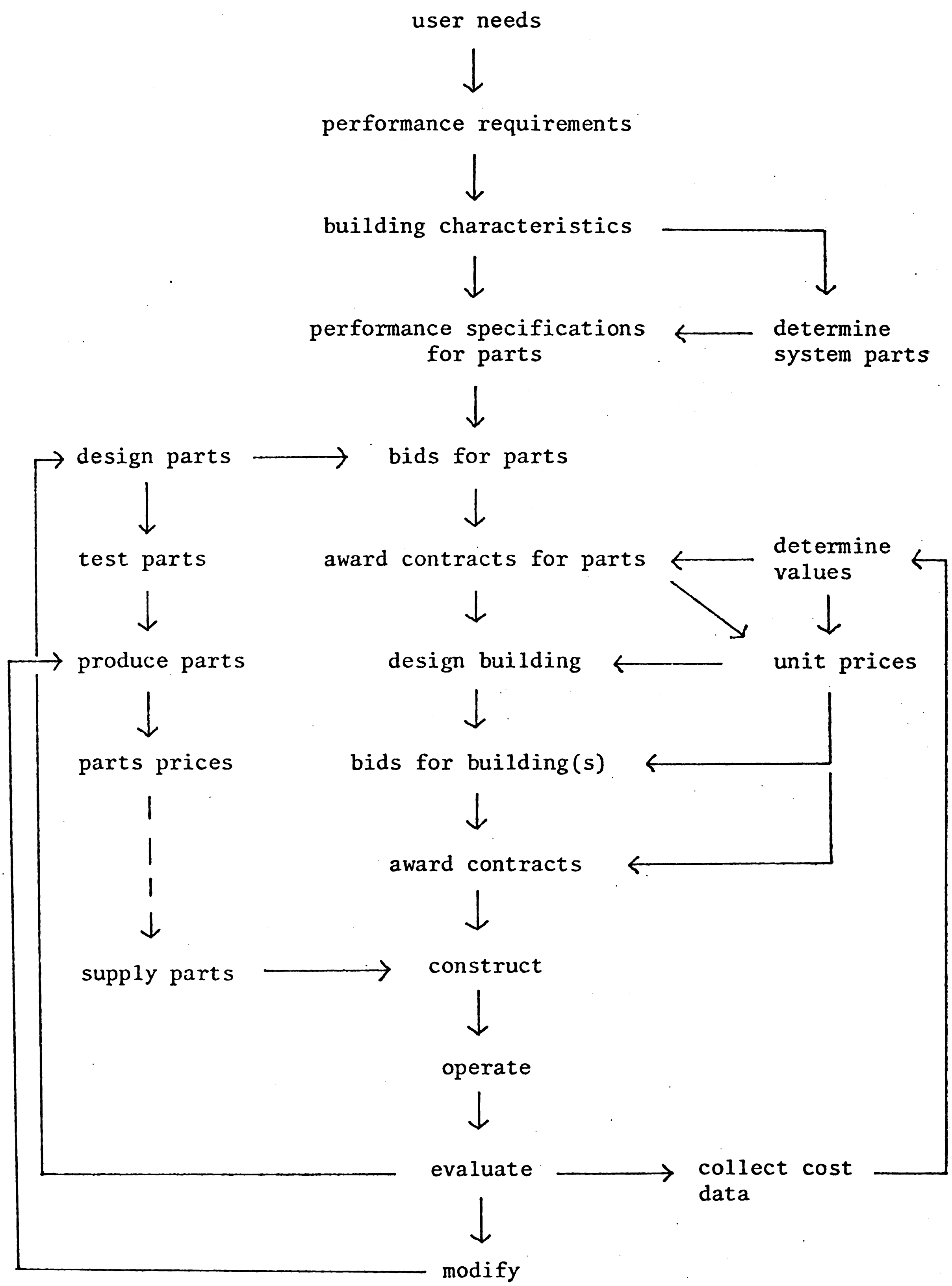
† the term 'cost-in-use analysis' was intended to cover staffing, maintenance and energy costs, but little guidance was given on how this was to be evaluated.

H4 DEPARTMENT OF THE ENVIRONMENT, PROPERTY SERVICES AGENCY
Plan of Work (1976) compared with RIBA Plan of Work Stages

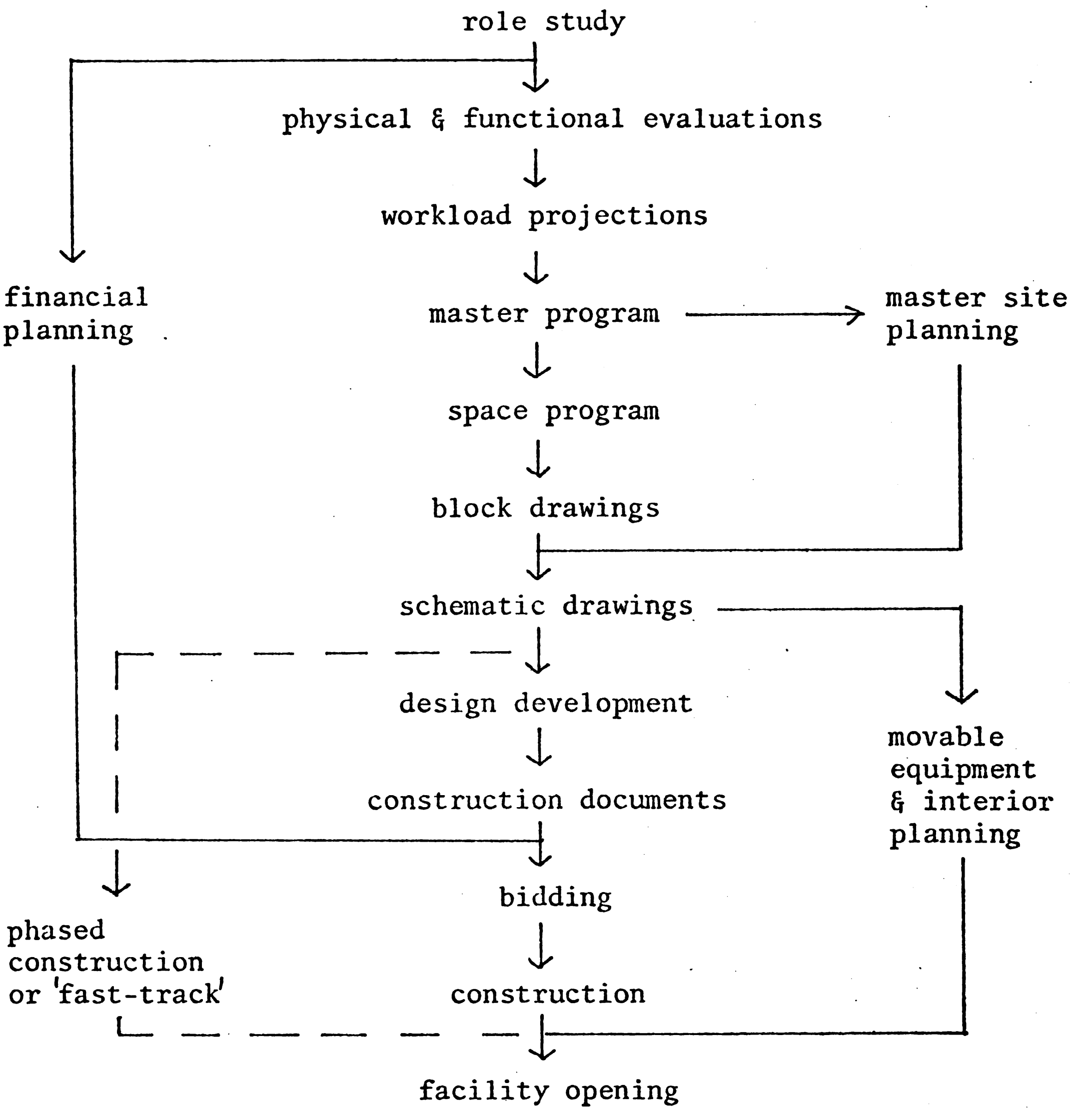
DOE-PSA Plan of Work		RIBA Stages
1. Pre-design	1.1 Need definition	A. Inception
	1.2 Need evaluation	
	1.3 Resource planning	B. Feasibility
	1.4 Site and brief	
2. Design	2.1 Outline design	C. Outline proposals
	2.2 Final sketch design	D. Scheme design
	2.3 Detail design	E. Detail design
		F. Production information
		G. Bills of Quantities
	2.4 Contract preparation	H. Tender action
3. Construction	3.1 Construction pre-planning	J. Project planning
	3.2 Construction control	K. Operations on site
	3.3 Construction completion	L. Completion
	3.4 Contractual completion	
4. Post Construction	4.1 Building operation	
	4.2 Maintenance	
	4.3 Performance appraisal	M. Feedback
	4.4 Improvement, disposal	

By comparison with the RIBA Plan the DOE-PSA Plan of Work gives greater emphasisis in the early stages to definition and evaluation of needs before establishing what resources are available or required. There is however little guidance on briefing in the procedure guide, although reference is made to a Briefing Handbook on such matters as site evaluation and briefing information required before design work can commence. An interesting aspect of the last stage of the DOE-PSA Plan is the reference to improvements and renewal works, and also to the eventual disposal of the building by demolition or sale, points which are often neglected in the planning/design process.

H5 BUILDING SYSTEMS DEVELOPMENT & STONE, MARRACCINI & PATTERSON (San Francisco), Integrated Building System Procedure for Veterans' Administration Hospitals (1972)



H6 HARDY & LAMMERS, Process of Planning & Design (1977)



This process is simplified into six main steps:

1. perception of need for building program
2. need survey and feasibility evaluation
3. organisation for planning, design and construction
4. determining the planning, design and construction approach
5. scheduling planning, design and construction
6. opening the completed project

APPENDIX I

INFORMATION SURVEY QUESTIONNAIRES AND FINDINGS

I1 Summary of main comments on original research proposals

I2 Questionnaire on information practices and problems

I3 Questionnaire on Hospital Lighting Bibliography, and summary of responses

I4 Questionnaire on information usage

I5 Information usage survey; respondents suggestions regarding improving information flow

I1 A SUMMARY OF MAIN COMMENTS ON ORIGINAL RESEARCH PROPOSALS

Copies of the original description of the proposed research project were sent to approximately forty people in the hospital planning and information field in Australia and in Great Britain. Replies were received from about half these people and a summarised selection of comments appears below.

Reply A
1) No usable information system in Australia at present - SfB not helpful.
2) Room data currently used as means of communication between architect and user - an interpreter needed.
3) A thesaurus of hospital planning terms could help.
4) Doubtful about value of standard plans.
5) Need for evaluation studies of buildings in use.

B
1) Query connection between planning process and information retrieval.
2) Suggest concentrate on one <u>or</u> the other.
3) Prefer '<u>process</u>' initially - this can then provide basis for information system.

C
1) Lack of accessible planning information a serious handicap.
2) Planning team's experience is not passed on to other teams.
3) Start study by examining way a <u>brief</u> is written.
4) Dismay at production of detail briefs by some planning teams prior to appointment of design architects - may be due to "political window dressing".

D
1) <u>Patients' viewpoint</u> should be represented in planning decision making.

E
1) Need for centralisation and dissemination of information on hospital planning, construction and equipment.
2) Need for evaluation team to assess validity of information used in planning and design.
3) Dangers of "over-rationalisation" in Australia with varied climate in each state.

F 1) Misunderstanding of doctors' potential role in planning.

2) Political intrigue as enemy of planning.

3) Briefing as main priority.

G 1) Need for economic aspects in decision making to be related to building planning policies eg centralisation v decentralisation.

H 1) Suggest study reasons for 'intuitive' design approach in Australia, eg over-confidence, traditional individuality, undue haste for financial or political reasons.

2) Need to persuade client organisations that enthusiasm is not adequate substitute for careful study.

3) Need to devote more time and resources to planning and research.

I 1) RIBA plan of work unworkable!

2) Need for realistic model of planning process.

3) Briefing should be recognised as an argumentative process.

4) Information systems must be easy to use.

5) With computers there is still a need for normal language to be used.

6) A model of design process can help identify the need for firmness and flexibility.

7) Standardisation versus capability for modification?

J 1) Reference to Anne Plowden's development work on classification of building types and functional spaces.

K 1) Information and communication are main problems from administrative viewpoint.

2) Inclined to concentrate on information indexing, classifying, retrieval, and semantics.

3) Model of planning process could follow.

L 1) Need for information retrieval system and for model of planning process.

2) Systematic model seen as first stop.

M 1) Dissatisfaction with SfB and CI/SfB.

2) Sent proposed classification developments in wall chart form - intended mainly for building process and standard specifications.

N 1) Proposed field of study should be narrowed.

2) Greatest need is for Australian planning process which enables project teams to proceed sensibly - unlike UK!

3) One useful by-product of Harness project may be a recasting of CAPRICODE which makes more sense.

4) Need for a model of planning process to act as vehicle for education of hospital planners.

5) Lack of coordination of members of planning teams due to absence of common language and hence/ dissimilar views of shared problems.

6) Own thesis proposal on 'Briefing' intends to study relation between 'Functions' as briefing topics compared with 'Activities'. Has discovered gaps between planning stages and proposes links between stages to allow use of pre-recorded activity data.

O 1) Problem of semantics - influence on thinking process.

2) Cost differences between town and country need to be considered.

3) Need for central library or information retrieval system - problem of cost of books.

P 1) <u>Briefing</u> seen as priority area; for if improved, then better cost control and greater standardisation would follow.

Q 1) Problem of maintaining balance between long term/ short term aims and hence depth of study.

2) Clients not educated in how to play their part.

3) Architects not given enough time to explore ideas and develop them.

4) Problem of stop/go from Commonwealth and State Authorities - delays work and leads to breakdown of communication at critical times.

I2 A QUESTIONNAIRE ON INFORMATION PRACTICES AND PROBLEMS

Please either ring appropriate words or figures, or write short answer.

A. NAME OF ORGANISATION/INSTITUTION:

B. ADDRESS (FOR CORRESPONDENCE) & TELEPHONE NUMBER:

C. SIZE OF ORGANISATION. (STAFF NUMBERS) - whole time equivalent 1-10 11-50 51-100 101-500 501+

D. NAME OF PERSON(S)

(1) Completing questionnaire

(2) Supplying information (if different)

E. RESPONSIBILITY OR ROLE OF 1) & 2) ABOVE:

(1)

(2)

F. TYPE OF ORGANISATION: Consultant, research, education, information service, government dept., trade, professional institution, local authority, public institution, private institution, other (please specify)

G. FIELD(S) OF WORK: architectural, structural, engineering services, quantity surveying, management, manufacture, building contracting, equipment supplier, landscape design, hospital administration,
medical, nursing,
other (please specify)

H. TYPE(S) OF WORK: general hospitals, teaching and special hospitals, health centres, homes for aged, nursing homes, doctor's consulting rooms, dental surgeries, welfare clinics, industrial building (e.g. laundries),
other (please specify).

I. COST OF BUILDING WORK: per annum, (average over last 5 years) handled by organisation.

Below $1000, $1001 - $10,000
$10,001 - $100,000, $100,00 - $1M
$1M - $10M, above $10M.

J. NUMBER OF SEPARATE OFFICES or departments in organisation (i.e. separately located)

K. NUMBER OF INFORMATION SOURCES in organisation e.g. libraries.......information centres.......filing systems.. ....data banks,..........information officers.........

L. OTHER SOURCES OF INFORMATION used by organisation:-
say yes/no.
technical libraries
packaged information services
current awareness services
enquiry services
manufacturers or suppliers
professional agencies
government authorities
other (specify)

M. IF YOUR ORGANISATION HAS A LIBRARY WHAT DOES IT CONTAIN?

Books, manuals, etc.	number of vols:-
Periodicals & series	no. of titles:
Trade data, catalogues	no. of items:
Other (specify)	no. of items:

Do you employ a librarian?

Part time or full time?

N. WHAT PROPORTION OF LIBRARY COLLECTION IS RELEVANT TO 'HOSPITAL' PLANNING:-

Less than 10%, 10% - 25%, 25% - 50%, more than 50%.

O. WHAT KINDS OF INFORMATION AIDS ARE USED IN THE LIBRARY?

Abstracts, Bibliographies, Published indexes, 'Current Contents', Directories, Home-made indexes, Punched cards, Computers.
other (please specify).

P. HOW MANY OF THE FOLLOWING SERIES OF PUBLICATIONS DOES THE LIBRARY CONTAIN? (give number held in each series).

1. Gt. Britain, Dept. of Health & Social Security (ex Ministry of Health).

   1.1 Hospital Building Notes.

   1.2 Hospital Equipment Notes.

   1.3 Hospital Technical Memoranda

   1.4 Hospital Design notes.

2. Scottish Home & Health Department

   2.1 Hospital Planning Notes.

   2.2 Hospital Design in Use.

3. King Edward's Hospital Fund publications.

4. Scottish Hospital Centre.

5. Building Research Station (UK).

6. Commonwealth Experimental Building Station & Dept. of Works.

7. Standards Assoc. of Australia.

8. British Standards Institution.

9. U.S. Public Health Service, Hospital Series.

10. American Hospital Association.

11. Nuffield Foundation or Nuffield Provincial Hospitals Trust.

12. Regional Hospital Boards (in UK).

Other overseas hospital or building publication series (not journals) (please specify titles).

Other Australian hospital or building publications series:- (please specify titles).

Q. LIST FIVE OF THE ABOVE SERIES YOU USE MOST
Specify in order of usage 1. - most used):-

1.

2.

3.

4.

5.

R. LIST FIVE OTHER SOURCES OF INFORMATION USED MOST
(e.g. abstracts, journals, books, enquiry services - specify titles)

1.

2.

3.

4.

5.

S. WHAT FORM OF CLASSIFICATION SCHEME IS USED FOR ORGANISING DOCUMENTS IN YOUR LIBRARY?

Dewey; UDC / :CI/SfB : SfB:
alphabetical subjects:
other (specify)

T. WHAT METHODS OF INDEXING FOR FINDING DOCUMENTS ARE USED?

pre-coordinate (subject headings)
post-coordinate (key words/terms)
author index (alphabetical)
title index (alphabetical)
shelf list (classified order)
other (specify)

U. CAN LIBRARY INFORMATION BE FOUND

a) QUICKLY, & b) ACCURATELY enough to satisfy your enquirers needs? a) Always/Usually/Sometimes/Never
b) Always/Usually/Sometimes/Never
c)if answer to either a) or b) is 'Sometimes' or 'Never', what is the problem:-

V. IF AN INFORMATION PROBLEM CANNOT BE ANSWERED SATISFACTORILY WITHIN YOUR OWN ORGANISATION WHAT IS NEXT LIKELY STEP?

ask nearest public library; ask professional colleagues; consult govt. dept; consult commercial enquiry service; ask special library (e.g. professional/university; other (specify)

W. DO YOU CONSIDER EXISTING OUTSIDE INFORMATION SOURCES AND SERVICES - Excellent; good; adequate; poor?

X. WHAT IMPROVEMENTS WOULD YOU SUGGEST?

Y. WHAT FORMS OF INFORMATION OR ADVISORY SERVICE WOULD YOU LIKE TO SEE ESTABLISHED?

a) Internationally

b) Regionally (National or State)

c) Locally (town or organisation)

I3 QUESTIONNAIRE ON HOSPITAL LIGHTING BIBLIOGRAPHY

Please return to Mirella Heath, School of Health Administration, University of NSW, P.O. Box 1, Kensington 2033.

A. DETAILS OF RESPONDENT

1. RESPONDENT'S NAME & POSITION

2. NAME OF FIRM/ORGANISATION

3. ADDRESS

4. TELEPHONE NUMBER

5. TYPE OF ORGANISATION
   Tick appropriate word(s)
   - architect
   - education
   - engineer
   - hospital
   - government dept.
   - research
   - other (specify)

6. TYPE OF WORK
   Tick appropriate word(s)
   - hospitals
   - residential
   - industrial
   - commercial
   - educational
   - other(specify)

7. SPECIALISED INTERESTS
   Tick appropriate word(s)
   - lighting
   - design methods
   - social needs
   - clinical needs
   - management
   - construction
   - economics
   - psychology
   - other (specify)

B. GENERAL BIBLIOGRAPHY USAGE

1. What indexes/bibliographies/abstracts do you mainly consult at present?
Tick appropriate word(s)
- Hospital Abstracts
- Building Science Abstracts
- Index Medicus/MEDLARS
- Hospital Literature Index
- Abstract of Hospital Management Studies
- Scottish Hospital Centre Bibliographies
- other sources (specify)

2. Which of these publications do you find most useful & why?

3. Which kinds of information source do you find useful in solving technical/design problems such as selection or design of hospital ward lighting systems?
Tick appropriate word(s)
- indexes
- abstracts
- book reviews
- journal articles
- 'textbooks'
- manufacturers' data
- advisory services
- packaged information
- other (specify)

4. To what extent have you previously made use of published abstracts or annotated bibliographies in finding answers to technical/design problems?
- frequently
- regulary
- occasionally
- not at all

5. How useful do you regard bibliographies/abstracts in providing a key to solving technical/design problems?
- very useful
- useful
- of little use
- no use at all

6. If of little or no use, why do you think this is so?

7. Can you suggest how they should be improved?

C. COMMENTS ON HOSPITAL LIGHTING BIBLIOGRAPHY

1. Have you used the bibliography in identifying sources of information? Yes
   No

2. How useful do you find the bibliography in identifying helpful sources of information?
   very useful
   useful
   of little use
   no use at all

3. Do you find the following items of information (1) useful or (2) superfluous?
   Please number accordingly
   priority rating
   technical rating
   professional interests
   geographical zone of application
   keywords

4. Can you understand the form of presentation of the information in the bibliography?
   very easily
   easily
   with some difficulty
   not at all

5. If you have difficulty in using or understanding the bibliograph - what are the problems?
   layout of information
   keywords used
   arrangement of pages
   size of bibliography
   getting the publication referred to
   other (specify)

6. Are there any additions or amendments you would like to see in this bibliography?

7. If you have made use of information source(s) revealed by the bibliography what was the effect?
   clarified the problem
   new approach to design
   suggested a solution
   led to expert advice being sought
   provided ready made answer
   other (specify)

8. What other kinds of information would you like to see included in a 'bibliography' of this kind?

   manufacturers names
   consultancy firms
   examples of installations
   product data
   more journal articles
   index of current research
   other (specify)

9. What subject would you like to see covered in any further bibliographies of this kind?

   eg. noise control
   fire safety
   cleaning methods
   car parking
   cardiac care units

   ....
   ....
   ....
   ....

10. Are you prepared to provide continual regular feedback, if requested, on your use of this & other bibliographies or similar series?

    Yes
    No

11. Are you prepared to be listed as a source of information yourself?

    Yes
    No

12. If yes, in what ways are you able to provide information, advice, design service etc. (Please specify).

13. Please suggest any additional names/firms etc. who you think would be interested in receiving a copy of this bibliography and questionnaire.

RESPONSES TO LIGHTING BIBLIOGRAPHY QUESTIONNAIRE (summary)

PROBLEMS in use were mentioned by ten respondents:

layout	3
keywords	2
obtaining publications listed	2
unfamiliarity	2
facet arrangement	1
abbreviations	1

SUGGESTIONS FOR IMPROVEMENT included:

- arrange in keyword order
- underline important keywords
- indicate if publication is illustrated
- supply binder for abstract pages
- more spacious layout
- list <u>all</u> libraries holding publications cited
- include abstracts in lieu of or in addition to keywords

OTHER INFORMATION WANTED (on lighting design)

descriptions of installations	21
index of current research	17
manufacturers' names	15
product data	14
journal articles	14
consultancy firms	9
statutory authorities' advisory sections	1
list of branch maintenance offices	1

SUBJECTS FOR FURTHER BIBLIOGRAPHIES
(topics mentioned more than twice)

fire safety	8
noise control	7
cardiac care units	5
operating theatre design	5
intensive care units	4
electrical services	4
communication systems	4
maintenance/security	4
car parking	3
facilities for the handicapped	3

OFFERS OF FEEDBACK on the use of the lighting (and other) bibliographies were given by 26 respondents, of whom 25 said they were prepared to be listed as information services.

I4 QUESTIONNAIRE ON INFORMATION USAGE
(condensed from original interview proforma)

1.1. What sources of health facility planning and design information do you have within your own organisation?

(Probe. Get unprompted and then prompted replies See notes).

2.1 Have you, within the last 3 years, sought information on the planning and/or design of health facilities from sources outside your own organisation.

If "yes" ask for up to 3 examples and apply 2.2, 2.3 and 2.4 to each.

If "no", go to 3.1

2.2 What information were you you seeking?

2.3 Where did you try to obtain it?

2.4 How do you rate the success of your search? Show Card A.

3.1 Do you have any first-hand knowledge of either the absence or non-use of information leading to mistakes in planning or design?

If "yes", ask for up to 3 examples and apply 3.2 and 3.3 to each. Try to establish whether the mistakes were considered planning <u>or</u> design errors. (See notes)

If "no", go to 4.1

3.2 Please state which category (ie. absence <u>or</u> non-use of information) and give a brief description.

3.3 Please try to give a rough estimate of the cost of these mistakes and explain why these costs were incurred. (Probe).

4.1 Do you think the organisations which supply health facility planning and design information should be the same, or different, from those which make and implement policy?

4.2 Why? (Probe)

4.3 How do you rate the acceptability of the following organisations (a) to provide information on health facility planning and design? (b) to lay down policies and/or undertake planning. Show Cards A and B.

Federal Government Department

State Government Department

Regional Office of Health Commission

Professional organisation (eg. A.H.A. Institute of Architects)

Educational institution

National Library

Autonomous national organisation set up for this purpose

Private planning consultants

Other (please specify)

5.1 How do you rate the value of the following kinds of information

a) to yourself personally?

b) as a service to your organisation?

Show Cards A and C.

Advice from specialists/consultants

Bibliographies of books and journal articles using abstracts

Bibliographies of books and journal articles using keywords

Bibliographies with references grouped under subject headings

Computer printouts of references (e.g. MEDLARS)

Evaluation studies of design in use

Guidelines on standards

Mandatory minimum requirements

Names of other people with similar problems

Newsletters or sections of journals giving information on projects, products, research

Personal assessment of other projects

Seminars

'State of the art' studies (i.e. studies of current knowledge on selected subjects)

Unbiased evaluation of manufacturers' data

Other (Please specify)

6.1 Have you, within the last 3 years, worked on any project which has produced information of potential use to other health facility planners/ designers?

If "yes", apply 6.2, 6.3 and 6.4

If "no", go to 6.4 and ask as hypothetical question.

6.2 Would your organisation be prepared to share this information with other firms/organisations?

6.3 If so, please indicate very briefly the kind of information you would be prepared to share.

6.4 How would you be prepared to make this information available?
Show Card D.

By publishing a report	Yes/No
By inviting an objective evaluation by another organisation	Yes/No.
By informal verbal communication and/or correspondence with enquirers	Yes/No
By giving a research/information worker access to staff, meetings, documents.	Yes/No
Other (please specify)	Yes/No

7.1 Do you see any need for education programmes in health facility planning and design for:

(a) Health facility designers (eg. architects, engineers)?

(b) Health facility users on planning teams (eg. medical and nursing staff, administrators etc)?

If "yes" to either, apply 7.2, 7.3 and 7.4

If "no", go to 8.1

7.2 Why? (Probe)

7.3 What should be the purpose of such programmes?

7.4 Assuming that such programmes are multi-disciplinary, what form do you think they should take? (Probe for duration of course, format, content).

8.1 The potential value of information brokerage is under investigation. Here is a list of possible roles for an information broker. Please rate the value of each (a) to you and your organisation. (b) to the improvement of health facility planning and design generally in Australia.
Show Cards A and E.

Information Brokerage Roles

LINK between information sources and users, providing users with one access point to all available information in selected subject fields.

PROMOTER of "information awareness" and of the desirability of sharing information by seminars, education programmes, meetings, discussion groups, clubs, newsletters, journal features.

IDENTIFIER of information needs (by contact with planners and designers) and organiser of means of satisfying those needs, either personally, or by one or more of the methods listed on Card C.

MEMBER of research or planning group responsible for advising on information services, collating information relevant to current and future stages of planning work, and writing up the work of the group for publication.

INSTIGATOR of information provision by the promotion of evaluation studies of design in use and of obtaining feedback from health facility users.

ADVISOR to federal and state authorities on the development of their information systems.

9.1 Please give any suggestions you may have for improving the flow of health facility planning and design information in Australia which have not been covered by your replies to the questionnaire.

I5 INFORMATION USAGE SURVEY,
RESPONDENTS" SUGGESTIONS REGARDING IMPROVING INFORMATION FLOW
(Question 9)

Problems

People work in too much isolation.

Feedback from users to designers prevented by government.

The 'power game'.

No one place to go for information.

Lack of information on who is doing what.

'Excess verbiage', 'useless information'.

Conservative attitude of some hospital administrators - "They don't want to listen to 'Smart Alec' fresh from university".

Reticence of people in hospitals in giving information - "one gets more information from the charge nurse than from professor".

Needs

More communication between people involved.

Community education and open discussion of health facility planning and design issues.

Greater sharing of information between hospitals and projects.

Admit failures and learn from mistakes.

Validate information and keep it simple, relevant, up to date.

'State of the art' reports on specific topics.

Information services to be run by experts.

More publicity on work done by the School of Health Administration.

Greater use of information from overseas and interstate.

Central reference on research on common problems.

Teach people problem-solving techniques rather than overburdening them with information.

More publicity for Hospitals Planning Advisory Centre's services.

More people to be involved in seminars.

Improve communication between architects and medicos.

More national coordination.

List of names of people one can go to for advice on particular problems.

Everyone to publish what they're doing.

'First get on with it' (setting up a system).

Publish cost analyses of projects (information is available in Health Commission but isn't published).

A personalised information service.