A METHODOLOGY FOR EVOLVING SPATIAL NORMS WITH REFERENCE TO ANTHROPOMETRICS & EQUIPMENTS IN HEALTH CARE BUILDINGS.

THESIS
Submitted in partial fulfilment
of the requirements for the degree of
DOCTOR OF PHILOSOPHY

BY
R . CHANDRASHEKHAR.

Under the supervision of
PROF. H. D. CHHAYA B.ARCH. M.TECH. (Planning)

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE
PILANI -333 031 (RAJASTHAN) INDIA
1997

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE
PILANI - 333 031 (RAJASTHAN)
Research & Consultancy Division

CERTIFICATE

This is to certify that the thesis entitled **A METHODOLOGY FOR EVOLVING SPATIAL NORMS WITH REFERENCE TO ANTHROPOMETRICS & EQUIPMENTS IN HEALTH CARE BUILDINGS.** and submitted by **R.CHANDRASHEKHAR.** ID NO. **89 PHX F-014** for award of Ph.D. Degree of the Institute, embodies original work done by him under my supervision.

Signature in full of the Supervisor

Name of the supervisor — **PROF. H. D. CHHAYA.**
B.Arch., M. Tech. (Planning)

Designation — Ex Head of department, Architecture.
School of Planning & Architecture.
New Delhi.

Date — 3rd july 1997

ACKNOWLEDGEMENTS

It is with a sense of deep gratitude and a feeling of immense pleasure that I extend my thanks to Prof. H.D. Chhaya, B Arch M Tech(planning) for his constant help, encouragement and constructive discussions throughout the Doctoral Research Work.

I greatfully acknowledge a very valued academic support by Dr. L.K. Maheshwari, Dean, Research & Consultancy Division BITS.

On a personal note, my gratitude must be expressed to Sh. R.S. Sodhi for his encouragement and infrastructural support.

Smt. Manjula Kansal & Smt. Hemlata had shouldered the major responsibility of illustrations & layouts and the young Himanshu Aggarwal gave a great support in preparation of Graphics and Charts with his computer skill.

Smt. Sushmita Sengupta & Shri. Gurjeet Singh's effort in converting my scribbled pages in to a neat word processed document is gratefully acknowledged. Not only their technical skill and resource fullness been of the highest quality, but their unending allegiance to the development of this document has transcended any human understanding of the term "Dedication"

Finally I would like to thank my mother, wife and children for their constant encouragement and support and great patience shown throughout my work.

R. CHANDRASHEKHAR.

ABOUT THE AUTHOR

The author of this research work is a senior officer of Government of India presently working as **Senior Architect** with **Directorate General of Health Services, Ministry of Health & Family Welfare, New Delhi.** The Research Data and outcome is based on fourteen years of continuous involvement in the Health facilities planning for the Government Hospitals and Health Buildings

During this period he attended a comprehensive short term course of fifteen weeks duration on **Health Facilities Planning** at the **School of Planning and Architecture, New Delhi.** It is here that the idea of working on Ph.D project occurred.

Subsequently, the Author also attended advance studies in design of Health Building and Management in **Medical Architecture Research Unit (MARU)** at **South Bank University, London**, under the WHO Fellowship.

During his tenure of professional work, the Author has designed and guided execution of the entire range of Health Facilities from sub centres in village to the highest referal level hospital. These include :

a) Sub Centre
b) Primary Health Centre(PHC)
c) Community Health Centre(CHC)
d) Block level hospital
e) Rural Hospitals -
f) 100/200/300/400 bedded hospital
g) 500 bedded/Teaching Hospital
h) Super-speciality Hospital
i) Referal Hospital

While the thesis has endeavoured to follow the academic research format and methods, it bases its finding on the field experience.

Purpose of this exercise is to undergo rigorous training in field experience documentation and R&D attitude in identification of issues and development of ideas, norms and design process, so as to elevate the state of Art level in Health Facility Planning.

CONTENTS PAGE NO.

CHAPTER III NORMS IN INDIA AND OTHER COUNTRIES. A GENERAL RE VIEW 47

SYNOPSIS

OBJECTIVE

The advancements in the scientific and technological research has taken the health care skills and facilities to a higher state of art level. In fact, improved efficiency in health care has risen the expectations of patients in the health facilities planning as well. **Needled planning** has to go hand in hand with **resources lead planning.** Besides the improvements in the qualitative aspects, the exponential escalation in the cost of construction of hospitals and constraints of resources have thrown new challenges in effective utilization and conservation of the resources. The onus here is essentially to achieve both the qualitative as well as the quantitative aspects of health care facilities within the cost effective planning. There is no compromise.

The success of the delivery system evolving multilateral expertise of medical care, Health facilities planning and health Administration depends on evolving a balanced strategy which effectively dovetails the various expectation. Presently, these three components of Health delivery system do not operate in a cohesive communication, resulting in a highly underutilized physical facilities with higher cost inputs. This work culture should evolve at the initial stages of operational policy planning where the norms for physical facilities are decided. The Ministry of Health has felt an urgent need to establish up to date norms and strategies on comprehensive and contextual basis in the following three field of health care and physical facilities planning in the year 1983.

I) Norms for A staffing pattern.

II) Norms for Architectural Design for the hospitals at different hierarchial levels.

iii) Norms for Equipments at each level.

The available information on these subjects however, has become obsolete owing to the rapid technological changes in the health-care and its allied fields .Consequently, such changes in technology have had far-reaching effects in the form of changes in equipment usage, in the concept of hospital administration and in the expectation of the community at large which awaited the services of these hospitals.

The proposed research work will be of greater help to architects and engineers in fulfilling the dual objectives of economy and optimum utilisation of space. It is undisputable that any unbalanced space provision also adds to the operational cost. More specifically, the research work has analysed the needs in the specific defined situations such as extreme geo climatic, economic and social condition i.e., plains and hills or plains with extreme conditions or socio-economic issues of extreme kinds. Considering the early stages of research in this field in Indian context, a broad and empirical objective covering the entire spectrum of Health Care Facility norms has been analysed. This has aimed to evolve basic matrices for generating the norms for local condition and they constitute three stages:

a) Identification of the problem.

b) Survey from primary & secondary sources.

c) Identification of the issues & the scope of work.

The research thus arrives at the evolution of a methodology for spatial norms which in turn, would facilitate the design brief in future for the health care facilities in a set of contexts.

BACKGROUND

The shortage of hospital beds in the country has been emphasized by several committees from time to time. The "BHORE" Committee(1943) recommended the increasing of bed-population ratio progressively in two stages. The position was reviewed by the Health Survey Committee in 1960 headed by Dr. A. Lakshmanaswamy Mudaliar.

A panel of experts on Hospital Buildings chaired by Dr. R. Vishwanathan under the aegis of the committee on Plan Projects, Planning Commission,(chaired by the then Ministry of Home Affairs, G.L. Nanda) recommended in 1964, design norms for health facilities, which were consequently followed by the government. These norms have proved to be rather outdated in meeting the rapidly changing concepts in health care facilities. In fact, the Bajaj Committee (1980) has summarily emphasized the staffing and equipment norms.

Standards can provide a valuable means of integrating all aspects of medical and hospital care in government and private sectors in order to avoid major omissions as well as costly duplication.

In situations where technical advice is hard to obtain or where professionals without the necessary expertise endeavour to design and construct the health care facilities, norms, standards and the technical requirement provide guidelines on functional and economic needs. Architects, engineers, doctors and health workers entrusted with the planning and building process find in the standards, sources of information which help them to avoid costly improvisation. The norms and standards are also of greater importance to developing countries like India where expenditure on hospital construction and operation rises enormously under the influence of foreign equipment manufacturers and foreign experts. Taking into account both human and economic constraints, physical planning standards or the spatial norms can be precious sources of reference for the judgement of projects to be provided by foreign country, e.g., specialized services for health facility on turnkey contracts.

THE APPROACH

The research work commences with the analysis of the National Health Policy which targeted, Health for all by the year 2000 and recommended norms for the creation of health facilities.

This was followed by an exhaustive survey and review of available information in the books, research papers and technical publications on the methodology of norm-making. The reviews also highlight the existing pattern of health care facilities by pitting the scenario against the changing patterns of health care system planning and design.

In the course of a WHO fellowship in Medical Architecture Research Unit (MARU) in South Bank University, London, a research review was carried out by the author on the methodology of norms-making. In keeping with similar prior studies in Australia and Singapore, a similitude across these studies was recorded in conclusion to the research at MARU. Significant among this was that the enclosed environment in the British and Australian hospitals being totally mechanically controlled, the space standards suffice in almost any given location throughout these nations. In India, however, **variable** like **climate, population pressure, doctor patient ratio** fluctuate between extreme degrees affecting the resultant scenario. hence, the norm making procedure in India assumes a more significant and necessary role in the manifestation of health care facilities than in their counterparts across Europe or Australia.

WORK IN THESIS

At an outset, **chapter I** deals with the general scenario of health facility in the country supplemented with statistical data on the number of hospitals and dispensaries, and on the health status in the nation. The immanent need for norms and standards is also discussed here categorically.

Chapter II reviews the international literature and technical papers to scrutinize the latest state of art in the field of norms making and derive relevant conclusions from the different methodologies to arrive at the various norm in different countries.

Chapter III describes the norms which are followed in India and abroad, elucidating the similarities and the variations between norms and standards, and its allied terms. Notably in this spectrum of study on norms, the emphasis has been on **Spatial norms**. Other kinds of norms have been only summarily discussed, where they have had a bearing on spatial norms. **It is clearly evident in conclusion to this chapter that the spatial norms are never dealt, perse, in any of the instances and hence, bemoans of these norms a workedout methodology for an apt comprehension of the characteristics .**

Chapter IV has been devoted to two case studies. One of them is the 500-bedded Deen Dayal Upadhayay Hospital at Hari Nagar, Delhi built by the Delhi Administration. The other is the Maidstone General Hospital , U.K. which is based on the famous nuclear concept of hospital building. The analyses of these hospitals bringing out the facts from the field research are reflected in the following chapter.

Chapter V weaves the tapestry which comprises normative planning, architectural programming and the appropriate methodology. It focuses on the validity of statistical spreadsheet modelling to arrive at the objectives.

To configure the all important norms, the service delivery of the entire hospital is divided into three sections:

(i) **Out Patient Department OPD** (where the patient is mobile while the doctors, paramedics and the equipment are fixed)

(ii) **WARDS** (where the patient is fixed while the rest of the attendant facilities including physicians are mobile)

(iii) **Operation Theatre and Laboratory** (where the equipment is fixed while the patients, paramedics and surgeons are mobile)

The discourse has identified broad division of an extreme type and a coastal type of climate to address the objectives comprehensively. It also sums up the total population pressure into two zones, viz., plateau (moderately populated) and desert/mountain (thinly populated).

The variable and fixed components within the broad realms of spatial utilization and functional suitability, which have direct bearing on normative planning are elaborately discussed.

The, questionnaires were used as investigative methods to collect information for activity data sheet after taking: account of the **service delivery** and the **operational policy.** These sheets also in help in identifying two levels of activity possibilities, viz., **activity unit** and **activity sequence**. Inputs from user identification and **work load tendencies** indicate the required **staffing** which produces a numerical requirement of spatial units..(Refer fig. 5.16) From these two coupled with the **activity datasheet,** emerges the **norms for spatial design** of the health care facility in form of a **design brief.** The present research work terminates here. It establishes the methodology which can be used for the specific component.

This work establishes a theoretical framework for generating comprehensive norms. It provides a methodology to be applied with contextual variations to arrive at appropriate norms of the specific components and situations related to health care planning. This is demonstrated here through selective examples of OPD and RADIO DIAGNOSTIC DEPARTMENT

It also purports a two fold future path. One, it provides a field application of an alternate comprehensive methodology for Architects and Health Planners specific to the Indian contexts. The other, it form basis and opens avenues for further research work in the specific areas of health care in India.

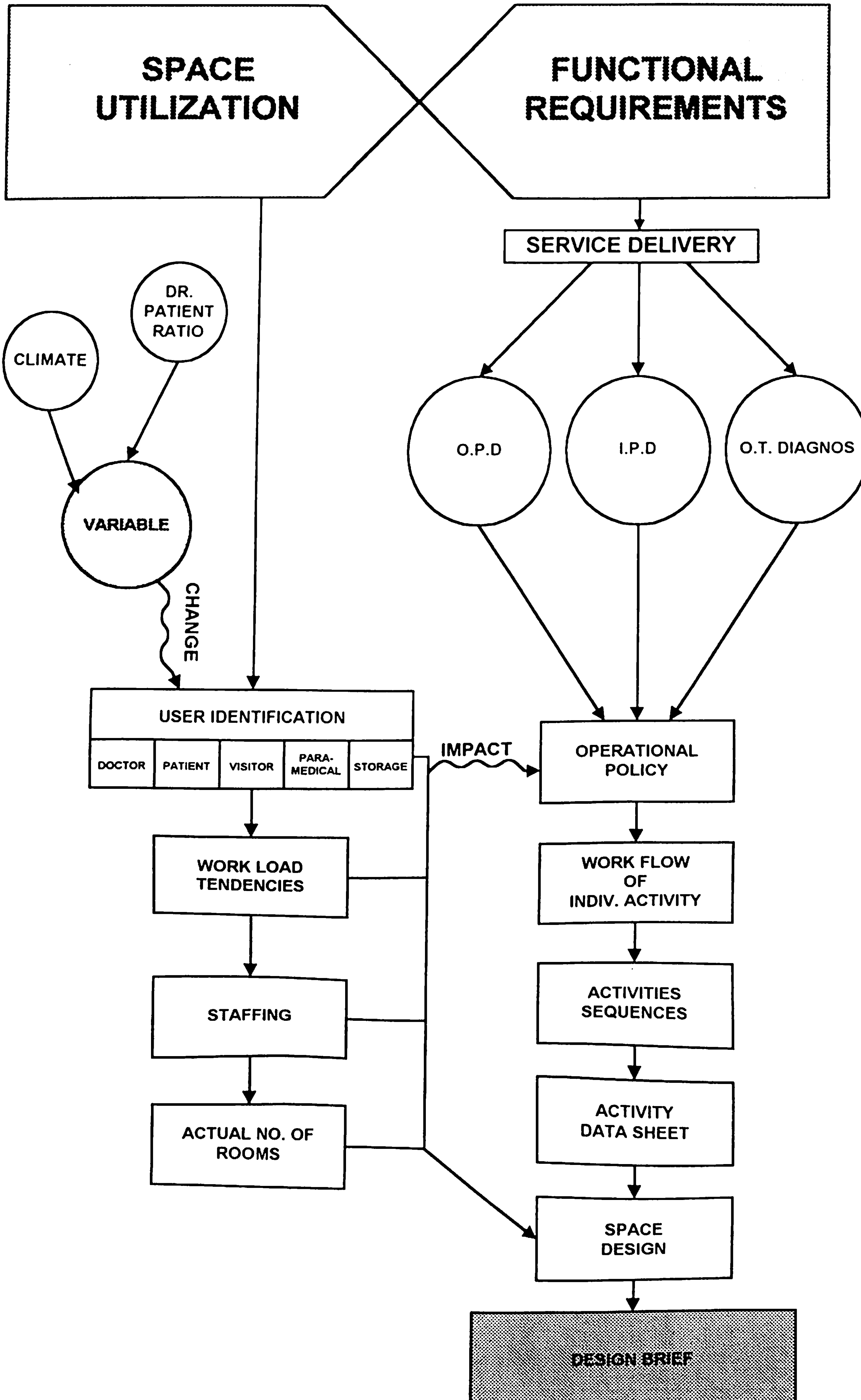

SPACE UTILIZATION
FUNCTIONAL REQUIREMENTS
SERVICE DELIVERY
DR. PATIENT RATIO
CLIMATE
O.P.D
I.P.D
O.T. DIAGNOS
VARIABLE
CHANGE
USER IDENTIFICATION
DOCTOR
PATIENT
VISITOR
PARA-MEDICAL
STORAGE
IMPACT
OPERATIONAL POLICY
WORK LOAD TENDENCIES
WORK FLOW OF INDIV. ACTIVITY
STAFFING
ACTIVITIES SEQUENCES
ACTUAL NO. OF ROOMS
ACTIVITY DATA SHEET
SPACE DESIGN
DESIGN BRIEF

FIGURE 5.16

CHAPTER I

NORMS AND STANDARDS

A HISTORICAL PERSPECTIVE

1.1 INTRODUCTION

Medical Science in India dates back to a hoary antiquity. Much importance was given to health care, which could be realised by the fact that the Ayurveda was an *Upaveda (a branch) of Rig Veda, the oldest written thoughts of mankind. Actually , the antiquity of medicare dates back to the very beginning of the mankind. From an obscure infirmary to the modern hospital, it is a huge qualitative and quantitative leap of concentrated efforts and resultant progress.

Archaeology has shown that there was surprising degree of Medical knowledge in very early periods. "TREPHINING" (Boring a hole in the skull to remove pressure on the brain) was widely and successfully practised in Neolithic Times. Plastic Surgery was known in India in ancient Hindu Society (This art was developed to cover up amputation of the nose-contemporary punishment for adultery) as early as third century BC. Nature cure had its own importance during ancient and medieval periods till the laboratory research dominated the field during subsequent periods. This had also its own effect on the medicare and other facilities. This coupled with vast technological achievements continue to influence design of hospitals and related infrastructural facilities.12

---

* *Every Veda has its upaveda, a subordinate branch of knowledge as follows

Veda	**Upaveda**
Rigveda	Ayurveda
Yajurveda	Dhanurveda
Samaveda	Gandharvaveda
Atharvaveda	Sthapatyaveda

"The philosophy of Natural light and fresh air dominated the hospital plan form of the early 19th century. This philosophy first developed empirically but was later given rational expression. The spread of infection was attributed to gasses or miasmas generated by organic filth. Hence great attention was paid to ventilating system.

The defects of existing Hospital during that time, long mainly in their inadequate standards of Natural light, ventilation space and crowding together into one building of a great number of the sick. In the health sector of our country systematic development and management of hospitals has long been neglected. According to the Constitution of India, Health is a state subject, which implies that the individual states are free to legislate, execute & implement the health care programmes and services as they want to. As a result, there is no uniformity in hospital building design, equipments and staff amongst various states. Lack of uniform policy for hospital management in government hospitals has made management the weakest link in these hospitals, which has resulted in a number of problems in the day to day working, adversely affecting patient care and leading to situation of crisis every now and then. The hospital authorities are not geared to deal with such situations and therefore they tend to make adhoc solutions to tide over the crisis.

Population explosion coupled with medical and technological advancement has only resulted in creating the gulf between what is required and what is provided.

1.2 HEALTH POLICY:

National Health Policy has laid guidelines towards comprehensive and integrated approach to development and strengthening of National Health Care Infrastructure. To achieve this objective it is necessary to strengthen the existing health care infrastructure & make it more efficient and responsive to the health needs and priorities of our country. A number of studies by **INDIAN COUNCIL OF MEDICAL RESEARCH AND NATIONAL INSTITUTE OF HEALTH AND FAMILY WELFARE** on the utilisation of Primary Health Centres (PHC) and other rural health institutions have revealed that these institutions are grossly under utilised. One of the major reasons for this under- utilisation is the non-availability of essential equipments and poor maintenance of the existing equipments and no specific norms have been followed for designing of these PHC's at various location of the country.[48]

1.3 HEALTH STATUS:

Then, there are pressures of ever increasing work load in the Government Hospitals. As a rule of thumb, the work load in a hospital doubles every 7-10 years, which has been arrived at on the basis of **HEALTH INFORMATION INDIA 1993**, of Ministry of Health and Family Welfare. This is applicable to all areas of hospitals including number of laboratory investigations. Forty nine years after independence an average Indian hospital continues to be primitive and under developed . At present there are nearly **13692 hospitals** in the country with approximately **596203 beds** and **number of hospitals per ten lacs is 16** and **number of bed per one lac population is 70.** (Refer Table No.1.1& 1.2) It is inadequate and inequitably distributed.[23] In the present days of inflation., cost of medical care too, is escalating at a very high pace. Then, there is the pressure of ever increasing population, which is increasing at a rate of over 2.25% per year.

Medical care facilities, obviously have to be strengthened to keep pace with the inflation and increasing population. Therefore, management of finances at the disposal of hospital authorities is of great significance because capital costs involving long term investment on building and purchase, repair, overhaul and maintenance of equipments required in various departments of the hospital & recurring costs are increasing at a very high rate. In these circumstances, to maintain the current bed population ratio of **0.7 bed per** 1000 population we need to add 7000 beds annually. If we calculate the capital cost and recurring cost of these additional 7000 beds, it amounts to Rs. 330 crores (Rupees three hundred thirty crores only). This amount is calculated on the basis of capital cost, i.e., building cost & basic equipment cost which is taken as Rs. 4 lacs per bed plus the recurring cost which is taken as Rs.200/-per bed per day.

This is a substantial amount for a country like ours. There is, therefore, an urgent need to analyse as to how best we can be more cost efficient and cost effective. "Despite several development which have taken place in first independence era, an average hospital in the country continues to be neglected & improperly managed institution. A paradoxical situation exists as far as the utilisation of these hospitals is concerned. While the large hospital in cities are over utilised, the rural & Taluka level hospitals are grossly under utilised. Besides, There is a vacuum on any Norms for physical planning of space, planning of equipment and staffing pattern in hospitals". This is mainly because of the gulf in priorities attached to the urban and rural sectors. and the objective is to bridge this gulf.

The Hospitals are being increasingly subjected to public scrutiny. The pressure on Hospitals come not only from the community but also from the Government, the physicians, the patients & the staff unions. Besides there is no hospital policy for the management of the Government hospitals. As a thumb rule the work load in a hospital doubles every 7-10 years. This is applicable to all areas of hospital therefore be it the number of patients in Out Patient Department(OPD), emergency, operations, admission, laboratory investigations or Radiological examinations. The hospital entirely has to cater to this ever increasing work load.

In the absence of any Norms for space, equipment or of staffing pattern, it becomes difficult for a hospital planner or the hospital administration, to make a smooth advancement in the implementation of the project.

1.4 NEED FOR NORMS:

Development in the field of medical science and subsequent innovations, modifications required to the physical facilities provided for health care and hospitals was indeed so great that existing facilities became antiquated immediately or soon after the facilities were commissioned. This was mainly because of lack of coordination between people engaged in research work and people working in the field of health care itself. Now is the time to take stock of the situation since the scenario emerging at the beginning of the millennium asks for the better coordinated and concerned effort towards the optimum utilisation of funds available for providing health care facilities. This objective could be achieved by developing suitable norms designing various facilities.[22]

Appropriate regulations and licensing requirement, established by the Ministry of Health and adequately publicised and enforced, can promote better use of scarce resources & improve solutions to health problems by helping decision makers in several ways.

Where there is lack not only of adequate health planning but also of knowledge as to its exact meaning, standards may provide guidelines for use by health authorities charged with area-wide planning and with the guidance of individual health facilities.

In the recent past the Government of India in the Ministry of Health & Family Welfare, too, has felt the need for setting up Norms for the hospitals in respect of three fields.i.e.

(i) Norms for the staffing pattern

(ii) Norms for the architectural design for hospitals of different sizes

(iii) Norms for equipment.

The main priority however is the optimum utilisation of funds to economise on space and at the same time provide better facilities. 52

The available information on these subjects has become obsolete due to the rapidly occurring technological changes in the field of hospitals, and its equipment changes, in the concepts of Hospital administration and also the changes in the expectation of the community at large which is availing the services of these hospitals.

1.5 NEED FOR STANDARDS:

Standards can provide a valuable means of integrating all aspects of medical & hospital care in Government & private sectors in order to avoid major omissions as well as costly duplication.

Where technical advice is hard to obtain & professionals without the necessary expertise endeavour to design and construct the health care facility, Norms, Standards & the technical requirement provide guidelines on functional & economic requirements. Architects, Engineers, Doctors & health workers entrusted with the planning and building process find in the Standards sources of information which help them to avoid costly improvisation. The Norms & Standards are also of greater importance to developing countries like India where expenditure on hospital construction & operation is rising enormously under the influence of foreign equipment manufacturers and foreign experts. Taking into account both human & economic constraints, physical planning standards or the spatial Norms can be precious sources of reference for the judgement of projects to be provided by foreign country or e.g. Health facility (Specialized services) build on turnkey contracts agency.[22]

1.6 ANTHROPOMETRIC:

There is one universal module present in Health facility planning, **The Dimension of the human body***, (Anthropometric) which dictates the size of the bed, the floor space per bed, the width of doors, the size of accommodation for patients and any dimensions in other departments, such as the height of laboratory, or kitchen platforms, the dimension of operating & diagnostic table etc. As human, technical, economic & legal conditions vary from one part of the country to another, however different constraints are imposed upon planning processes and operating variables; making it difficult to find universal standard however it is necessary to establish some norm to influence investment in hospitals & development of health care infrastructure in the country, which is appropriate up to date efficient and at the sametime feasible to develop and maintain within our resources.(Fig. 1.1, 1.2)

*** Man is the basis, Facilities are means and Health Care is the objective.**

As a guide to establishing correct dimensions for workspaces Singleton (1972) lists some general principles. These may be summarised thus :

* Dimensions should suit at least 90% of the user population.
* Note exact definitions of dimensions, especially 'end points'.
* Note size and kind of population samples used in deriving data.
* Note range of distribution of dimensions given (if possible 'static' and 'dynamic'fit.
* Allow for changes in dimensional characteristics of user population over appropriate period of time.
* Anthropometric data may be used in four ways :
    a) Drawings and Tables.
    b) Manikins or Lay models.
    c) Graphs or Holograms for particular tasks.
    d) Fitting Trials.
* Consider both posture and size.
* In choosing between seating and standing at a workspace consider :
    a) Location of controls and components.
    b) Patterns of activities involved.
    c) Knee space available.
    d) Amount and direction of forces to be exerted.
* In designing seats consider :
    a) Effect of activity on posture variation.
    b) Ease of sitting down and standing up.
    c) Stability and mobility of the seat.
    d) Extent of cushioning appropriate on seat and back.
* Consider variability of working methods and effect on posture and movement of worker
* Restricting movement increases fatigue.

* Allow choice of sitting or standing if possible.
* Different classes of user, e.g. by age, sex or occupation, may have markedly different critical dimensions and lifting abilities.
* Comfort is not necessarily related to optimum work performance.
* Adverse conditions may help to stimulate the worker for short periods.
* Too close a grouping of controls or signs may be more convenient but can cause confusion.
* Visual requirements may cause postural problems, e.g. in turning to look at a dial or indicator.

1.7 NORMS & ITS SUITABILITY:

While working out these norms the past experiences were also used as the inputs as the solutions which are well adopted to one situation may be over ambitious or completely unsuitable under different circumstances for example.

(a) The number of beds needed can not be stated simply in terms of population to be covered: Where as industrialized area may make efficient use of upto 14 beds per 1000 inhabitants, even two beds may be too much for the same number of people in underdeveloped rural areas, frequently remaining empty where there is lack of health manpower & where population by-passes rural Hospital.

(b) The type of building also depends largely on local conditions: A single storey building is certainly the best solution where cheap land is available and there is no electricity hence no lifts.

(c) While the double corridor system with proper ventilation is an acceptable solution in a moderate climate, but it is very inconvenient where a hot climate & lack of air-conditioning calls for efficient cross - ventilation.

(d) A compact surgical suite with beautiful inner and outer circulation, separating clean and soiled traffic, can only functional where air-conditioning is both economical to obtain and to maintain.

(e) While automation used to reduce costly manpower proves to be economical in industrialized cities, it represents an extremely expensive solution where manpower is cheap. Equipments are generally imported and lack of maintenance and non availability of skilled staff leads to complete break down of the automatic system.

f) Centralization of laboratory tests, pharmaceutical supplies and laundries is impossible to obtain where there are enormous distance to be covered, bad roads and un related competing health services.

g) While in highly developed counties children normally stay alone in hospital, in country like India accommodation has to be provided for those who frequently accompany them.

Thus the Norms and Standards to become really useful when it suits the local needs, customs, climatic, condition, population usage as well as available manpower and equipment.8

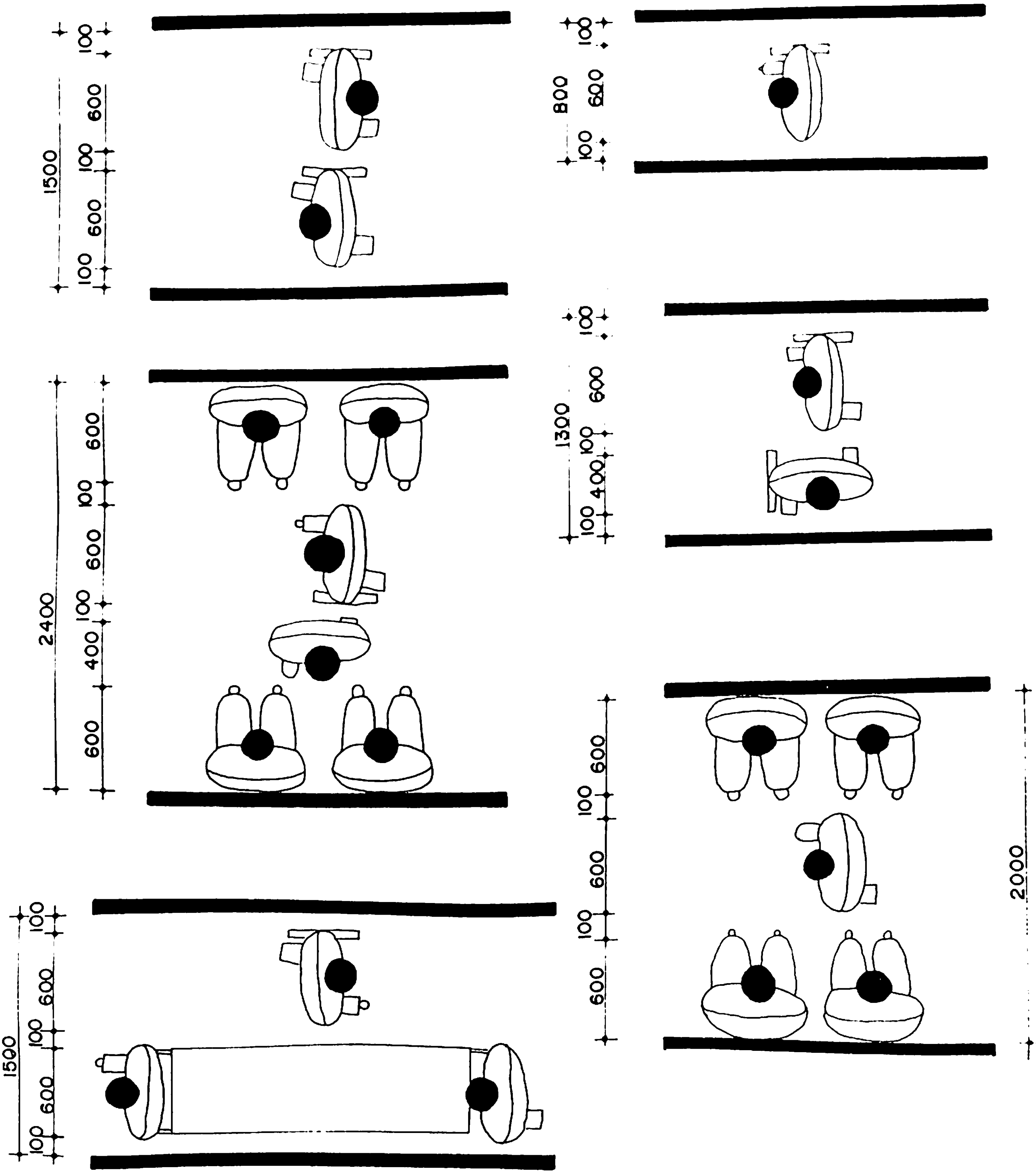
1.8 HYPOTHESIS:

"Therefore the methodology of norms making have been arrived at with set natural constants of the given agroclimatic context of places in a region e.g. India with the constants such as local parallel constant, weather, temperature, relative humidity, skydome, wind etc with variable such as the land, building material" These set of Norms have been developed keeping in mind the requirements of general hospitals at different levels viz.

(1) The Taluka level (50 beds) District hospital (100 to 200 beds) and the large city hospitals(500 to 750 beds) at the tertiary level.

List of various departments associated with various levels of hospital is indicated in Annexure 1.1

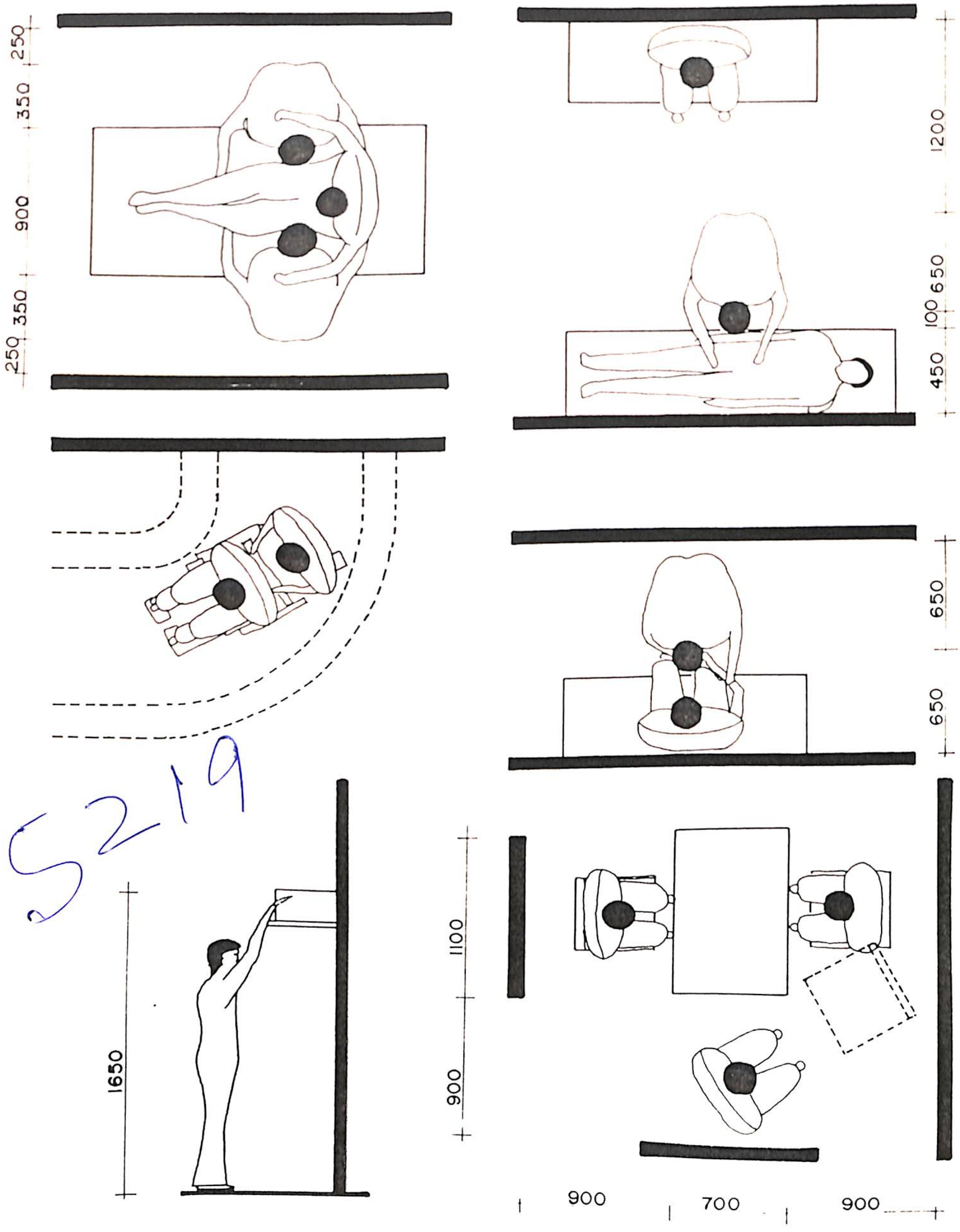
LIST OF FIGURES :



MOVEMENT IN PASSAGES AND WAITING

ANTHROPOMETRIC STUDY

FIG.1.1



ANTHROPOMETRIC STUDY

FIG. 1.2

LIST OF TABLE:

TABLE 1.1

NUMBER OF HOSPITAL AND BEDS ACCORDING TO RURAL/URBAN AREAS AS ON 1-1-1993

S.No	States/U Ts	Rural	Rural	Urban	Urban	Total	Total
		Hospital	Beds	Hospitals	Beds	Hospitals	Beds
1.	2.	3.	4.	5.	6.	7.	8.
1.	Andhra Pradesh	733	9491	1130	17300	1853	26791
2.	Arunachal Pradesh'92	251	1654	11	822	262	2476
3.	Assam'91	151	3949	117	8712	268	12661
4.	Bihar'92	100	3018	228	26072	328	29090
5.	Goa	45	1345	69	2299	114	3644
6.	Gujrat	189	6800	2181	52184	2370	58984
7.	Haryana	8	543	70	6485	78	7028
8	Himachal Pradesh	19	496	38	3356	57	3852
9.	Jammu & Kashmir'89	65	8062	2	140	67	8202
10	Karnataka	25	3015	268	34914	293	37929
11.	Kerla	1443	44103	597	33096	2040	77199
12.	Madhya Pradesh	245	6182	118	11959	363	18141
13.	Maharashtra	469	10209	2646	68711	3115	78920
14.	Manipur	25	925	4	636	29	1561
15.	Meghalaya	0	0	9	1867	9	1867
16.	Mizoram	6	196	11	1108	17	1304
17.	Nagaland	21	257	10	793	31	1050
18.	Orissa	122	3427	162	11067	284	14494
19.	Punjab	75	2330	142	12341	217	14671
20.	Rajasthan	15	1050	203	19415	218	20465
21.	Sikkim'92	0	0	5	575	5	575
22.	Tamilnadu'90	89	4235	319	44545	408	48780
23.	Tripura	12	335	13	1395	25	1730
24.	Uttar Pradesh'86	83	2585	652	44693	735	47278
25.	West Bengal	113	7486	279	47281	392	54767
26.	A&N Islands	2	164	1	412	3	576
27.	Chandigarh	0	0	1	500	1	500
28.	Dadra & Nagar Haveli	0	0	3	70	3	70
29.	Daman & Diu'92	0	0	3	150	3	150
30.	Delhi	4	252	78	18518	82	187
31.	Lakshadweep	0	0	2	70	2	70
32.	Pondicherry'92	0	0	10	2608	10	2608
	Total	4310	122109	9382	474094	13692	596203

SOURCE : DIRECTORATE OF HEALTH SERVICES (HEALTH INFORMATION INDIA 1993)

TABLE 1.2

NUMBER OF HOSPITALS AND BEDS ACCORDING TO OWNERSHIP AS ON 1.1.1993

S.No	States / U.Ts.	Govt. Hospitals	Govt. Beds	Local Bodies Hospitals	Local Bodies Beds	Pvt. & Vol. Org. Hospitals	Pvt. & Vol. Org. Beds	Total Hospitals	Total Beds	Population Served Per Hospitals	Population Served Per Beds
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1.	Andhra Pradesh	141	2554	0	0	1722	24237	1863	26791	36474	2536
2.	Arunachal Pradesh'92	262	2476	0	0	0	0	262	2476	3302	349
3.	Assam'91	141	9687	47	982	80	1992	268	12661	92973	1968
4.	Bihar'92	237	20522	1	49	90	8519	328	29090	263335	2969
5.	Goa	15	1881	0	0	99	1763	114	3644	10416	326
6.	Gujarat	263	20708	76	4779	2031	33497	2370	58984	17765	714
7.	Haryana	58	4796	0	0	20	2232	78	7028	216185	2399
8.	Himachal Pradesh	46	3607	5	58	6	187	57	3852	92434	1368
9.	Jammu & Kashmir'89	65	8062	0	0	2	140	67	8202	106226	868
10.	Karnataka	209	27216	28	714	56	9999	293	37929	156452	1209
11.	Kerala	141	28030	0	0	1899	49169	2040	77199	14455	382
12.	Madhya Pradesh	363	18141	0	0	0	0	363	18141	186656	3535
13.	Maharashtra	445	34261	87	6901	2583	37758	3115	78920	25921	1023
14.	Manipur	25	1461	0	0	4	100	29	1561	64973	1207
15.	Meghalaya	5	1217	0	0	4	650	9	1867	202823	978
16.	Mizoram	13	884	0	0	4	420	17	1304	41944	547
17.	Nagaland	31	1050	0	0	0	0	31	1050	40736	1203
18.	Orissa	250	13077	5	111	29	1306	284	14494	113519	2224
19.	Punjab	174	10786	4	103	39	3782	217	14671	95232	1409
20.	Rajasthan	218	20465	0	0	0	0	218	20465	206909	2204
21.	Sikkim'92	5	575	0	0	0	0	5	575	81200	706
22.	Tamilnadu'90	282	37935	7	479	119	10366	408	48780	133903	1120
23.	Tripura	25	1730	0	0	0	0	25	1730	113553	1641
24.	Uttar Pradesh'86	534	34267	42	985	159	12026	735	47278	166792	2593
25.	West Bengal	242	47252	21	603	129	6912	392	54767	177506	1271
26.	A & N Islands	3	576	0	0	0	0	3	576	97385	507
27.	Chandigarh	1	500	0	0	0	0	1	500	664598	1329
28.	Dadra & Nagar Haveli	1	50	0	0	2	20	3	70	47329	2028
29.	Daman & Diu'92	1	100	0	0	2	50	3	150	34000	680
30.	Delhi	29	9298	21	3756	32	5716	82	18770	119658	523
31.	Lakshadweep	2	70	0	0	0	0	2	70	26653	762
32.	Pondicherry'92	8	2462	0	0	2	146	10	2608	80800	310
	TOTAL	4235	365696	344	19520	9113	210987	13692	596203	61503	1412

* POPULATION SERVED PER BED HAVE BEEN WORKED OUT ON THE BASIS OF ANNUAL ESTIMATES OF POPULATION AS ON 1ST MARCH AND TO WHICH THE DATA RELATES.

SOURCE: **DIRECTORATE OF HEALTH SERVICES.**

CHAPTER II

LITERATURE SURVEY:

2.1 MARU Health Building Research Centre, South Bank University, FUNCTIONAL SUITABILITY AND SPACE UTILISATION Assessment Methods, London. 1986,

This paper contains draft guidance material on functional suitability and utilisation assessment. It has suggested a possible method of approach, without being prescriptive and to demonstrate using worked examples of some of the existing hospitals in UK to indicate how these approaches would work in practice.

The purpose of the Functional Suitability assessments are.

- To identify the suitability of whole site and buildings for the functions housed in them
- To identify those whole sites or buildings which are inappropriate for their present uses ar. ' to indicate what, if any, remedial action can be taken and appropriately at what cost.
- To provide an assessment frame work which will ensure some level of compatibility whilst recognising that health authorities may differ in the level of detail to which assessments are made.

The aspects covered by whole site assessments include:

- Functional content analysis
- Location and relationship to other services
- Site characteristics & usage
- Scale & balance of provision
- Layout & building shape.

Aspects covered by Departmental Assessment include

- Space
- Layout
- Facilities
- Environmental Conditions
- Amenity
- Essential Equipment
- Location within site
- These assessment will also be utilising the possible yard stick of National regional & Local standard, professional judgement of Survey team, experienced user judgements.

2.2 Nuffield Provincial Hospitals Trust & University of Bristol.
<u>"STUDIES IN THE FUNCTIONS AND DESIGN OF HOSPITALS"</u>
Geoggrey Cumberlege Oxford University Press,. London 1955.

This relates to the report of investigation to study the functions and Design of the Hospitals. These were in three principal groups,

- Studies of individual departments
- Studies in physical environment
- Study of Hospital case load

The detail study undertaken were divided in three distinct stages

- Appraisal of Current problems & historical background
- Research on selected and specific aspects
- Design and construction of experimental building, in which result of the Research could be tested and demonstrated.

The three basic areas of the hospital where the book has given detail description & analysis:

(I) **WARD**: Historical Introduction, Studies by investigations which shows

(a) Comparison of this use of space in open ward and corridor type units

(b) The incidence of Cross infection, inadequacies in Ward design and equipment

(c) Utilisation of Treatment room and its importance

(d) Record of Journey's between beds and ancillary room

(e) English and Foreign view of Bed Spacing

(f) Assessing need for simple room in different kind of ward

(g) Assessment of percentage of patient utilising toilets & could sit in Day Space and Nursing Organisation in Wards.

(II) The Out-Patient Department (OPD): The historical background, the outpatient service today. The studies by investigation which shows

(a) Common Pattern of visit to OPD with particular reference to time factor.

(b) Utilisation of common examination room by two consultants and given the patient uninterrupted attention.

(c) Theory on efficient appointment system.

(III) The Operating Theatre suite: Advances in Aseptic techniques and improvement in Surgical Equipment, Distinction between "Clean" & "Dirty" procedures. The size of each room in the suite & its relationship with the work to be carried out in that room, lighting, finishes, colour, Central Sterile supply systems & the system of Heating & Ventilation for comfort of patient.

(iv) The Physical Environment within the Hospital: Day Lighting, Artificial Lighting in ward units, colour, the control of sound, Heating & Ventilation.

2.3 Department of Health & Social Security
<u>SPECIAL TREATMENT CLINIC - A DESIGN GUIDE</u>
UK. September 1974

This document gives guidance on the planning of special clinics as part of the Out Patient Departments(OPD) of district general hospital which are required to provide a service throughout the week for the treatment of sexually transmitted diseases and so must have accommodation for their exclusive use.

The Document describes the general planning principles with relation to other department.

- Layout & Contents of the department
- Engineering Services
- Workflow pattern of male & female patient
- Schedule of accommodation

2.4 Department of Health & The Welsh Office.
<u>"OUT PATIENT DEPARTMENT"</u>
Design Briefing System Note Book. HMSO, UK. 1990.

Design Briefing System. Adopts a disciplined check list approach, identifying the planning decision which need to be made by the project team. The formal as presented in two parts:

The pages on left hand side indicate the design guidelines and Health Building notes and the right hand side indicates the sequence of options implied by the text and are set out in such a way that they may easily be marked for acceptance, modification or rejection.

Hence member of the project team can make their own record of decision.

2.5 Research & Development Unit; Western Regional Hospital Board, "ORGANISATION AND DESIGN OF RADIO DIAGNOSTIC DEPARTMENTS" U.K. Jan 1973

The Research and Development unit of Western Regional Hospital board in conjunction with the Scottish Home & Health Department, has studied in depth, the organisation & Design of general radio diagnostic departments in District General Hospitals.

The Study Group consists of an Architect, Engineer, Physicist, Nurse, Doctor, and two Administrators. The advise of radiologists radiographers and specialist radio diagnostic engineers were taken at all stages of the study.

The study is based on examination of a small number of department in depth rather than examine large number of Hospital radio diagnostic department superficially.

The main objective being to assess, evaluate the existing Radio diagnostic department and to suggest design modification & ascertain to what extent standardisation can be recommended in Design.

2.6 Kleczkowski B.M. & Pibouleaur R
<u>APPROACHES TO PLANNING AND DESIGN OF HEALTH CARE FACILITIES IN DEVELOPING AREAS (vol.1,2,3,4 &5)</u>
WHO,GENEVA 1984.

This book is aimed to bridge the gap between existing knowledge on the subject and its practical applications. The intended audience are National Policy Maker, Architects, Health Facility Planner, Health administrator and Health Manager Teachers and Students of this field who are concerned with the planning of Health Care Facilities in developing countries. This book will be useful for "**National Health Planning**",since they would offer concrete alternatives, togetherwith information on the performance of facilities in given situations". It will also be helpful in providing information on the most"**Appropriate Technologies**" for developing the physical infrastructure of National Health Care Systems and in disseminating them for wider application. The success of achieving objective of book is supplemented by the Case Studies, which is significant. In the present day context this book has the essence of the requisite information which is required by a health facility planner or a policy maker, as the study team co-ordinators, involved in the work are, the eminent personalities in the field of Health Facility and have consulted and involved International Hospital Federation(IHF), and the Public Health Group of the International Union of Architects(IUA).

2.7 Sara O. Marberry
<u>INNOVATIONS IN HEALTHCARE DESIGN</u>
Published by:Van Nostrand Reinhold,New York 1995

This book is a collection of 24 edited presentations delivered by design and healthcare professionals. The 24 were culled from the 115 lectures presented over 5 years at the annual Symposium on Healthcare Design. The symposium is run by the Centre for Healthcare Design in California, founded and run by Wayne Ruga.

The book is organised into five areas (i) past and future trends (ii) the patient experience(iii) the design impact (iv) new design technologies (v) project case-studies. Each presentation handles a different topic and each of them has important and often far reaching points to make.

There was an interesting paper on Vibrational medicine and how as a bio-molecular body we are sensitive to energy fields in the environment including light, colour and sound waves. Ultra-sound, shock wave therapy, infrared and ultra-light therapy, thermal and other types of imaging are already used in medicine. Other papers specifically talked about the impact of noise and music, colour and light. Psychoneuroimmunology(PNI) was mentioned by several contributors. PNI is the study of how the body responds chemically to everything we see, hear or feel. Therefore the environment, which is only experienced through the senses, has an impact on the functioning body.

The negative impact that the environment can have on health, was highlighted by several papers from many different perspectives.

Designing for special care groups such as the children and the elderly was covered from several aspects including project descriptions. Two of the projects described are of particular interest. One was the Lambeth Community Care centre, the other was the Aga Khan University Hospital and Medical Centre which demonstrated a good example of culturally sensitive design.

The aim of the book is to offer the best of the current knowledge accumulated by the Centre for healthcare design. It is achieved by this culled collection of presentations. There is something of value for both the design and healthcare professions, which is its intended audience. It is of value on two counts. It encourages the present status quo to be questioned and rekindles enthusiasm. It also presents some very topical issues of Its timing, when healthservice delivery is undergoing change, could not be better. How effective or relevant the offered solutions are, will depend on how the solutions are adapted to meet individual circumstances and cultural needs. The outcomes can only be evaluated in the future.

2.8 Putsep Ervine.
<u>MODERN HOSPITAL-INTERNATIONAL PLANNING PRACTICES.</u>
Lloyd- Luke Ltd,49 Newman Street,London.1979

The Estonia-born Swedish author was a distinguished hospital planner and architect, having designed hospitals with beds totalling more than 7000. The late Putsep, a WHO fellow, having books published in several other languages, has lectured in Africa, Asia and Europe , and MARU. at London.

The book through it's nearly 700 pages discusses issues relevant to the physical planning of a hospital. In his attempt to do so, the author, besides using his own knowledge and experience, quotes extensively from various publications, the literary as well as the scientific.

In it's opening chapters it discusses elements of hospital planning and health care issues such as medical(health care) needs, wants and resources; regionalisation of health care; health economics; medical practices, expectations and innovations, changing attitudes to health, role of nurses and paramedical and finally the patient in different hospital environment.

The next part deals with actual planning tasks, particularly designing. The need for accurate and technically correct information is stressed, whilst appreciating the obstacles in it's availability and it's temporary validity; and hence the limitations of forecasting. The author laments the paucity, of research into medical service(as opposed to medical science), and therefore of hospital planning information. An interdisciplinary planning approach is called for, involving even the public.

The **biologic**(functional) approach to design, resulting in **anticipatory**(open-end) but a distinct plan, is advocated. Design considerations include variations in hospital shapes, architectural influence, needs of individual patients, hospital areas and economics in relation to construction of a hospital. Examples of hospital building standardisation, construction based on macro elements or universal envelopes, and attempts at unlimited adaptability designs are mentioned.

Hospital infection- it's causes, effects, transmission and measures towards prevention, has drawn significant coverage.

The book deals largely with the physical environment, such as colour, ventilation, floors, ramps, walls, ceilings, doors and lighting; engineering and electrical installations; and finally the then new technology, i.e automatic data processing and monitoring. It also discusses in depth, planning of the clinical service areas, such as the acute and critical nursing units, laboratory and radiology (imaging and therapy) services, operation and delivery (Obstetric) departments, and the ambulatory care, day care and emergency departments. The mortuary and animal facilities also find a brief mention.

The author aims to spread information on hospital(health building) planning issues, so that the built environment is based on sound design thus playing it's part effectively in delivery of quality medical care.

Though the book is intended primarily for the hospital(health) architects and planners, it is more than useful for even health care professionals with developmental and managerial responsibilities, or any other professional connected with development of a health care facility.

The result after consulting various specialist doctors and planners, is a lucid anecdotal compilation of technical information utilised in planning of a health facility in various parts of the world. It is not prescrptive in nature, but merely an attempt to highlight the principles underpinning planning of a hospital and it's functioning.

NURSING ZONES :

Earlier it was understood that nursing care is best in the own house, where a nurse was hired to look after the patient. Slowly and steadily this concept has changes and nursing zones have become the un-detachable part of the hospital. Hospital status is measured with the bed strength of the hospital. Extensive systematic experiments have been responsible for the growth of Nursing Zones.

CLINICAL ZONES :

Rapid changes have taken place for the design of operation theatre since early 1950s. Area of operation theatre has become a significant place in the hospitals. Operation theatres are directly concerned with the bed strength of hospital which resulted in the innovation of day surgeries . Ultra clean air system has been designed to check the infection in operation theatres.

SUPPORT ZONE:

Support zone is also a very important part of the Hospital. Its purpose is to satisfy the needs of the hospital like, supply of linen, sterile supply of instruments, food and other day to day needs of the hospital. Enormous area is required to house these activities. Location of support zone has become a significant factor in planning the hospital and its expansion programme when the hospital grows.

PROCEDURES FOR PLANNING AND DESIGN :

Design of hospital is not so much a matter of fresh ideas but a process of refinement and improvement of solutions with concentrated attack on the new problems. Hospital come in all shapes and sizes. The variety of different ways in which planning design, production and delivery can be organised and this would justify further experiments which is a non-ending process.

This book is able to achieve the aim and will always be a guide to planner and architects in the field of health facility to the present day context.

2.9 Paul James & Tony Noakes
"HOSPITAL ARCHITECTURE"-critique
Longman Building Studies, Longman Group(UK)Ltd.,Essex UK1994

This book Aim's to inform upon the current design of the world's Health Buildings by refferring 28 hospitals constructed over the 10 year period from 1984 until 1994.

Architects and professionals concerned with the design and procurement of hospitals ranging from small community units to large teaching hospitals are the targeted audience.

The book describes about creating new and better working environment for patients & staff, which prioritises patient treatment & care-questions the functionality, quality, aesthetics & the patients'(and staff) relationship to the effectiveness of the design.

Examples offered are on a broad conceptual basis and grouped by three principle zones- nursing, clinical and support. A diagram analysing the functionality or zoning strategy is presented and prefixes a table containing the basic site and healthcare provision data. The opening chapter concentrates on the pressures affecting hospital design e.g. "The technical success of the hospital depends on the case in which they can grow and develop as medical technology, treatment activities and processes advance." It suggests the use of a **Development Control Plan** to manage phased developments or construction.

The authors argue that adaptability (in particular engineering services) is crucial to the ultimate flexibility and therefore life of the building. The introduction also discusses location and its effect on design, merits of vertical or horizontal developments, energy efficiencies, Organisational setup and the need for proper facilities & maintenance management.

A well produced book which clearly sets out the factors influencing the design of hospitals. An architect's book for architects, Patients reactions are limited to the UK design examples.

However, a very useful reference book which sets out key issues and shows significant design examples from the developed world.

2.10 Hugh Gains Borough & John Gains Borough
<u>PRINCIPLES OF HOSPITAL DESIGN.</u>
Published by Architectural Press, London 1964

This book considers design from all perspectives & all current thoughts and newly developed schemes . This Book is aimed at Designers, Architects and Clinicians forming the design team. It suggest the Potential Future trends and examines the methodology used.

It describes the basic issues like design is for the patient or the clinician, do the clinician appreciate the needs, views and expectations of the patient. It also describes about the function of hospital and how is it likely to change in next 20 yrs. How will it be managed and what is the best size and from what perspective. It investigates the reduction of beds and increase in outpatients and also the describes the flexibility in provision for relative and visitors space.

It has critically examined the openward concept with the issues like noise, privacy, observability, climate and cross infection. It also indicates appraisals of recently built schemes, the ward and its associations, pros and cons of bed arrangement. The author favours the single bed concept but recognises as not practical. It also analyses the Ward's functions like Nurses' station, a hygienic requirement of the ward, the kitchen and delivery and disposal system.

The contemporary ward development has been described in detail with a analysis of contemporary design, also consolidating the lessons learnt and comparison of long ward vs Short ward vis-a vis its orientation and Deep Plan. The inter-departmental functional relationship and its association with the high rise or horizontal development.

Similar detailed description for Operating Theatre Suite, the Diagnostic centre the Outpatient, accident and emergency departments have been described.

The Book is concerned with the future of the hospital. It seeks to consider all the criteria which may be used in design for future hospital facilities, to suggest future trends and promote flexibility. It recognises the limitation of its thoughts on shortage of nurses also emphasizes there is no solution of anything and everything is already out of date. But the information provided must be used to improve the future.

2.11 D Costin and M Warner
<u>FROM HOSPITAL TO HOME CARE</u>
WHO-King's Fund Centre, U.K. 1991

This book is the outcome of 1991 conference which was held Cardiff to review the role of Technology to enable sick people to be care for at home rather than in Hospital. The purpose was to stimulate a critical debate among those who are actively involved with health care policy concerning the application of technology to home care as an alternative to acute hospital treatment.

The definition of acute home care :

a) "Provision of Equipment's and Services to the patient in the Home for the purpose of restoring and maintaining his/her maximum level of comfort function and health"

Counsel of Scientific Affair US 1990.

b) "Provision in the home of levels of diagnosis and care associated with hospitals"

Lida Marks UK 1991.

The book explain following reasons for movements of Health Care out of the hospital to the community and to the patient's home.

- Improved home environment
- Patients dislike of hospitals
- Dangers of hospitals
- Changes in medical technology
- Assumption about cost effectiveness
- Demography/inability of hospitals to cope with the elderly

EXAMPLES OF ACUTE HOME CARE:

- Renal and peritoneal dialysis
- Intravenous infusion of antibiotic cytoxic drugs or pain killing drugs
- General and parental nutrition
- Respiratory therapy including use of ventilators and oxygen cylinders / concentrator
- Home monitoring of patients
- Intensive nursing and rehabilitation therapy

THE TYPES OF HOME HEALTH CARE:

A) Acute home health care

- Early discharge after hospital treatment
- Rehabilitation after ordinary or day surgery
- Occasional intensive therapy within cornice illness

B) Continuous home health care

- To avoid hospital admission (specially of children the elderly) wherever possible
- To bring about supportive self management (for example diabetes) and sucessful aging
- Palliative and terminal care

THE DIFFICULTIES IN MOVING TO HOME HEALTH CARE:

- Will home care policy be carried out cheaper with primary motivation to save money
- Will it pose extra and acceptable burden on careers,it is wrong to assume that all carrers which to have sick relatives at home
- Will the patient/career have any genuine choice in the matter or will home care become an irreversible bandwagon in which there is no effective choice.

2.12 The Peterborough Initiative
<u>HOSPITAL AT HOME,THE COMING REVOLUTION</u>
Service Developments- Issue, U.K. October 1989

In the UK interest HAH developed in the mid 1970s; it was stimulated by the work of a social worker Freda Clark. Her ideas were themselves based on observations of a successful French initiative the hospitalization Domicile Service in Bayonne.

The best British experiment in HAH provision is the Peterborough that started in late 1978. Initially the Peterborough HAH scheme that was set up with the direct involvement of 2Freda Clark was organized much along of the Bayonne model. It was at first separate from the established district nursing services. This proved unsatisfactory it was soon restructured and it is now integrated with the district nursing establishment. It serves a catchment area of over 200,000 people admitting 300-400 patient a year.

The mean characteristics of the scheme are:

1) it is open to anyone (except midwifery and psychiatric patients) who's General Practioner (GP) and district nurse will accept medical and nursing responsibilities for them.

2) Patients should use the services either as an alternative to hospital admission or as an aid to early discharge

3) Once admission has been agreed the district nurse asses the nursing care required and liaison with the HAH patient service manager who coordinates admissions staffing and support

4) each patient receives at least 2 visits every 24 hour from a team member who provides treatment and reassesses their condition. If additional nursing care is required it is provided

5) ALOs in a Peterborough hospital at home"bed" is about 11 days. Once accepted patients usually stay in the scheme until they are ready either for complete discharge from NHS care or transfer to the regular district nursing services.

2.13 Hospital At Home in France

<u>HOSPITAL AT HOME, THE COMING REVOLUTION</u>

Servoce Developments-Issue, U.K. OCTOBER 1989

first major French HAH initiative began in 1961 in Paris and independently in Byonne. Originally designed for cancer ill patient to die at home but since have developed into wider services of particular value to elederly and chronically ill patients. The Bayonne model has become the best known hospital at home services. The Bayonee service is reported to be popular with both patient and informal carers alike.

The area of South West France it serves has a population 1/4 million,1/5 being aged over 65 years and 1/10 75 years old.

One important reason for why hospitalization domicile has being able to expand and meet the consumer choice for home care more easily than NHS is because the funding arrangement available. In France insurance schemes guarantee support for a given number of HAD places regardless of other services costs whereas in the UK district has a limited budget covering all hospitals and community services cost. This means that the introduction of desirable innovations like HAH may be prevented by inability to cover periods of double cost outlay during transitions from one services pattern to another.

CONCLUSION:

The idea of Hospital at Home is not a new one, in the other hand its development is very slow. The diversity of the fundamental health systems for example ;public, private, insurance etc. makes it difficult to see a compatible implementation for comparison and measuring its success.

In France because of the insurance system it proved successful.. However the French spend nearly 50% more of it's GNP on health care than the UK. In order to implement HAH successfully then a National Strategy for Home care is required. Furthermore is the Training and education of the health care profesionals so they could adopt to it quickly and easily. Finally harnessing patient empowerment groups and giving incentives to business for making use of the home based Technology.

The information given in the two booklets are dated 1989 and the book is dated 1992, I believe more up to date research was done and would give more superior knowledge on the issue to health planners and managers.

2.14 Tom Health
<u>METHOD IN ARCHITECTURE</u>
Tom Health Jhon Wilay & Sons New York 1984

A comprehensive theoretical account of architectural practice. Problem solving theory is applied to the empirical study and description of day-to-day architectural activity. The treatment through out is descriptive rather than mathematical the first half of the book describes the condition under which architects work : The kinds, quality and structure of the knowledge available to them, the social, Industrial & professional setting of architectural practice and the value of architects.

This is, in problem- solving terms, the "task environment" of architecture. The remainder of the book describes what architects actually do and how they do it and shows by the theoretical analysis of case, study that there is not just one architectural method, and that method is not specific to each individual task. The operational level of method, which links the over all strategy and the many techniques used in detailed design, is discussed, with particular emphasis on briefing or programming & on decision processes & economy in the design process; Conventional approaches are strongly criticised.

The book concludes with short account of detail design and its relation to the strategic & operational levels of method.

This edition of Health, United States continues the approach used during the previous 2 year by emphasizing trends and comparisons over time. Once again, the detailed tables emphasize age-adjusted data. This was necessary for two reasons. First, the elderly constitute a growing proportion of the U.S. population and second, several demographic subgroups of the population have different age structures. By adjusting for age data can be compared more easily over time and for different groups.

2.15 Manuel Marti JR
<u>SPACE OPERATIONAL ANALYSIS</u>
Publisher Corp. USA 1981

This book deals with :

a) Architectural Programming

b) The Project Programming

c) Building Programming

In the form of descriptive chart and graphics explaining the comprehensive basic Architecture Services. It also deals with the Architectural Office operational functions. The designs process has been explained keeping the practical approach in mind. It deals also with existing systems and techniques. After analysing each issue the author has arrived at SPATIAL PROJECTIONS DATA SHEET AND PROJECT EVALUATION DATA SHEET.

2.16 Todd Wheeler
<u>HOSPITAL MODERNIZATION AND EXPANSION</u>
Mcgrawhill Book Company N.Y.

This book deals in detail, the Evaluation method right from evaluating site and its surrounding and building including each and every aspect of the building and ultimately concluding with Evaluation Sheets describing each and every activity such as :

a) Construction

b) Fire Safety

c) Heating and Cooling

d) Electrical

e) Plumbing

f) Beauty and Appearance etc.

2.17 <u>U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES.</u>
Health United States 1981

It presents, in a single volume, statistics concerning recent trends in the health care sector and detailed discussion of selected current health issues.This report was compiled by the National Centre for Health Statistics with the assistance of the National Centre for Health Services Research, Office of Health Research Statistics, and Technology.

This report is divided into two parts. Part A consists of several analytic articles on selected topics of current interest in the health field. These articles are not intended to cover all the important health issues. Many significant topics are not addressed because of constraints in report size and data availability. Part B consists of 79 detailed statistical tables that are organized around four major subject areas-health status and determinants, utilization of health resources, health care resources and health care expenditures - and includes a guide to the detailed tables. There are also two appendixes that provide descriptions of the data sources and a glossary of terms.

This edition of Health, United States continues the approach used during the previous 2 year by emphasizing trends and comparisons over time. Once again, the detailed tables emphasize age-adjusted data. This was necessary for two reasons. First, the elderly constitute a growing proportion of the U.S. population and second, several demographic subgroups of the population have different age structures. By adjusting for age data can be compared more easily over time and for different

ABSTRACTED FROM:

1. Committee on Plan Project
REPORT ON GENERAL HOSPITAL
Ministry of Health, Govt. of India, 1964.

2. Bureau of Indian Standard
BASIC REQUIREMENTS FOR HOSPITAL PLANNING Part - I
BIS Delhi 1988.

3. Dr. I.D. Bajaj
REPORTS OF THE HOSPITAL EQUIPMENT STANDARDISATION COMMITTEE
Directorate General Health Services, New Delhi. 1980.

4. G.A. Popov
PRINCIPLES OF HEALTH PLANNING IN THE U.S.S.R.
WHO Geneva 1971.

5. U.S. Department of Health & Human Services
HEALTH : UNITED STATES
U.S.A. 1981.

6. **THE PLANNER'S RESPONSE**
Mcgraw Hill Publications N.Y.

7. Manual Marti Jr. P.D.A
SPACE OPERATIONAL ANALYSIS
Publisher Corp. USA 1981.

8. **SCALES OF ACCOMMODATION FOR ARMED FORCES HOSPITALS**
Govt. of India, Min. of Defence, New Delhi 1982.

9. R.Llewelyn Davies & H.M.C. Macanlay
HOSPITAL PLANNING AND ADMINISTRATION
W.H.O, Geneva 1966

10. B.M.Kleczkowski & R.Piboulean
APPROACHES TO PLANNING & DESIGN OF HEALTH CARE FACILITIES IN DEVELOPING AREA VOL. 2.
W.H.O., Geneva 1977

11. Deptt. of Health & Welsh Office
HEALTH BUILDING NOTE
HMSO Publication , London 1990

12. E. Todd Wheeler
HOSPITAL MODERNIZATION AND EXPANSION
McGraw-Hill Book Company, N.Y

CHAPTER -III

NORMS IN INDIA AND OTHER COUNTRIES

A GENERAL REVIEW

3.1 INTRODUCTION

The Govt. of India is committed to achieve the objective of **ALMA ALTA declaration** i.e. health for all by the year 2000 A.D.[48] The present strength of the countries hospital is about 13,692 with over six lakhs beds, with a bed population ratio 0.7 bed per thousand as per the **Health Information India 1993 of D.G.H.S.** and at the same time it is inadequate and inefficient.[23]

The guidelines laid by the National Health Policy(1983) is toward the comprehensive and integrated approach to development. It also advocates to strengthen the existing Health Care Infrastructure and to make it more efficient and responsive to the health needs in relation to its priority of a specific region of the country. Health being a state subject under the constitution of India, the various states of the union have their own policy norms and standards.

3.2 NEED FOR NORM

Govt. of India in the Ministry of Health felt the need for setting up the norms in the following fields:

1. Functional Programme
2. Functional and Space Requirement.
3. Man-Power Requirement
4. Instruments and Equipments
5. Building Requirement.

The above requirement will serve as a guideline for planning of the hospitals, each specific for the different types and levels of hospitals, where every specific norms vary from the contexts to contexts.[49]

3.3 DEVELOPMENT OF STANDARDS

Generally the standardisation is only the broad guidelines in the preparation of functional brief for a hospital for its man power requirement, material requirement and architectural design as every hospital has its own environment, culture and characteristics. The fast and increasing changes in the field of Medical Science and Administration and the changes in the community, the availability of data becomes obsolete and need to be revised very often.

Development of standards is an ongoing process. The revision of these standards also account for innovative techniques, changes in govt-regulations, advancement in technical knowledge and the demand by the consumer and thus standard is established to identify the need to measure or improve quality of proper aspect of medical care of service.

3.4 DISTINCTION BETWEEN THE NORMS & THE STANDARDS

As a health facility planner and especially in the evaluation of Medical care and activity of health establishment, it has become necessary to have clear distinction between **The Health Norms & The Health Standards.**[53]

"Scientifically established indices of environmental conditions of the medical care requirement by the community of various groups of population and health facilities with utilization value are covered under **Healthnorm.**" The following basic types of health norms are identified and practised globally.

1. **Hygienic Norms**, such as the maximum permissible concentration of atmospheric pollutants, toxic substances in water etc.

2. **Sanitary and epidemiological norms**, covering the inspection of industrial undertakings, eating houses, dwellings water supply systems, etc prophylactic immunization epidemiological investigations etc.

3. **Norms for the requirements of the community for medical care,** covering outpatient care, supervision at follow up centres (the number of attendances per person per year) hospital care (the percentage of patients hospitalized, the proportion of the population hospitalized) etc.

4. **Norms for attendances for treatment** (the co-efficient of repeat attendances, i.e. the average number of attendance for treatment per first consultation).

5. **Productivity Norms** such as the work load per hour of physicians and staff in establishments of various types.

6. **Norms for the requirements for drugs and dressings.**

7. **Spatial norms** dealing with Architectural Planning of different related spaces.

In contrast the term "**Health Standard**" covers indices relating to the resources required to meet the needs specified by the Norms i.e. indices related to the public health facilities and the availability of medical care, the main types are:

1. Standards for the organization of medical care establishments, such as sanitary and epidemiological stations pharmacies, etc.

2. Standards for the average length of stay of patients in bed;

3. Standards for the average bed occupancy;

4. Standards for the numbers of hospital beds, both for beds of all types and for beds for the various specialities.

5. Staffing standards and model staff lists;

6. Standard for the total number of medical, paramedical and other public health personnel required.

7. Standards for medical and other equipment.

8. Standards for soft furnishing furniture, household equipment and transport.

9. Construction standards for quality of construction & materials used with respect to its local byelaws.

10. Financial standards for the upkeep of public health establishments.

The norms and the standards are optimal in character. They are Medical health needs at a given state of development. These norms and standards are in a dynamic concept to their population and resources. The Norms which are developed on the basis of practical experience are known as design norms and standards. They are empirical in nature. The norms and standards developed on these basis are approved by the Ministry of Health, The design norms and standards get revised, so as to make optimal returns in relation to the demands and the inputs.[53]

Norms and standards in the health facilities has close association with space, time, people and equipment within the homogenous and definable parameters.

3.4.1 SPATIAL NORMS

Of these Spectrum of Norms our study would be confined to "SPATIAL NORMS" and other Norms will be studied only incidentally in so far as they will have bearing on the "SPATIAL NORMS".

The process of norms making is dynamic in nature. It operates at the following scales:

a) **MICRO LEVEL:** Optimization of efficiency and economy among the various departments within the hospitals limited to space time and Eco-cultural zones.

b) **MACRO LEVEL**

1) Development in Health Facilities in time

2) Spatial inter relations and active co-operations among various agencies within the country and among the global agencies with varying norms and stands.

3) The local parameters of the sponsoring agencies which make the basis for the norms.

While the norms and standards may have their base in the local situation, they are flexible enough to the dynamics of Micro and Macro situation.

The objective of this thesis is to focus on the process of Norms making rather than specific of standards and norms. However the end result of the space and building instructor standards would be utilised for the choice of an appropriate process for Norms and Standards.

3.5 STANDARDISATION OF SYSTEM & PROCESS

The Hospital is defined as integral part of a social and medical organisation and is supposed to deliver the complete health care for curative and preventive aspect to the entire population. Out patient services should reach out to the family in its own home environment. The birth and growth of the hospital is based on the advancement of the civilization. It is supporting the cause of man's right to well being. It has the support and recognition of the community of the given social structure of the place. Its moral responsibility for providing the means for keeping him well or restoring the lost health.

Health care is service area in Hospitals where input consists of people who deal with health problems and other resources available for it. While output consists on improved health, alleviation of suffering and restoration of functional capacity of the patient.

Medical decisions are the governing factors for health care delivery and decision may be arrived at by different approaches to the one given problem. The variation of the process is accompanied by variation in the cost and the outcome of the care. The proverbial cost explosions in health care are due to unnecessary hospitalisation on injudicious use of diagnostic tests. Hence the difference in health care process results in variation in the outcome of the care. It is commonly desired that there shall be reduction in variation. A common method to reduce variation is standardisation of system and process. To achieve standardisation, the guideline to be followed should be of a time- honoured method. It is imperative to note that the facilities ones provided on the assumed norms were only augmented from time to time. This bridges the gap between growing needs of the society due to population explosion and on the other hand advancement in the medical sciences and technological requirements.

3.6 EVOLUTION OF STANDARD & NORMS

For the quality assurance of a product and its services, the standard provides the right basis. Standards are evolved by the consences principle and generally they are followed faithfully by those who implement it and also by those who are concerned with them. The Standards will ensure quality and norms, a guideline as the case may be like in Hospital planning, sterilization of medical devices, method for disposal of wastes in Hospitals could be implemented at the hospital level. The quality of medical devices could be ensured through the implementation of standards at users level, manufacturer's level and guarantee through the government agency. Hospital planning is an important area where standardisation would be of immense benefit to the country. The most significant exercise in this direction was the report of the **Col.R.D.Ayyar "Hospital Equipment Standardization Committee"** in 1963. It included the minor Hospitals of 10/25/50 beds and the major hospitals of 100/250/500 beds. The equipment required has been identified. In addition to the general instruments, equipment & furniture, the needs of 15 identified special departments ranging from ambulance service, Out Patient Department (OPD), Clinical Examination Eye & Ear, Nose and Throat (ENT) department to X-ray and Neuro departments have been listed. Subsequently Sh.S.K.Patil committee report submitted in 1964 as **"Committee on Plan Projects"** giving detailed exposition of the various factors governing the planning and construction of Health Care facility. In this report the panel has given careful consideration in fixing up requirement of different section of the hospitals and has given direction to planners and engineers for adopting these **"SPATIAL NORMS"**. The report is not clear about the methodology adopted for formulation of these SPATIAL NORMS. There is no indication of volumetric consideration of these SPATIAL NORMS.[19]

3.7 CATEGORISATION OF HOSPITAL

However for the purposes of proportioning facilities the hospitals are divided into the following three categories:[52]

a) Small Hospital - Bed strength unto 25 beds

b) Medium Hospital - Bed strength from 26 to 100 beds

c) Large Hospitals - Bed strength over 100 bed.

It is inferred from the reports that these have been formulated with the inputs given by the experts participating in the committee and on the spot studies. No specific mention has however been made regarding methodology or process of making Norm. In 1980, **Dr. I. D. Bajaj committee Report** additionally covers 750 bed hospitals and provides for both teaching and neon-teaching hospitals.[20]

3.7.1 ARMED FORCES HOSPITAL NORMS

In the year 1982, **Ministry of Defence** formulated **Scales of accommodation** for Armed Forces hospital. For the purpose of scales of accommodation they were grouped into different bed strength. The smallest unit of Hospital in three services namely Section Hospitals, Sick bays and Station sick quarters which have bed strength upto 24 beds are grouped as one type of hospital. Other types of hospitals are classified under different hospital bed slabs viz.

a) 25 bed to 49 beds

b) 50 bed to 99 beds

c) 100 bed to 199 beds

d) 200 bed to 399 beds

e) 400 beds to 599 beds

f) 600 beds and above

A separate scale of accommodation is also formulated for bed strength upto 24 beds.

These norms do have a set methodology. Norm is based on a space module. A viable space planning module of 14 sqm based on basic space unit of 3.50 sqm has been stipulated in order to rationalise the requirement for various facilities in hospital. The space planning module is derived by assuming planning grid of 1.6 m Six such grid units i.e.., 3.2x4.8 m will lead to a carpet area of about 14 sqm after deducting the wall thickness. This could be further sub divided into 3 grid units for bed space in general ward and 1.5 grid units to cater for smallest need of toilets etc. Various table of the hospital scale indicating the floor space are arrived at on the same basis as mentioned above.(Refer Fig. 3.1,3.2 & 3.3)

Separate scale of Accommodation for Married and Other Than Married (OTM) has been stipulated A conversion factor of 120% is to be added to total floor area requirement to arrive at plinth area.

3.7.2 THE BUREAU OF INDIAN STANDARD

(BIS) have a separate Division council, namely "Medical Equipment and Hospital Planning Division" council for formulating national standards in the field.

Through its 19 Technical Committees, the Bureau of Indian Standards is presently engaged in the formulation of national standards for medical instruments and equipment, codes for maintenance & servicing, tests and calibration, general requirements, etc. Already more than 1000 standards have been formulated in the field of medical instruments about few years ago, the Bureau took up work on "Hospital Planning" on the recommendations of the Conference on Medical Instruments & Equipments held in New Delhi in March 1986. This area was also identified as a thrust area by the Bureau. Some work had already been done by the Bureau for hospital buildings. However, it was felt that the standards for hospital planning should include manpower requirements, instruments and equipment besides physical requirements.

Keeping this in view as also the need for standards for a 30 bedded hospital, commonly known as community health centre, the concerned Technical Committee of the Bureau formulated a standard on the subject on a priority basis.

In the area of hospital planning, Indian Standards for classification and matrix for various categories of hospitals has been published according to which general hospitals have been divided into five categories, that is 30, 100,250,500 & 750 (teaching & non-teaching) bedded hospitals. An Indian standard for basic requirements for general hospital buildings has also been published covering administrative and hospital services department building; medical services department buildings and engineering services department buildings.

For proper planning of the community health services which are normally set up with 30 beds, an Indian standard has been formulated for basic requirements of 30-bedded hospitals. There is proposal to develop Indian Standard for primary health centres besides preparing standards for basic requirements of 100,250,500 and 750 bedded hospitals.

For preparing national standards on hospital planning, the Bureau of Indian Standards has constituted Hospital Planning Sectional Committee (CPDC38) which has representation from hospital administrators, hospital planners, architects and technical experts from concerned disciplines.

The Committee's programme of work includes formulation of standards for planning various categories of hospitals including physical, space, staff equipment and building requirements.[52]

3.7.3 INDIAN STANDARDS ON BASIC REQUIREMENTS FOR HOSPITAL PLANNING: PART I UPTO 30 BEDDED HOSPITAL

This Indian Standard (IS12433 (Part I):1988) is mainly meant for community health centres having upto 30 beds. It includes requirements, such as functional programme, functional area, workflow, manpower, instruments and equipment. Certain essential requirements for building services and environment have also been included. As no single standard can meet the requirements of different regions in the country representing plains, hilly terrains and diverse geo-climatic conditions; an attempt has been made in the standard to cover the minimum needs for a 30-bedded hospital which could be suitably adjusted to meet the specific needs and priorities of a particular region or community.

3.8 CONCLUSION

As per the Health Information of India'93 there are about 13692 hospitals in the country having about 596203 beds and 27403 dispensaries with about 25173 beds; of these, about 50 percent are government owned. This number is elated for a substantial increase as a result of substantial provisions made for the health care sector in successive Central Plans. In the private Sector, hospitals are progressively becoming an industry with professional management. Their number too will increase. While everyone should care for the health of the people, caution should be exercised about the proliferation and unplanned growth of health care facilities. Norms and Standards would help regulate this process on health lines.

The norms and standards followed in different countries vary due to various determinants which include climate, topography, physical environment and the most important Gross National Product (G N P). Though it is necessary to know, what is happening in other countries all over the world,finally it is up to our own planner to devise appropriate norms for our own typical environment governed by typical working conditions for the given region.

3.9 INDICES OF MEASUREMENT OF HOSPITAL UTILISATION AND RELATED DEFINITION

Various Indices are commonly used in the assessment of hospital utilisation, but no one of them alone can give a full picture of the utilisation pattern in a certain area or country, further they are all affected by a multiplicity of factors, & their use must therefore take in to consideration, the particular circumstances of the area concerned. The different indices may be calculated on a gross or a specific basis A gross index is an index expressing the overall average utilisation.for all types of hospital in the area. The specific index , on the other hand, expresses the utilisation of certain type of hospital or of a certain services within the hospital. The various indices may be classified under two main headings.

(a) Those relating to data concerning the hospital, such as the number of beds, bed days & admissions, discharges,& deaths.

(b) Those relating to population at risk.25

3.9.1 HOSPITAL BEDS

A hospital bed is one, regularly maintained & staffed for the accommodation & full time care of a succession of inpatients, & is situated in wards or areas of the hospital where continuous medical care for inpatient is provided. The total number of such beds constitutes the normally available bed complement of the hospital.This bed complement excludes the cots for normal,healthy new born babies in maternity wards but includes incubators & bassinets for premature babies.

3.9.2 ADMISSION

Admission refers to the number per year of acceptances by a hospital of patient who are to receive medical care while in residence therein & who are expected to remain for one or more nights. Normally healthy new born babies are not counted as inpatient admission, but babies requiring special care should be included among the admissions.

3.9.3 DISCHARGE & DEATHS

The annual number of discharges includes the number of patient who have left the hospital (cured,improved etc.). The number who have transferred to another health or social institution, & number who have died.

3.9.4 BEDS DAYS OR PATIENT DAYS

"Bed days" or " Patient days" is the unit of measure denoting the service rendered to one inpatient in the hospital census between one day and the succeeding one. Sometimes the day of admission and the day of discharge are counted as one day.

In other cases a full day is counted only when admission is before mid day, or discharge is after mid day. Thus the data given should be the annual total of the daily census of occupied inpatient beds through out the reporting year. Patient days should not include data for healthy new born infants.

The General Notation are

1. The bed compliments = B.
2. The annual number of admission = A

   Which can be replaced by the sum of Discharges, Deaths. (D +d)
3. Annual number of hospitalised patient day = H.
4. The daily average of bed occupied $= N = \frac{H}{365}$

3.10 INDICES RELATING TO THE HOSPITAL

Average Length of Stay (L): This index indicate the average period in hospital (in days) per patient admitted. Ideally, this figure should be calculated as follows.

Cumulative number of bed-days of all discharges patient (including those dying in hospital) during one year divided by the number of discharges & dead patient. This calculation takes in to account the bed days of patients in the year (or year) previous to the under consideration, but disregard the bed days of patients who were still in hospital at the end of the year. 24

It may be said, therefore, that the result of this method of calculation represents the true average length of stay per patient; & it is recommended that this method be used,at least in long stay hospitals.

There are various other methods adopted by different countries. Following are some of the formulas currently in use:

(a) $$\frac{\text{Total number of bed days in the year}}{\text{Number of admissions in the same year}} = L = H/A$$

(b) $$\frac{\text{Total number of bed days in the year}}{\text{Number of discharges \& deaths in the same year}} = L = \frac{H}{(D+d)}$$

(c) Total number of bed days in the year divided by half the sum of admission & discharges deaths in the same year.

$$L = H \times \frac{1}{1/2\ (A+D+d)} = 2 \times \frac{H}{A+D+d}$$

These three methods mentioned above, result in a figure representing average Length of stay per patient per year,which is not the same as the average period of stay per patient admitted.In Hospitals in which the patients stay is usually short, the two figures are practically identical and either may be used in whereas hospital in which patient stay for relatively longer periods, or in cases in which changes in bed compliment have occurred during the year, the average length of stay is more correctly calculated by the first method described above.

A new method of assessing the length of stay in hospital derives from the distribution of patients by number of days spent from the day of admission.This can be done by counting, on a survey day taken at random the number of days all the patients have spent since their admission.

It is possible to obtain a graphic curve that expresses the number of patients in relation to the number of days spent between the admission day & survey day. this curve shows a maximum that corresponds to a value that can be called,"**average time after admission**".

This value is practically identical to the average length of stay. It happens that the curve shows two maxima, because the patients are composed of two group, the acutely ill,with a short Length of stay & the long term patients.

The advantage of this method is that it is possible to select during a ward round with a clinician a homogeneous group of patients & to disregard those who suffer from chronic disorders & those who are kept in Hospital for Social reasons.

It is also possible to study separately are category of patient those suffering from pleurisy, for instance & to determine their average length of stay. To obtain a higher standard of accuracy the Survey can be made at intervals.

3.10.2 BED OCCUPANCY RATE(O)

This figure expresses the average percentage occupancy of the hospital bed .Which is calculated by dividing the daily census of occupied beds) by the bed complement (nominal number of beds in the establishment) and multiplying by 100.

$$O = \frac{N}{B} \times 100 = \frac{H}{365 + B} \times 100$$

The bed-occupancy rate reflects the ratio between beds used & beds provided.Opinions differs regarding the wisdom of using this mode of presentation,& some would prefer to use as a denominator the actual number of beds used (including any additional beds)rather them the bed complement.On the other hand, it would appear preferable to use the bed compliment as a denominator since a bed occupancy rate of 100 or over would call the attention of administrator to a disproportion between the number of beds provided & the number used. Furthermore, it some times happens that the need for additional beds is only seasonal in nature,in which case a month by month analysis would enable administrators to plan ahead for meeting this continency. A persistently high occupancy rate all through the year would, on the other hand, call attention to a possible shortage of beds. [8]

Occupancy rate should not be thought of solely as a measure of administrative efficiency. Although it is reasonable to expect that services such as "Cold" Orthopaedic surgery, in which admissions can be controlled should achieve high occupancy rates such as 90%, while the other services, such as accident care and children's services, in which a faintly low occupancy rate is necessary perhaps 75% to ensure that emergency admission is always possible. Thus, the establishment of occupancy rate is an instrument of medical and social policy. (The other form of expressing the same term is explained in 3.10.4.3)

3.10.3 TURNOVER INTERVAL(T)

The turnover interval expresses the average period, in ɗ that bed remains empty, in other words, the average time elapsing between the discharge of one patient & subtracting actual number of hospitalization days from the potential number of hospitalization days in a year & dividing the result by the number of discharges (&deaths) in the same year.

$$T = \frac{B \times 365 - H}{D + d}$$

The turnover interval is zero when the bed occupancy rate is 100 and becomes negative when the bed occupancy rate is over 100.In order to be meaningful, the turnover intervals should be calculated separately for the various type of hospital & especially, for the various wards of the hospital. A very short or negative turnover interval points to a shortage of beds whereas a long interval may indicate an excess of beds or a defective admission mechanism.

3.10.4 INDICES RELATING TO THE POPULATION AT RISK

The object of calculating indices relative to the population at risk is to know to what extent the population utilizes the hospital services; therefore it is necessary to know the number of people that this population comprises. This number can easily be found when two conditions are fulfilled.

a) The geographic area served by the hospital or group of hospitals is clearly defined and a regular census is made, as in the case of nations, or regions or isolated areas.

b) The hospital or group of hospital is with in reach of this population and the means of communication are fairly fast and convenient.

If these two conditions are not fulfilled, it is necessary to make a detailed statistical survey. If there is more than one hospital in the area the analysis will show the distribution of patients among them. If part of a population cannot easily reach the hospital, the survey will give the gradient of attraction of each hospital.

The method for determining the population at risk is applied by the planning authorities. The population at risk is designated as "**P**".

3.10.4.1 ADMISSION RATE

The admission rate, which is also known as the hospital frequentation rate or hospital attendance rate and which is designated "**Fh**" is usually expressed as the number of hospital admissions per 1000 of the population per year. Other units of the population may be used. However, rate per persons, rate per 100 persons etc. In calculating admission rates, all admissions, including re-admissions for the same pathological conditions, are counted. In the case of mental Hospital and the other establishments in which the patient stays for a long time but may be allowed to leave the hospital for a short or long periods "on parole" or 'On leave", an admission should be counted only if the patient has previously been discharged, not simply let out "on parole".

Admission rates are calculated both on the basis of total admission to all hospitals,regardless of type,ownership etc. (gross admission rates) and separately for the various types of hospital or hospital service (specific admission rates).

$$Fh = \frac{A}{P} \times 1000$$

3.10.4.2 HOSPITALIZATION RATE PER PERSON

This index expresses the volume of hospitalization in terms of number of hospitalization days per person per year. It is calculated by dividing the total number of hospitalization days in a year by the mean population in that year.

$$Hc = \frac{H}{P}$$

3.10.4.3 BED OCCUPANCY RATES

The bed occupancy ratio is the average daily number of persons hospitalised per unit of population (usually per 1000 population). It is obtained by dividing the average daily number of beds occupied (average daily census) by the mean population in the same year and multiplying by 1000. Alternatively, this ratio could be obtained by the product of the Bed/population index ($I_{b/p}$) and bed-occupancy.

$$Bc = \frac{N}{P} \times 1000 = I_{b/p} \times \frac{O}{100}$$

3.10.4.4 BED/POPULATION INDEX

The bed/population Index ($I_{b/p}$) is probably the commonest and most controversial figure used for the assessment of hospital utilisation.

It expresses the availability of hospital beds in terms of the number of beds per 1000 of the population. Sometimes this figure is expressed as the number of peons per bed.

The bed/population index is obtained by dividing the bed complement by the mean population and multiplying by 1000.

$$I_{b/P} = \frac{B}{P} \times 1000$$

used alone, this figure cannot be considered as an index of hospital utilisation, but simply as an indicator of the availability of the beds, regardless of how they are utilised. On the other hand, the availability of beds is perhaps the most important single factor in the determination of the hospital utilisation in a country. 25

3.11 CALCULATION OF BED REQUIREMENT

Following things are to be assumed

1. Universe of work in terms of population the establishment ,is responsible for serving including both the direct population of the locality and the indirect population of the catchment area.

   Number of admission which it is aimed to be able to deliver to both population groups. The average length of stay that it is expected to be working with and occupancy rate desired for the hospital.

The method (Example)

Data:

Direct population (of the locality)	20,000
Indirect population(of the catchment area)	1,00,000
Admission per year per 10 inhabitants, direct population	1
Admission per year per 10 inhabitants, indirect population	0.3
Average length of stay(bed days per patient	10
Hospital occupancy rate	80%

Procedure:

Direct population x admission/year/10 inhabitants 20000x1/10 =

= admissions/year direct population 2000 admissions

Indirect population x admissions/year/10 inhabitants 100000x0.3/10

= admission/year indirect population 3000 admissions

Total admissions/year = 5000

Total admissions/year x average stay = Total bed days/year 5000x10 = 50000 bed days/year

$$\frac{\text{Total bed days/year}}{365} = \text{total bed days with 100\% occupancy}$$

$$\frac{50000}{365} = 137 \text{ beds} \quad \text{occupied 100\%}$$

$$\frac{\text{Total bed days with 100\% occupancy}}{\text{Occupancy desired}} = \text{beds with 80\% occupancy}$$

$$\frac{137}{0.8} = 172 \text{ beds}$$

This system enables rapid calculations to be made with the above variables. The two indices of admissions, for direct & indirect population, can be taken as the level of coverage it is hoped to attain. The average length of stay assumed may reflect the thoroughness of the care provided. Finally, the occupancy rate of the hospital indicates the efficiency it is hoped to achieve in the use of the services.[8]

3.12 CALCULATION OF CONSULTING ROOM REQUIREMENT

Universe of work is determined in a similar way. Indices are assumed for consultations to be delivered both to the direct population and to the referral population of the area. Indications are also given of the average number of first and of subsequent consultations given in the area; the estimated duration of each consultation; and the time during which the consulting rooms are in use

Data:

Direct population	20,000
Indirect population	1,00,000
Consultations per person per year, direct population	2
Consultations per person per year, indirect population	0.5
Average first consultations in the zone	20%
Average subsequent consultations in the zone	80%
Time taken for first consultation	30 minutes
Time taken for subsequent consultation	15 minutes
Hours of work of consulting room	6 hours

Procedure:

Direct population x consultations/person/year	20000x2 =
consultations per year, direct population	40000 consultants
Indirect population x consultations/person' year	10000x0.5
consultations per year indirect population	50000 consultants
Total Consultations per year = 50,000 + 40,000 =	90000 consultants

$\frac{\text{Consultations/Year}}{\text{Working days}}$ = Consultation/Day $\quad \frac{90000}{300}$ = 300 Consultation / Day

Consultations/Day x % First Consultation = First Consultation/Day =

300x0.2 = 60 first consultants/day

Consultations/Day x %subsequent consultation=Subsequent consultation/day

300x0.8 = 240 subsequent consultants/day

First Consultation/day x time = Time first consultations

60x30 = 1800 minutes

Subsequent consultation/day x time = Time subsequent consultations

240x15 = 3600 minutes

Total time = 1800+3600 = 5400 minutes

$$\frac{\text{Total time in minutes}}{60} = \text{hours consultation/day necessary} \quad \frac{5400}{6}$$

$$= 90 \text{ consulting room hours/day.}$$

$$\frac{\text{Consulting room hours/day}}{\text{consulting hours}} = \text{Consulting room}$$

$$\frac{90}{6} = 15 \text{ consulting rooms}$$

To know the specific numbers of speciality beds and consultations there are records from which the same can be determined, replacing the global index for the population by these data. The sum total of these partial data for each speciality will give the total number of beds and consulting room by specialities.24 The other alternative way of calculating consulting room requirement is explained in 3.13

3.13 ASSESSMENT OF NUMBER OF CONSULTING/EXAMINATION (C/E) ROOMS REQUIRED IN OPD

3.13.1 INTRODUCTION

Some of the factors which must be taken into account when assessing the size of an OPD. There is no simple formula, but a method which may be helpful is set out below.

The patient and staff data used are for illustrative purposes only; local figures should be substituted.[57]

3.13.2 DEFINITION OF TERMS

a) **CLINIC SESSION** - a notional period of a half day (usually morning or afternoon) when a clinic is held, comprising a preparation period, consultation period, and clear-up period;

b) **CONSULTATION PERIOD** - the total timetabled period that one doctor (or other professional) spends in consultation during a clinic session;

c) **ROOM SESSION** - the use of a consulting/examination room (C/E room) by a doctor for a period of a clinic session; the total number of room session per week is the product of the number of rooms used and the number of clinic sessions held in each of them;

d) **CLINIC SIZE** - the number of doctors and/or other professionals requiring consulting/examination rooms for a clinic session. More than one room may be needed by each for effective use of the consultation period.

3.13.3 CURRENT SERVICE PROFILE

A profile of the current out-patients service should be prepared. An example, showing two specialties only, is indicated in 3.14

3.13.4 FUTURE SERVICE PROFILE AND DERIVATION OF SPACE NEEDS

A profile of the planned out-patients service should be prepared and should include the following key factors for each speciality:

a) the projected population on which the required calculations are based;

b) total planned attendances, taking accounts of trends;

c) average number of attendances per patient per annum, following examination of return attendance ratios and frequencies;

d) average consultation times for new and return appointments;

e) consultation period;

f) clinic size.

An example, for two specialities only, is indicated in 3.15

3.13.5 PLANNED SERVICE

When preparing the 'planned service' profile, consider:

a) the current service profile;

b) the need to consult appropriate clinical and managerial staff recognising that this will vary between specialities;

c) unmet demand. Levels can be assessed by comparing actual waiting times for non-urgent out-patient appointments with local, regional and national target waiting times and, as necessary, make adjustments to the service provision being planned;

d) proposals for future new clinics.

3.13.6 NUMBER OF CONSULTATION PERIOD

Calculate the number of consultation periods required by each speciality (Refer 3.15 for method)

3.13.7 NUMBER OF ROOM SESSION

Calculate the number of room sessions required for each specialty. Staff who are familiar with each speciality clinic should be involved in assessing the number of combined C/E rooms required for each clinic session, as this will be affected by :

a) the clinic size.

b) the method of working.

c) the time required for patient undressing/dressing.[57]

3.13.8 TOTAL ROOM SESSION

The overall total of room sessions required for delivering the planned OPD service is obtained by adding together the room needs of all the clinics.

3.13.9 NUMBER OF C/E ROOMS REQUIREMENT

On the basis that a combined C/E room can be used for nine sessions each week, the number of combined C/E rooms required in an OPD is:

$$\frac{\text{Total number of room sessions per week}}{9}$$

3.14 CALCULATION OF NUMBER OF COMBINED CONSULTING/EXAMINATION(C/E) ROOMS REQUIRED (CURRENT SERVICE PROFILE) 57

CURRENT SERVICE PROFILE		SPECIALTY A	SPECIALTY B	METHOD OF CALCULATION
A	Population served	200,000	250,000	Local data
B	New attendances per annum	2,419	2,386	Local data
C	Return attendances per annum	9,499	9,652	Local data
D	Total attendances per annum	11,918	12,038	B + C
E	Attendances per 1000 population	59.59	48.15	(D / A) x 1,000
F	Average attendances per patient per annum	4.93	5.05	D / B *
G	Number of sessions per annum	735	309	Local data
H	Average attendances per clinic session	16.21	38.96	D / G*
J	Duration of consultation period (in hours)	3.5	3.5	Local agreement
K	Consultation rate No.of patients per hour	4.6	11.1	H / J*

* Checks should be made to see if improvement can be achieved; these should include comparing the values with the performance of other Districts.

3.15 CALCULATION OF NUMBER OF COMBINED CONSULTING/EXAMINATION (C/E) ROOMS REQUIRED (FUTURE SERVICE PROFILE) 57

	FUTURE SERVICE PROFILE CALCULATION	SPECIALTY A	SPECIALTY B	METHOD OF
A	Planning population	250,000	250,000	Local data projections
B	Planned total attendances	15,000	12,050	Local data, from current profile, unmet demand, need etc.
C	Planned attendances per 1000 population	60	48.2	$\frac{B \times 1{,}000}{A}$
D	Planned average attendances per patient per annum	4.75	4.5	Local data - may differ from current figures
E	Calculated new attendances per annum	3,158	2,678	B / D
F	Calculated return attendances per annum	11,842	9,372	B - E
G	Average consultation time per new attendance (in minutes)	18	12	Local data - from discussion with clinicians
H	Average consultation time per return attendance (in Minutes)	10	4	Local data - from discussion with clinicians
J	Annual consultation time required (in hours)	2,921	1,160	$\frac{(E \times G) + (F \times H)}{60}$
K	Average duration of a consultation period (in hours)	3.5	3.5	Local decision
L	Number of consultation periods per week	18	7	$\frac{J / K}{48}$
M	Average attendances per clinic session	17.36	35.86	$\frac{B}{L \times 48}$
N	Consultation rate - number of patients per hour	4.96	10.25	M / K

3.16 NORMS & STANDARDS FOR MEDICAL MAN POWER IN THE USSR [53]

In the USSR, the fundamental unit in the planning of medical manpower requirements is the "staff posts". Whether for physicians or paramedical personnel, and the determination of number of staff, posts, either for the country as whole or for the various administrative units, is the main aim of this aspect of the planning procedure. The number of staff posts can be determined by means of: (1) norms for hours of work; (2) work load norms; (3) staffing standards.

Norms for hours of work : The monthly norm for the hours of work of medical personnel is given by:

$$N_m = C_h . D - \Sigma h$$

Where N_m	=	monthly norm for hours of work
C_h	=	length of working day (hours)
D	=	number of working days per month
Σh	=	number of hours by which working time is reduced on days preceding rest days and holidays

The length of the working day is fixed by law in the USSR.

In the case of medical personnel, the monthly norms for the hours of work includes the time spent on call.

The corresponding annual norm is given by:

$$N_y = \Sigma N_m - L$$

Where N_y	=	annual norm for hours of work
L	=	length of leave period (normal & supplementary) in hours

In practice, however, the following formula is generally employed:

$$N_y = (365 - \Sigma R)\, C_h - \Sigma h$$

Where R	=	total number of rest days, holidays, and day of leave

Under the legislation now in force in the USSR, the length of the basic leave period is twelve working days. For medical personnel, the length of the period of supplementary leave may be six working days, or a multiple of six, up to total of 36 working days, depending on the character of the work performed & the working conditions. In practice, of course, the figures for the hours of work given by the above-mentioned formulae may be reduced as a result of time lost due to illness. In principle, however, once the annual norm for the hours of work has been determined, it is possible to calculate number of staff posts necessary to ensure that work places are manned for a specified number of days, by means of the formula developed by Dr.G.A.PAPOV.

$$B = \frac{365\ K.M}{N_Y}$$

Where B = number of staff posts

K = number of hours for which work place must be manned

M = number of work places.

3.17 CALCULATION OF NUMBER OF HOSPITAL BEDS REQUIRED

The number of hospital beds required is one the most important items of information needed in health planning. A large number of formulae have been proposed for this purpose by various investigators in different countries, and will be considered here. These formulae are based on indices such as the proportion of the population hospitalized, the average length of stay patients in bed, the bed occupancy , etc in certain formulae, account is taken of the variation in the daily number of patients seeking admission to hospital.

Most of the formulae are suitable for use in short-term planning only, since they call for a knowledge of the demand for hospital treatment. This is the consequence of the fact that data on hospital admissions and the size of the waiting list for admission are more readily available to public health administration than the morbidity data needed for long-term planning. As a result, the majority of the formulae fail to take the disease into account. One exception to this rule, however, is the formulae proposed by Dr. G.A. PAPOV, which is therefore suitable for long-term planning.

3.17.1 FORMULA . SUITABLE FOR SHORT TERM PLANNING

The formulae considered here are suitable for use in short-term planning, but do not take into account the variation in the daily number of patients seeking hospital treatment. The de Wolff formula, which does take this factor into account, is considered separately.

A formula in USSR takes the following form :

$$K_a = \frac{N.R.P}{D.100}$$

Where K_a = average annual number of beds required

N = size of population.

R = proportion of population hospitalized(%)

P = average length of stay patients in bed (days)

D = average bed occupancy(days per year)

A similar formula also proposed in the USSR takes the form:

$$K_a = \frac{a.P}{D}$$

Where a = number of patient hospitalized per year.

3.17.2 A METHOD SUGGESTED IN THE USA [54]

A completely different method was suggested in the USA in 1944 based on the statistical data on the number of deaths occurring in hospital. These data show that there is one death in hospital for approximately every 250 bed-days, so that if 100% bed occupancy is assumed, the number of beds required is found by multiplying the number of deaths by the number of beds required per death per year , i.e.,250/365 = 0.7.

For maternity beds, the method proposed was based on data for the average length of stay in beds per birth, which was found to be 11 days. One birth therefore requires 11/365 = 0.03 beds per year, & the number of maternity beds required is thus obtained by multiplying the number of births by this factor.

In order to obtain a formula for calculating the number of beds required in general hospitals, it was assumed that:

(1) 50% of all deaths in hospital occur in general hospitals:

(2) 100% of all births occur in hospital;

(3) About one seventh of all beds are maternity beds, so that the factor by which the number of death must be multiplied is reduced to 0.6.

The formula then is:

K_a = [0.6 x 0.5 (number of death in hospital)] + [0.03x (number of births)]

A formula identical with that given above was used by a number of inter-departmental commissions in the USA over the period 1938-1945. In using this formula the commission took into account the fact that, for 20% to 25% of the times beds are by cleansed and are therefore not available for use by patients.

A formula suggested by Bridgiman gives the bed/population ratio :

$$R_{b/p} = \frac{K_a}{N} = \frac{F.P}{365.B}$$

where $R_{b/p}$ = bed/population ratio

F = number of patients admitted to hospital per person

B = average yearly bed occupancy (expressed as a decimal)

3.18 THE DE WOLFF FORMULA

A formula has been published due to de Wolff for determining the number of hospital bed that require that takes into account the fact that the number of patient seeking hospital treatment on any given day is subject to change fluctuation, the formula is not applicable for the bed for patients suffering from communicable disease. If it is desired to ensure that the demand for the hospital treatment must be met on one 199 days out of 200 i.e., to ensure, in effect, that every patient requiring hospital treatment is admitted on the same day as that on which he is referred to hospital, the number of beds is given by the following formula.

$$Kd = PJ \left[1 + \left(\frac{3\sigma}{J} \times \frac{J}{\sqrt{P}} \right) \right]$$

where Kd = daily number of bed required

P = average length of stay of patients in beds

J = daily number of requests for admission

σ = standard deviation of J

It will be realised that the value of Kd given by the above formula is the maximum bed requirement. The minimum bed requirement i.e., number required if the chance fluctuations in J are ignored is given by PJ .

The application of the de Wolff formula is illustrated by the figures given below which show considerable differences that can arise between maximum and minimum number of beds required in different specialities

MEDICAL BEDS

Assumed values of variables: $J = 11, P = 17$ days and $\sigma = 0.33$

Maximum number of beds = 232

Minimum number of beds = 187

Excess of maximum over minimum = 25%

Beds occupancy = 80% (292 days per year)

PAEDIATRICS BEDS

Assumed values of variables: $J = 8, P = 14$ days and $\sigma = 0.42$

Maximum number of beds = 150

Minimum number of beds = 112

Excess of maximum/minimum = 34%

Beds occupancy =74.7% (273 days per year)

DERMATOVENEREOLOGICAL BEDS

Assumed values of variables: J = 2,P=35 days and σ= 1.1

Maximum number of beds. = 109

Minimum number of beds = 70

Excess of maximum/minimum = 56%

Beds occupancy =64.2% (234 days per year)

In practice, it is usual for patients needing hospital to have to wait some time before they are admitted to hospital. This helps to make the flow of patients more uniform. And hence reduce the value of σ and as a result the number of beds required. All decisions as to the desirable length of the waiting period, however, must be somewhat arbitrary in character. Nevertheless it was established that in the case of patients not suffering from any acute form of disease the waiting period should not exceed 3 weeks after a physician has decided that hospitalisation is necessary while a waiting period of less than 6 days has no appreciable effect on the flow of patients needing hospital treatment The length of the waiting period should therefore falls between these limits.

A formula was also worked out by de Wolff to take into account fluctuations in the length of the waiting period but the resulting increase in the number of beds required is so small as to be without practical significance.

3.19 NORMS AND STANDARDS FOLLOWED IN BANGLADESH

In 1979 the Planning Commission constituted a subcommittee of doctors, administrators, civil servants, architects and engineers to put forward recommendation for the standardisation of hospitals in terms of functional and space requirements, staffing pattern, quantum of land etc. They made recommendations for 50, 100 and 200 bed hospitals. These covered the following areas. 28

a. Bed Distribution according to speciality

b. Standard staffing pattern

c. Quantum of land for each hospital

d. Standard floor area

The land area allocated for all the three sizes appears to be same, 6 to 7 acres which is not logical. The decisions may be taken without the support of extensive studies. The Government circular also mentioned that the recommendations were based on personal experiences and formulated after only threadbare discussions.

<u>**Standard space requirements for 50,100 and 200 bed hospitals (sq.m))**</u>

	50 bed	100 bed	200 bed
Administrative block including OPD, X-ray, pathology, Emergency & Blood transfusion etc.	1115	1487	1858
Ward Block	836	1672	3344
Operation theater & labour room	223	335	446
Kitchen	93	140	167
Isolation beds for 8 patients	149	149	149
Dead House/Mortuary	19	19	19
Library	28	28	28
Store room	46	74	110
Corridor & passage	112	187	224
Total	2621	4091	6345

3.20 FUNCTIONAL SUITABILITY AND SPACE UTILISATION

Assessment methods devised by Maru Health Buildings Research Centre, South Bank University, London [13]

PRIMARY SPACES - FUNCTIONAL CAPACITY MEASURES

1. OUTPATIENTS

Average Consulting/Examination Rm. utilisation (%) $= \dfrac{\text{Total clinic staff session/weeks}}{\text{Total C/E Rooms} \times 10^{*}} \times 100$

2. OPERATING DEPARTMENT

Average Session usage $= \dfrac{\text{Total booked theaters sessions}}{\text{Total No. of theaters} \times 10^{*}} \times 100$

3. STAFF DINING AREAS

Average seat utilisation % $= \dfrac{\text{Max no. of lunch time meals/day} \times \text{Average eating time}}{\text{Number of seats} \times \text{Length of Lunch Period}} \times 100$

4. X-RAY

Average radiodiagnostic room utilisation % = % of normal working week=in use (user assessment)

5. ACCIDENT & EMERGENCY

Average use of exam/treatment cubicles/day (9 to 5 pm) % $= \dfrac{\text{Avg. daily attendance} \times \text{Avg.treatment time} \times 100}{\text{No. of exam treatment rooms} \times 480 \text{ mins.}}$

* Each theatre suite or consulting/examination room is assumed to be available for 10 session/week.

3.21 NORMS FOLLOWED FOR DESIGN OF MEDICAL BUILDINGS IN NAIROBI (AFRICA)

3.21.1 CALCULATION OF AREA/BED SPACE

University of Nairobi, Housing Research and Development Unit in association with African Medical & Research foundation have worked out **Area per Bed space** while assessing the floor area it is stated that the case of addition to existing facilities, a preliminary design can be worked out using the Design Criteria and an approximate floor area arrived at. Where a new hospital is proposed it is impractical to work out the whole design at the feasibility stage merely in order to arrive at an approximate building area. Fortunately it is possible to use a rule of thumb based upon the number of beds required to give a sufficiently accurate estimate of floor area for purposes of provisional costing.

Although the area taken up each bed is somewhat less than 2 sq.m the total area required in a ward, where space must be allowed around each bed for nursing and general circulation, amounts to about 6 sq.m. For each nursing unit of 20-30 beds other facilities such as toilets and showers, a duty room, examination room and storage must be included bringing the total floor area per bed required in the inpatient department to 8 sq.m. When other essential items relating to the inpatients are added, both medical: laboratory, theatre, X-ray etc, and non-medical: kitchen, laundry, cental stores etc, the area per bed doubles to around 17 sq.m. Finally the outpatient department will require between 50 and 70 sq.m per 100 patients per day adding about 3 sq.m bringing the **total floor area required per bed to approximately 20 sq.m.** (Ref. fig. 3.1)

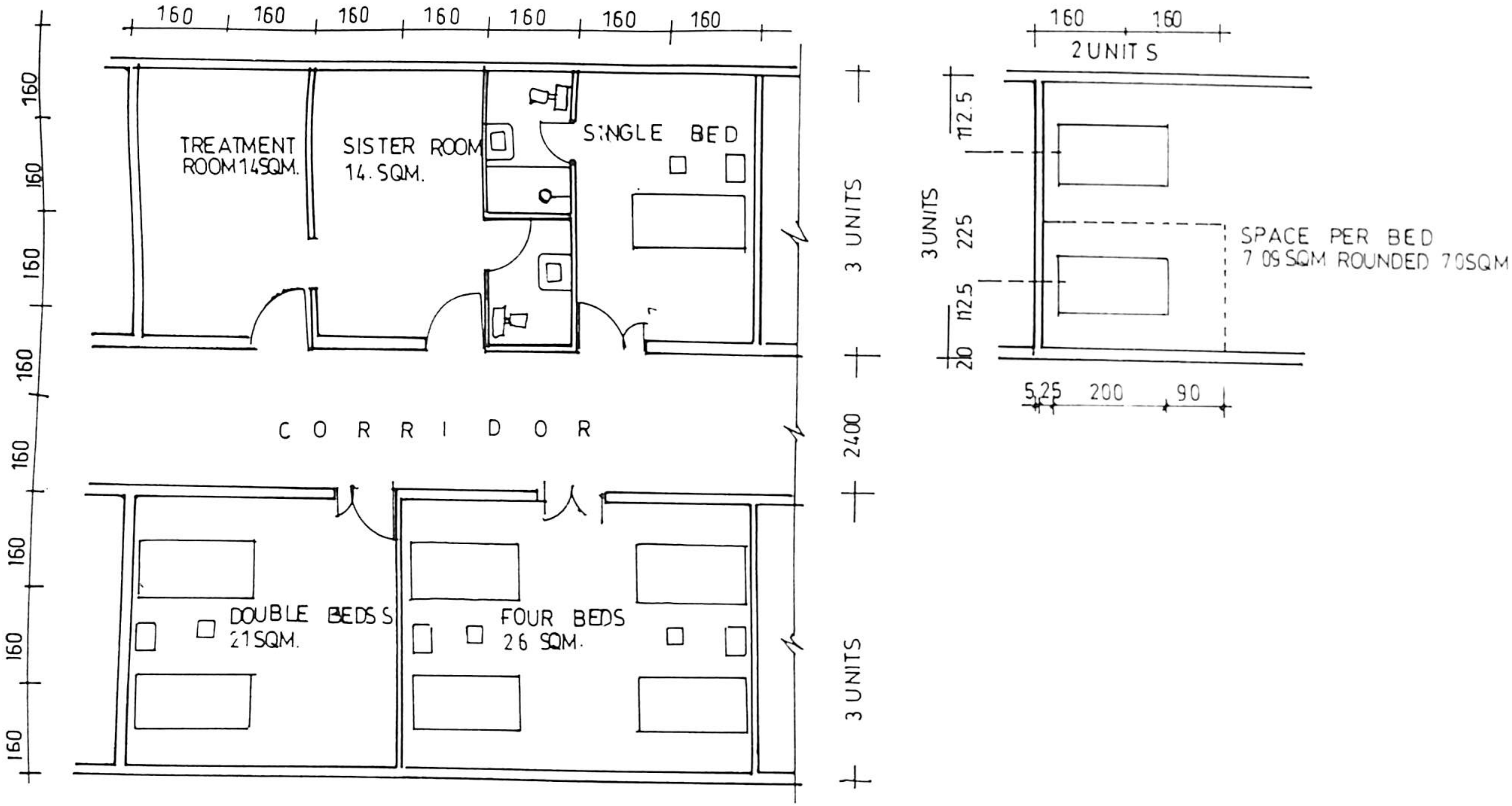
3.21.2 VARIABLE FACTORS

The figure of 20 sq.m is an average one based upon surveys of a number of hospitals in East Africa taking into account the adequacy of their facilities. It has also been checked against the building designs prepared specially for this manual. It assumes a hospital of around 120 beds with an outpatient department dealing with up to 400 patients a day. For a smaller hospital of say 60 beds the area per bed will increase toward 23 sq.m because the size of common facilities cannot be scaled down in direct proportion to the number of beds. The converse is also true in that a **larger hospital of say 240 beds should require nearer 18 sq.m per bed.**

3.21.3 ACCURACY

The above figures will vary according to the situation and the particular facilities provided, but in practice they should be accurate within a tolerance of $\pm$ 10%. The total area arrived at should only be used for costing purposes. When the detail design is undertaken, it ought to be possible by careful planning to reduce the area. Staff housing is not considered in the above but it should be borne in mind that this essential item can account for up to 30% of the total building budget. [9]

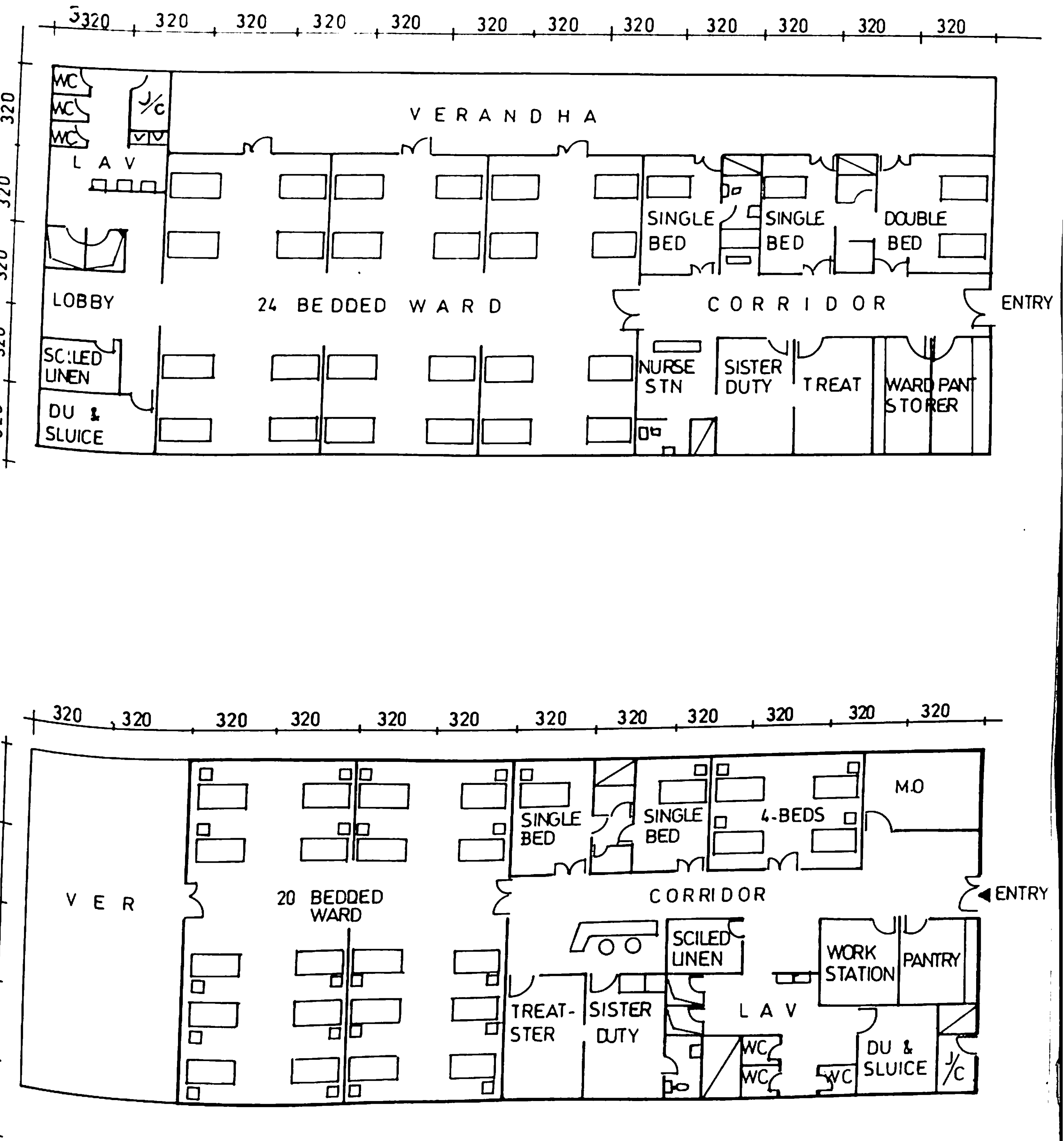
LIST OF FIGURES :



RATIONALIZATION OF FLOOR SPACES

E IN CS BRACH
MINISTRY OF DEFENCE

FIG. 3.1

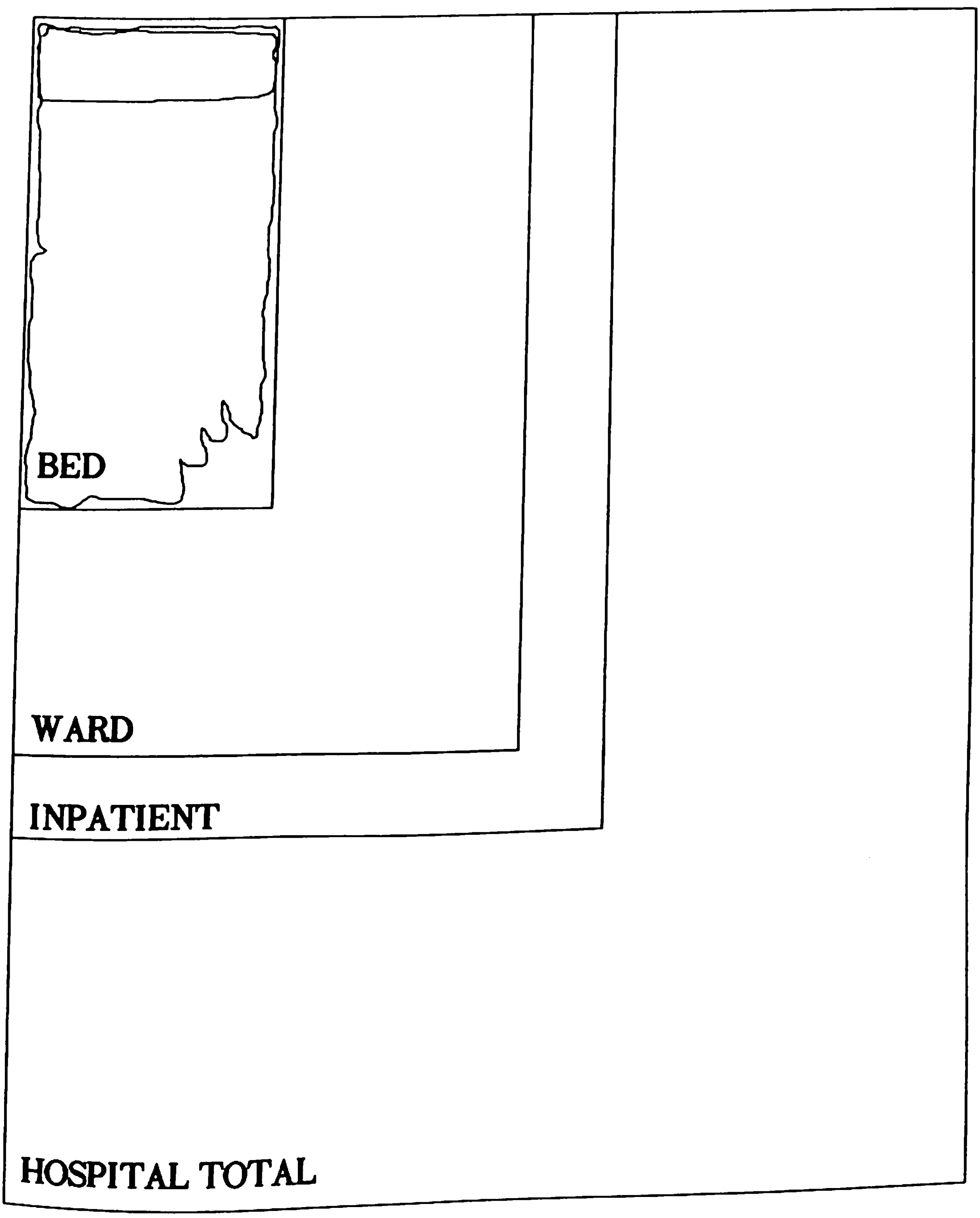


28/26 BEDDED WARD

E IN CS BRANCH
MINISTRY OF DEFENCE

FIG 3.2

NORMS FOLLOWED IN NAIROBI
FOR DESIGN FOR MEDICAL BUILDINGS



AREA PER BED

FIGURE 3.3

CHAPTER IV

CASE STUDY

4.1 DEEN DAYAL UPADHAYAY HOSPITAL COMPLEX

Deen Dayal Upadhayay Hospital is a 500 bedded General hospital constructed to cater for the population residing in western part of Delhi. This population is almost 1/5th of the total population of Delhi. Sufficient hospital facilities are not available in this area, to cater to the needs of this large segment of population with the construction of the proposed 500 bedded hospital at Hari Nagar, it is expected that the people of West Delhi and the neighbouring areas will not lack hospital facilities and will not have to go to the Safdarjung hospital, Dr. RML Hospital or AIIMS etc. for Medical requirements. The construction of DDUH complex started in the year 1978 for which Delhi Administration had acquired 12.17 acres of land in Hari Nagar in West Delhi. Initially, the hospital was to accommodate 200 bed, but subsequently its strength was increased to 500 beds.

At the time of the proposal of 500 bed hospital , Delhi suffered from gross imbalance of location of hospital beds while 6,372 beds existed within one kilometer of the jurisdiction of New Delhi Municipal Committee, the rest of Delhi has only 8,132 beds out of the total number of 14504 hospital beds. As per zonalisation of Union territory of Delhi, the Hari Nagar falls in 'G' zone. In this zone existing hospital beds are 718 whereas the requirement is 4795 beds based on the estimated population of 1983 (as per the prevailing norm at that time was of 5 beds per 1000 block of population therefore, shortfall of hospital beds upto year 1983 was estimated around 3,207 in this zone). Hospital beds mainly concentrated near Lok Nayak Jai Prakash Narain hospital (Irwin hospital)and GB Pant Hospital complex in North Delhi).

Dr. Ram Manohar Lohia Hospital, Lady Harding Medical College and Sucheta Kripalani hospital /Kalawati Saran Children hospital in Central Delhi, All India Institute of Medical Sciences & Safdarjung hospital in South Delhi . Regionalisation of Medical Care Facility has been recommended for Delhi by a number of committees , last being the Rao Committee in 1968. But, the regionalisation has not been possible due to non establishment of hospital at the periphery while the beds have been added to the existing hospital.

Thus in the year 1978, it was decided to construct 200 bedded Allopathic wing and 300bed Ayurvedic wing but during that the, 200 bedded Allopathic wing was in the final stage of construction as the earlier decision taken was to have a 200 bedded surgical wing based on modern Allopathic medicine and separate 300 bedded Ayurvedic medical wing and it was desired that Ministry Of Health &F.W. to examine this suggestion and modify the project suitably before implementing it. However, in the year 1981, after taking into account the nature of the medical need of the population of the area, it was decided by the Delhi Administration to revert the original proposal of construction of 500 bedded Allopathic hospital.On reconsideration, the Ministry Of Health& F.W. agreed to this proposal with the approval of then Union Minister of Health &F.W. Accordingly, it was proposed to construct additional 300 bed of Allopathic system by adjusting them within the 200 bedded hospital under construction on the plot measuring 12.73 acres and the residential complex in the opposite plot 7.2 acres. It was also approved that the vertical extension of ward block Operation Theatre Block and Administration to accommodate and support the additional 150 beds and for remaining 150 beds a separate ward block was proposed for construction.

Sallent project statistics.

Area of land	:	12..73 Acres.
Ground coverage	:	22 %
Total floor area constructed	:	40,130 Sq. mt.

Block 1 (5140 Sqm.)

Two storey, main entrance building comprising Out Patient Department and Casualty/Emergency area.

Block 2 (5481 Sqm.)

Four storied block accommadating main diagnostic & surgical procedure such as X-ray, Ultrasound, C.T. Scan, Laboratory and Operation Theatres.

Block 3 (1026 Sqm.)

Single storey block comprising of Administration and Medical Superintendent. Office, Library and Conference facility.

Block 4 & 5 (14022 Sqm.)

Six storied block comprising of Intensive Care Unit, I.C.C.U. General Wards of various discipline individual patient's room, and Drug de-addiction centre.

Block 6 (6651 Sqm.)

Ten storied block which accommodate Nurse's hostel with dining & recreation facilities.

Block 7 (4311 Sqm.)

Eight storied block accommodating House surgeon's Hostel with dining & recreation facilities.

Block 8 (1143 Sqm.)

Single storey block comprising of Hospital kitchen, laundry and central sterile stores department. Apart from these blocks the single storey service block comprises of electric substation, generator, boiler room and a sperate block for incinerator has been planned and executed.

LIST OF PLATES

LIST OF FIGURES :

PLATE 4.1 500 BEDDED DEEN DAYAL UPADHAYAY HOSPITAL, HARI NAGAR, DELHI.

PLATE 4.2 ENQUIRY, INFORMATION AND REGISTRATION COUNTER.
* COMPUTERISATION OF THESE FACILITY WILL EASE OUT QUEUING SYSTEM.

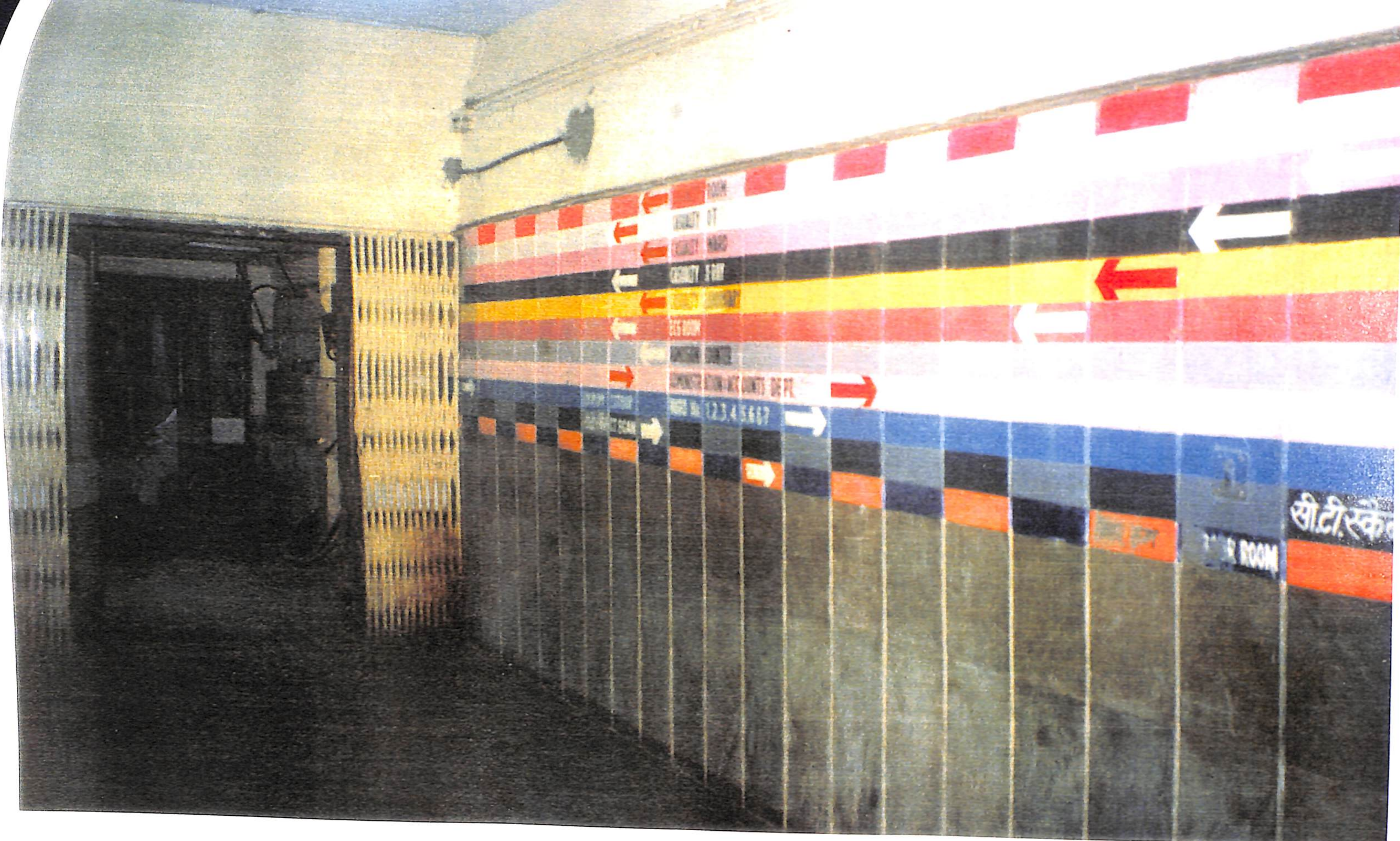


PLATE 4.3 WAYFINDING OR SIGNAGE SYSTEM

PLATE 4.4 PATIENT LIFT BEING USED ALSO FOR MEDICAL EQUIPMENTS/ GOODS.

LATE 4.5

"CORRIDOR OF OUT PATIENT DEPARTMENTS"
IMPACT ON WIDTH OF CORRIDOR, DUE TO MOVEMENTS OF DOCTORS, PATIENTS, VISITORS AND STAFF

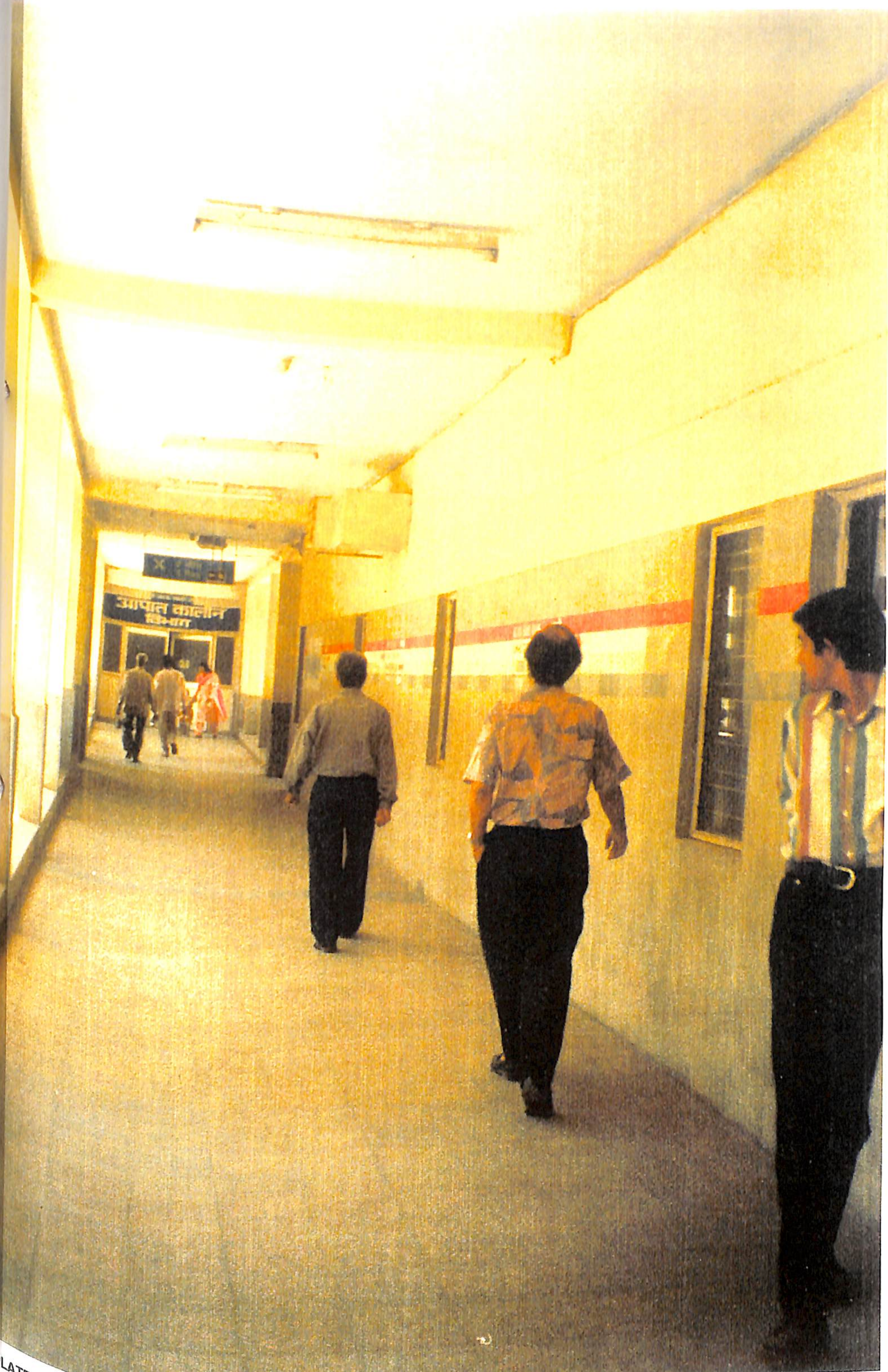


PLATE 4.6

CONNECTING CORRIDOR OF CASUALTY & DIAGNOSTIC BLOCK.
RESTRICTED MOVEMENT OF PATIENT & PARAMEDICAL STAFF.

PLATE 4.7 CORRIDOR OF LABORATORY AREA
MOVEMENT OF PARAMEDICAL STAFF & EQUIPMENT

PLATE 4.8 WAITING AREA OUTSIDE CONSULTANT/EXAMINATION ROOM OF O.P.D.

PLATE 4.9 TYPICAL ROOM OF CONSULTANT/EXAMINATION IN AN O.P.D.

PLATE 4.10 PEOPLE QUEING UP FOR MEDICINE IN DISPENSARY AREA

PLATE 4.11 VIEW OF C.T. SCAN

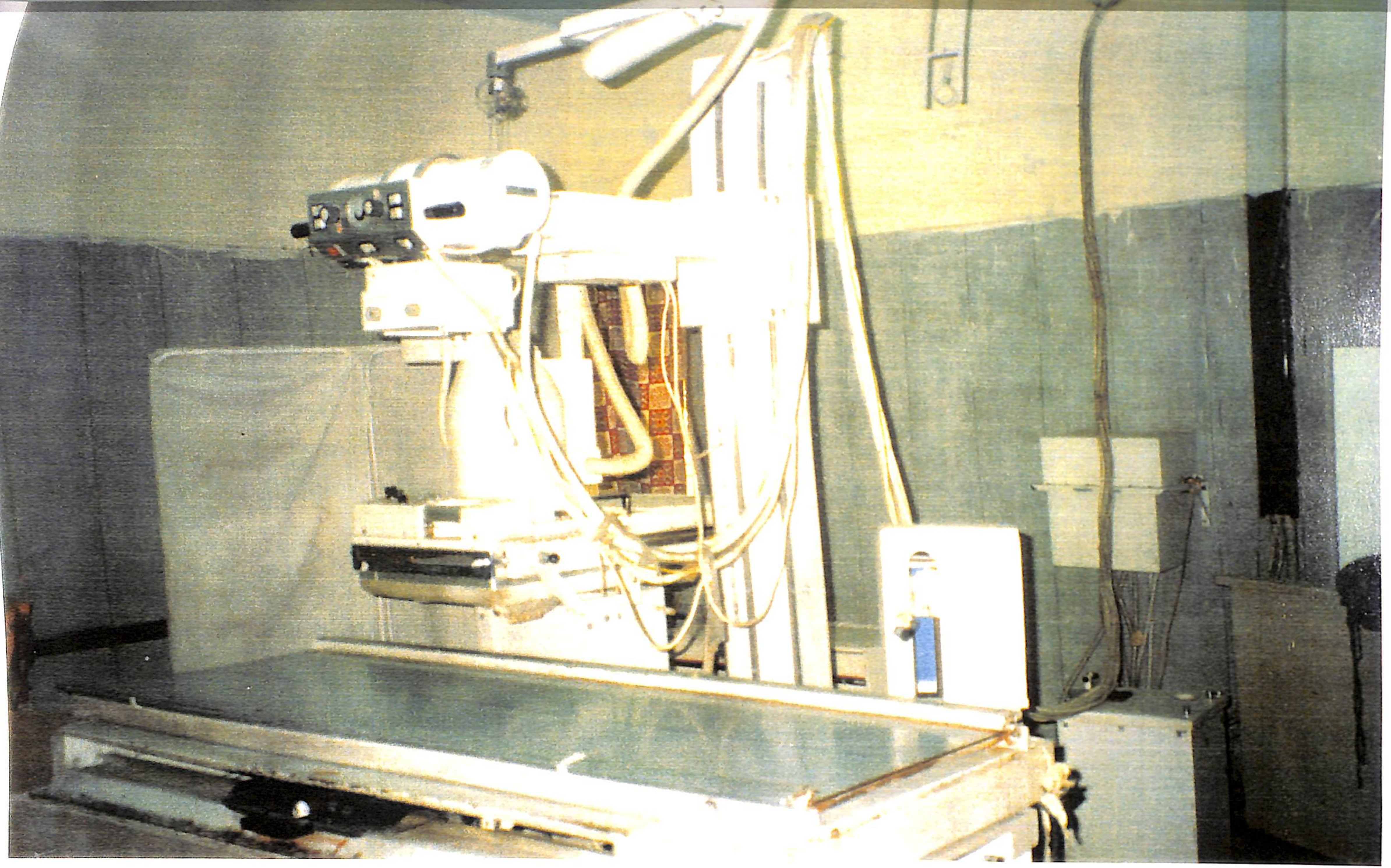


PLATE 4.12 A VIEW OF X-RAY ROOM WITH SPECIALIZED ELECTRICAL & MECHANICAL SERVICES.

PLATE 4.14 TYPICAL VIEW OF GENERAL WARD.

PLATE 4.15 INDIVIDUAL CUBICLE OF INTENSIVE CARE UNIT.

4.16

A TYPICAL ROOM LAYOUT WITH SPECIAL EQUIPMENTS IN AN INTENSIVE CARE UNIT.

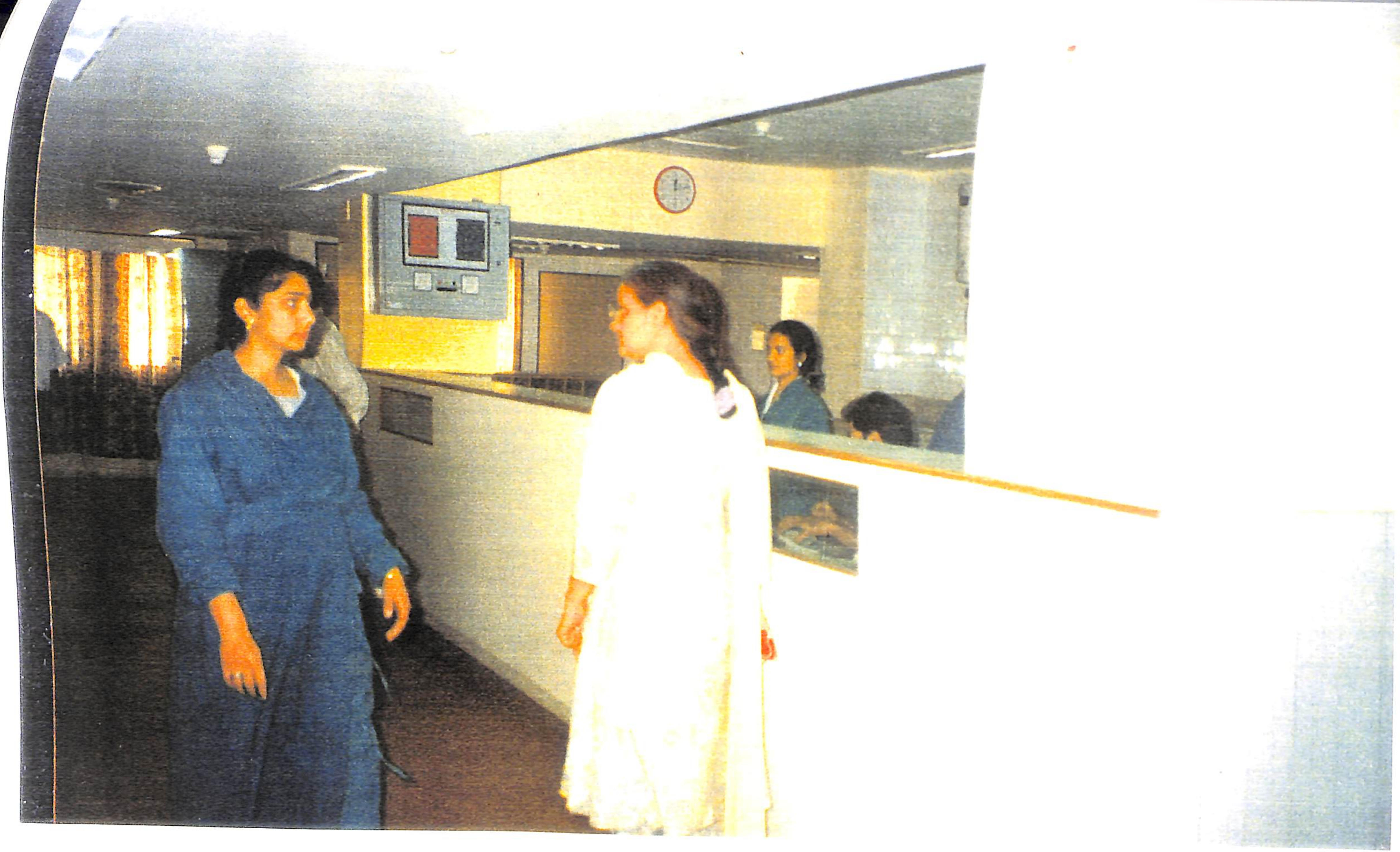


PLATE 4.17 NURSES DUTY STATION OF I.C.U.


500 BEDDED HOSPITAL AT HARI NAGAR
NURSES HOSTEL
HOUSE SURGEON'S HOSTEL
WARD BLOCK
X-RAY & O.P.T.
KITCHEN
LAUNDRY
O.P.D.
MORTUARY
waiting
open to sky
treatment
dressing
connecting corridor

GROU

4.2 MAIDESTONE DISTRICT GENERAL HOSPITAL

The Maidstone District General Hospital is located at Maidstone in UK. This is a design set with nucleus concept of hospital. The nucleus template permits easy linear growth and are generally low i.e two storeys and with cruciform standard templates which are broken up into wings and courtyard of a modest scale. One parts of the building can be seen at a time. The nucleus programme was developed in response to the rising demand of hospital and the cost of acute care hospital. The sizes of Nucleus is limited around 300 beds and it is designed to be fully operational in its own right. Confirm templates contain standard departments, each template is approximately 1000 Sqm. in area.

The siting of each department and its relationship with others have been governed not only by functional needs but also by the character of the site. For the first phase, all the wards are on the east side which has a pleasant avenue of trees and fine view both near and distant.

The 300 bed first phase includes wards containing 112 adult acute beds , 46 children' and 24 Geriatric beds. The operating theatres are in a suite of four. There is a 75 bed maternity unit,a special care baby unit with 20 cots and 20 place adult care centre with 15 day beds. The architect was appointed in the year 1977. The details drawings etc. were ready in 1978 and the construction started in the year 1979.The phase II in 1986 and phase III in 1992 totalling to 400 beds. Serving a populations of about 210,000

The detailed profile of the roof vary according to the amount and character of the services they carry or alternatively the natural light provided by the roof light. The roof over the air-conditioned space like Operation Theatre has a different character as compared to the naturally ventilated department like wards.

The nucleus plan, by nature of the varied open spaces created by the grouping of its templates give the wide scope for the beautiful landscaping , enclosed courtyard and semi-enclosed garden between projecting wings and merging with the outside landscape.

Maidstone hospital is famous for its horizontal emphasis giving a slightly Japanese field, a strong monochromatic exterior and nautical touches .

The site is nearly a storey below road level and is approached down a ramp flagged by the parking area and gives the feel like a cottage hospital than a district general hospital.

A daring decision of cladding the exterior by stainless steel which has considerable cost factor however, guaranteed of 25 yrs life before maintenance and the ultimate life more than twice of that.

The hospital street which is the major spine of communication in any such nucleus hospital is followed in this hospital with the main waiting area and refreshment facility in the first template and the entrance pavilion is somewhat in the corner but overall in the prime location of joining the hospital street in both the access.

The hospital street is 100mt. Straight offsetting only at the entrance to restrict the view into the service department. At this length the corridor does not appear very long as its character is modulated by the daylight from the courts, by width variation and by soothing colour. The view in to the courtyard from the street are deliberately restricted by large solid walls. Each template is colour coded to case the directions and signage is the unobtrusive standard hospital system.

The architects were much helped by the interior designer in the regional health authority who interpreted their ideas in to practical selections.

Good natural lighting is achieved by selection of right size of ;window as well its placement. Roof lights are used most effectively on the upper floor wards.

Being Nucleus, this hospital benefits from this almost automatically. In one of the templates where ward is located has the advantage of day light and natural ventilation because of its perimeter location and service functions occupy the centre of the plan, where necessity of artificial lighting & mechanical ventilation is usually advantageous. This arrangement of "Natural" perimeter and " mechanical" case also means that airconditioning plant is not subject to high & fluctuating loads from solar gains.

The detailing of building reveals careful attention to the achievement of goods thermal insulation The insulation is carried continuously out side the concrete structure, avoiding cold bridge problem.

ANALYSIS

Block 1 (13700 Sqm.)
Two storey main block, comprising four operating theatres, intensive therapy unit, outpatients, administration, pathology, kitchen/dining room, accident and emergency, four X-ray rooms, rehabilitation, maternity, mortuary, hospital sterilising and disinfecting unit.

Block 2 (670 Sqm.)
Two storey main entrance building, comprising porters' accommodation, telephone operators' room.

Block 3 (2542 Sqm.)
Service centre, comprising kitchen, dining room, laboratories, telephone exchange (two storeys)

Block 4 (939 Sqm.)
Two storey boiler house, full-height boiler room, sundry plant and control rooms.

Block 5 (435 Sqm.)
Single-storey outbuildings, comprising stores, generator rooms, unroofed fuel tank storage compartment and sundry control rooms.

LIST OF PLATES

LIST OF FIGURES :

PLATE 4.18 THE MAIDSTONE DISTRICT GENERAL HOSPITAL, U.K.

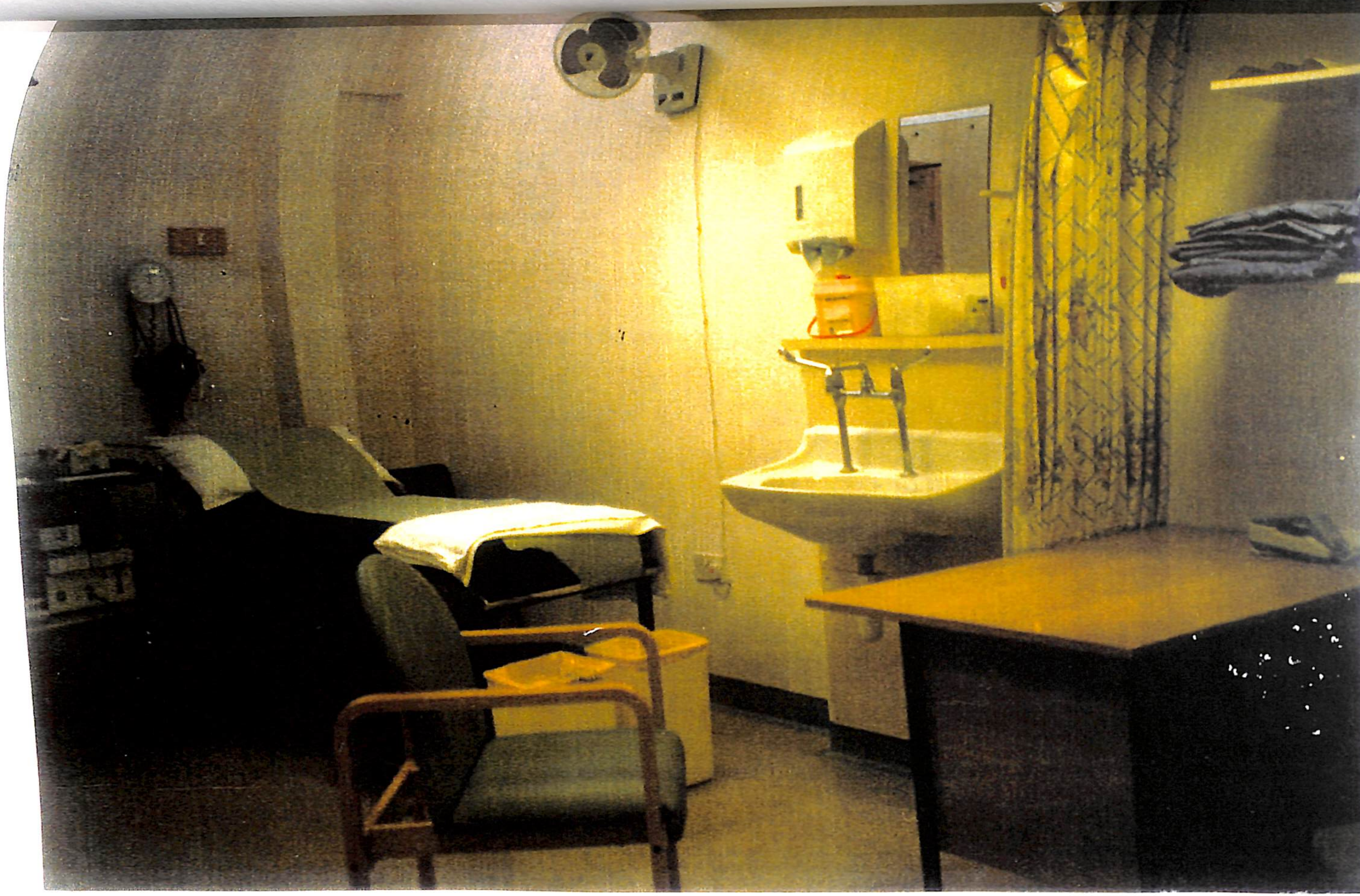
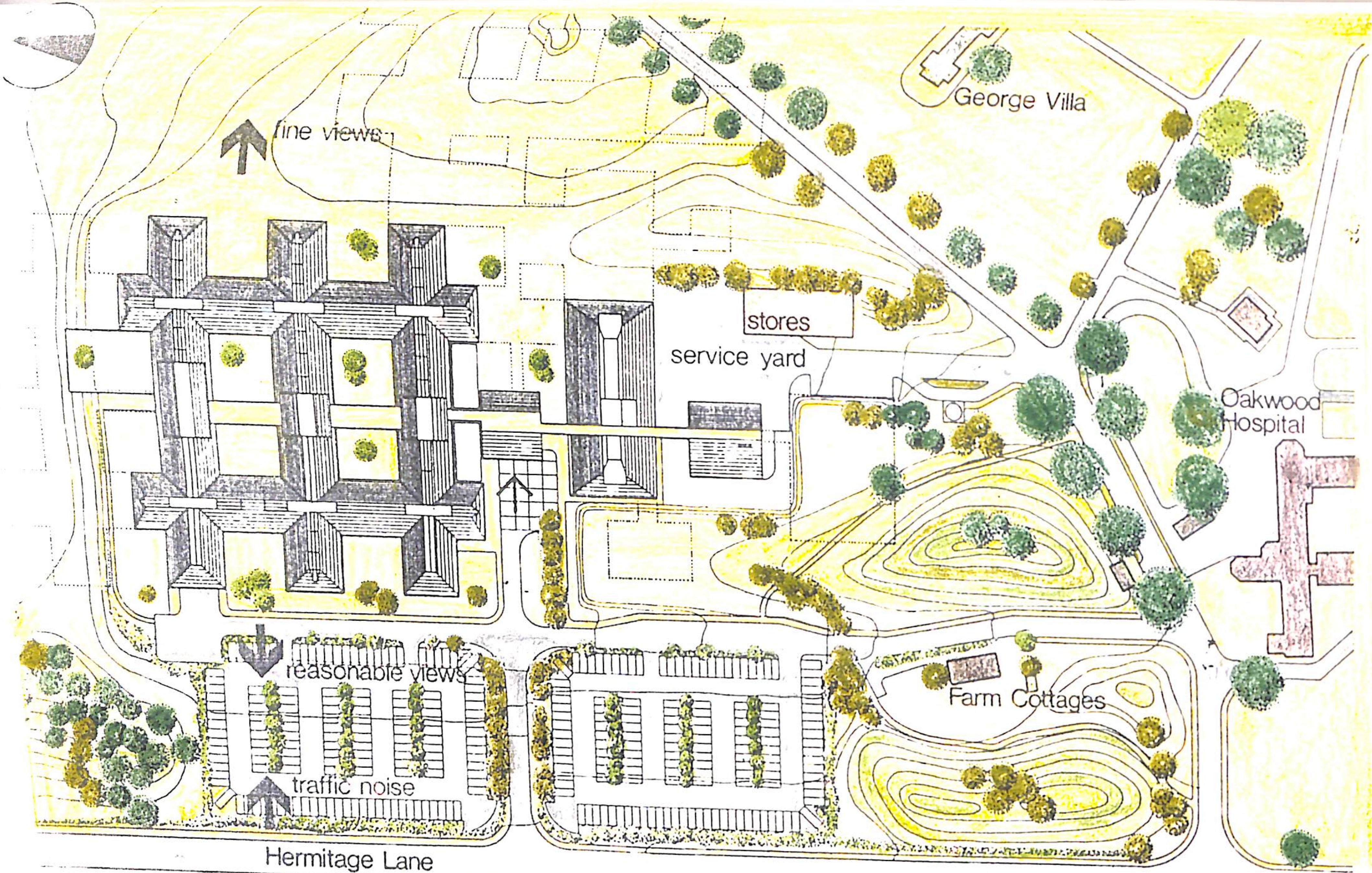
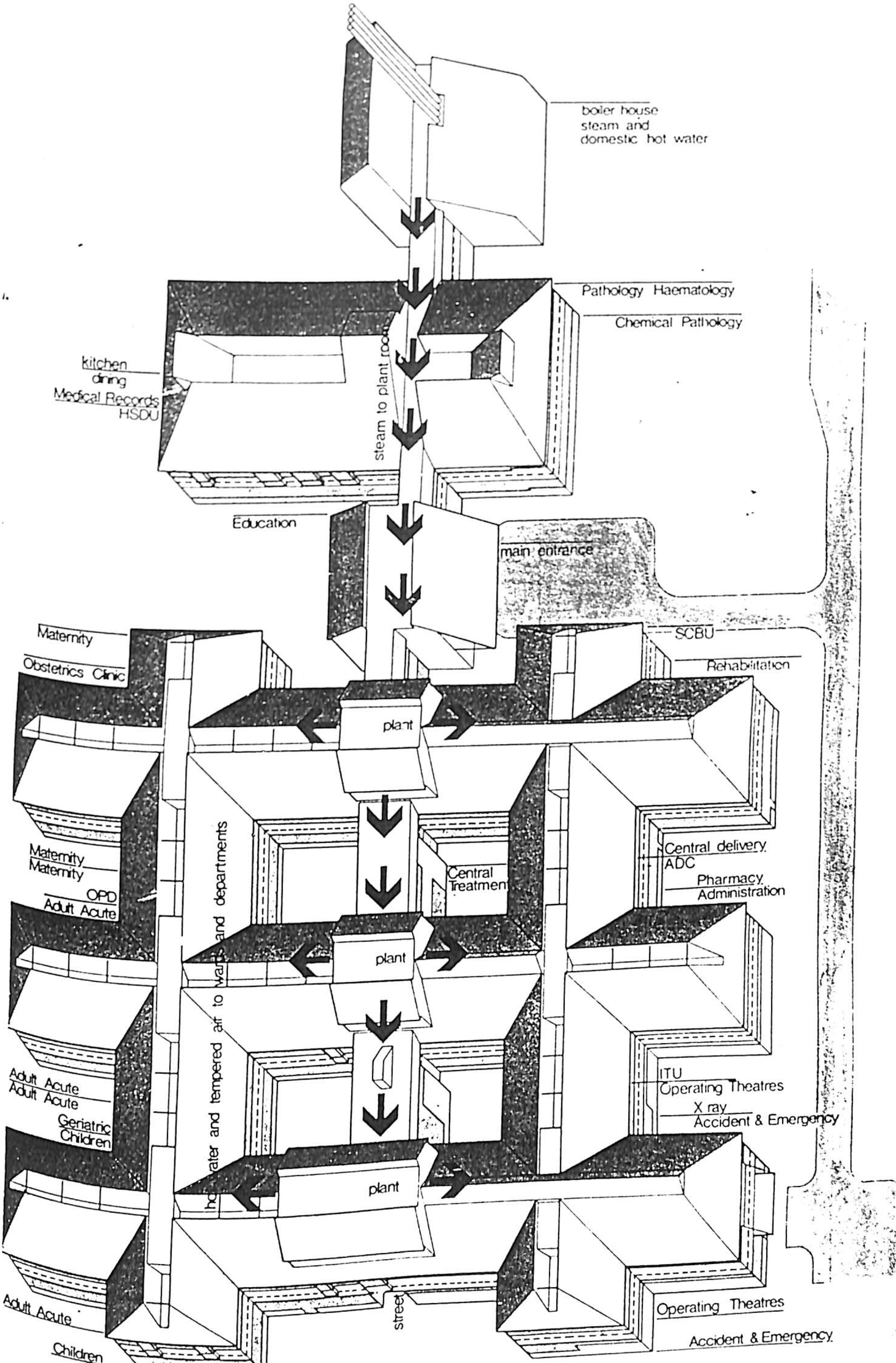


PLATE 4.20 TYPICAL LAYOUT OF COMBINED CONSULTANT/ EXAMINATION ROOM.

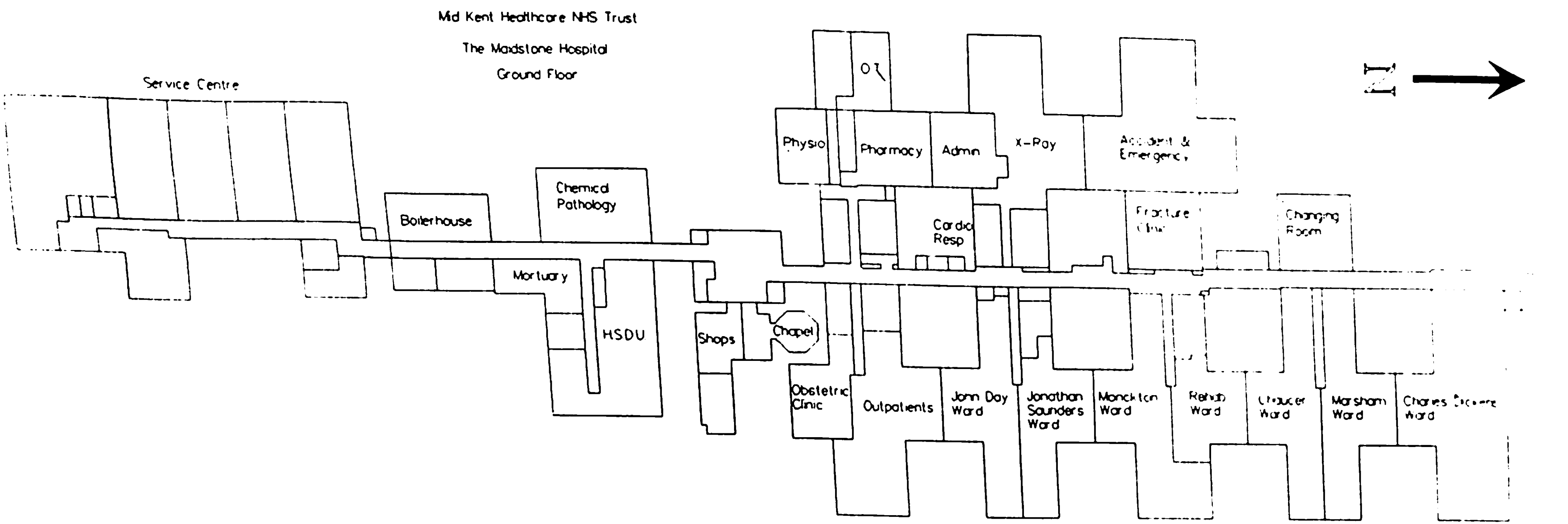
PLATE 4.21 SPECIALISTS ROOM (EYE) IN AN O.P.D.
(VARIETY OF SPECIAL EQUIPMENT CAN BE SEEN)



MASTER PLAN OF MAIDSTONE HOSPITAL U.K FIG.

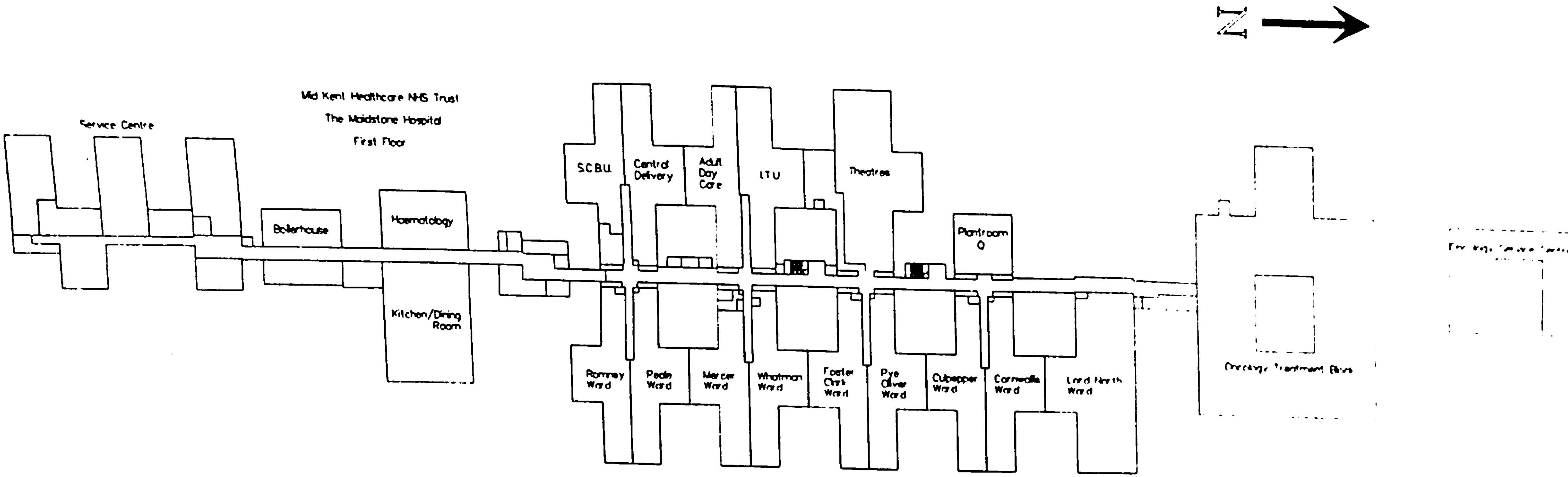


THREE DIMENSIONAL PLAN OF MAIDSTONE HOSPITAL U.K. FIG. 4.4



MAIDSTONE GENERAL HOSPITAL U.K
GROUND FLOOR PLAN

FIG. 4.5



MAIDSTONE GENERAL HOSPITAL U.K
FIRST FLOOR PLAN

FIG. 4.6

CHAPTER V

5.0 NORMATIVE PLANNING

SPATIAL NORMS APPROACH AND METHODOLOGY

5.1 HOSPITAL PLANNING

A CHANGING SCENARIO

The main architectural principles while planning modern hospitals and other related built forms have been the functional ,the rational. They were about standardisation and economy with emphasis on equipments planning which changes with a change in technology, over the years. Built spaces have substantial influence on human behavioural patterns. The ecology and environment of a particular zone have a great influence on the cultural mallein and behavioural patterns of humans and through them on built space norms. On the other hand, the norms have a tendency to get stabilised on an evolutionary basis. It is thus, the facilities once provided on an ethic basis have their influence on their future growth. This is specially evident in the present Government Hospitals where facilities are provided for to meet an urgent need of a specific requirement , specially on an ethic manner, are continued even when the need no longer exist. This inadvertently results in the constraint in planning of optimum space utilisation for the future needs. In the process, the total are a requirement of the hospital is also affected. For example, when the Drug De-addiction was found to be an urgent need and patients were to be treated in the hospital, the space was allocated by reorganizing the existing requirements. Subsequently, when the treatment of Drug De-addiction became an established stream of hospital treatment, this requirement of Drug De-addiction became a permanent and recognized in that area. This eventually affected the space required for other future needs which were planned for the hospital. To ameliorate this situation, a separate building has to be planned as Drug D-addiction Centre in the Hospital Complex..(Refer Plate 5.1)

With rapid changes in the variables that shape a developing society, adhocism described above becomes inevitable and an integral process of evolution.While certain changes are predictable, some are not for instance with detection of the first AIDS(Acquired Immune Deficiency Syndrome) case in India in 1986, there was a spread of HI infection in a few big cities. Eventually, it spread to many more cities and percolated to the general populace. Today HI infection is present all over the country. It is observed that the futurological vision and calculations play an important role in hospital planning. This is achieved by identifying the **predictable and the unpredictable** components. Further, it is imperative to plan for change, flexibility and growth at every level. [2]

At the cell, the subsystem and overall system/environment are well recognised ideas but so far intelligential quantifiable and workable processes are yet to be established in the developing countries. The developed world has models such applicable to their contexts. Study of these models can help to evolve context based strategies for the Indian conditions.

The need for the change resulting from developments in science, societies and community expectations is a necessary and an inevitable one. The present need is the "Change Management" in the field of planning which would offer sufficient leverage to avoid "Crisis Management" for the orderly development in the future.

Once having recognised that the necessity ofthe change management, the management techniques and processes to be identified and established to facilitate it. This would include both the modification of the existing hospitals as well as a renewed design approach for the new ones. [3]

5.2 LOGISTICAL AND HUMAN FACTORS

The factors to be taken into account for the space requirement on the basis of normative planning or even for crystallizing norms for spatial structure are:

5.2.1 SOCIO ECONOMIC PROFILE OF COMMUNITY

Health facility in the country is part of the planned budget of Government of India. However, it cannot be provided free of cost to all. Socio-economic profile of the community plays a vital role in determining the ratio of patients who can afford to pay for the facility to others who totally depend upon the free facility. This aspect will have imminent bearing on the space determination of paid wards and general wards and also the expected standard of hospital facilities a reflection on the economic affluence of the community.

5.2.2 EXISTING MEDICAL FACILITIES

Availability of Health Care infrastructure and the type of Health Care facility in the region are important as the event of a natural calamity or disaster would have a direct impact on them. We know of the seismic regions of our country and areas prone to the natural calamities which are not fully geared up to meet the situation. In some cases, there are instances of contingency plan to take care of them. Hence, existing health facilities of the region do have the impact on the space norm.[5]

5.2.3 HEALTH PROFILE OF THE REGION

Every region has some factor that has immediate bearing on its health profile e.g., the state of Bihar has typical diseases such as *Kala -azar* related to pollution from industries. The cases of Filaria is more in the coastal region.

We are equally concerned about rising pollution levels in our metropolitan areas. The varying disease pattern of different regions affect the spatial relations within the hospitals . It is the type of predominant disease to be treated and the related need of particular types of equipment that dictate the spatial norm.

5.2.4 VERNACULAR ARCHITECTURE

VERNACULAR ARCHITECTURE or the local traditional Architecture has major role to play in the planning of building housing medical facilities of that particular region. This building tradition is a result of age old construction methods which take into account the climatic conditions, seasonal variation and such other aspects with special emphasis on locally available material. While providing the new facilities this aspect can be taken into account so that the built form provided is generally in tune with the local surroundings. Suitable variations could be made to accommodate new materials and also the requirements dictated by the emerging technologies, and these could be translated in the built form [11]

5.2.5 SITE PROFILE & CHARACTERISTICS

Site profile varies from region to region and place to place, A hilly terrain will have different type of circulation pattern that the flat terrain thus affecting the normative planning.

5.2.6 LOCAL REGULATIONS

Governing body and the local bodies from region to region has different type of restrictions related with the respective regional planning norms, thus effecting the spatial relationship of health planning. Floor Area Ratio varies from place particularly from cities to towns to villages and influence the type of development to be undertaken.

5.2.7 SOURCE OF FINANCE

Government of India, International Financing Institutions such as the World Bank, the World Health Organisation and the Asian Development Bank, which fund various health programmes and keep checks for proper utilization of fund. They have specific sets of requirements which influences the normative planning.

5.2.8 CHOICE OF TECHNOLOGY

This depends upon the type of health facility being planned for the specific level of health care. The availability of finance and the type of equipments being that are to be provided for the specific hospital or the health care unit.

5.3 THE CLIMATIC ZONES OF INDIA:

The Central Building Research Institute has divided entire country into six climatic zones (Annexure 5.1) which are broadly as follows -

Zone 1 WEST COASTAL TOPICAL.

Zone 2 EAST COASTAL TROPICAL.

Zone 3 PENINSULAR PLAINS.

Zone 4 THE GANGETIC PLAINS.

Zone 5 THE RAJASTHAN DESERT.

Zone 6 THE EASTERN HILLS.

(Figure 5.1 Clarifies Climatic Zones Region Wise)

5.3.1 DIVISION OF ZONES

Design and space parameter definitely has a bearing on the type of climatic zone in overall planning. The impact of climate in space norm can be seen in different situation e.g., a volume of space in a consultants room or a ward in a cold region will have lesser opening and compact in nature whereas the same in coastal region will have more window area and open type of planning for cross ventilation. Thus it is concluded that space has a bearing on Agro climatical situation, the Air change and Air lock of desired envelope surface for the given context. For the Normative planning they can be broadly divided into two important zones :

a) EXTREME CLIMATE

b) COASTAL REGION

5.4 GEO CLIMATIC FACTORS

India is a vast country with numerous climatic, physical and geographical conditions. It is important to realise that the objective and programme of each hospital will vary from one regions to another. It is not practical to suggest a standard which would comprehensively meet the requirements of hospitals all over the nation. Nevertheless, the necessity to evolve and establish some general norms have to be established in order to undertake and finalise the investment decisions at various levels. 7

5.5 PRE DESIGN REQUIREMENT

Hospital design is the complex process involving various parameters concerning various determents e.g., the design parameters for a general hospital shall vary greatly from those required for a hospital specializing in a particular disease such as Cancer, Spinal Injury or Cardiology. The programme of requirements will, therefore, change accordingly.

5.6 HOSPITAL FORM AND DESIGN

After the decision to construct the hospital is taken by the appropriate authority. The activity of formulating the programme of requirement is to be undertaken.This includes the statement of historical trends, current and future needs which will help to arrive at the specific service function of the intended facility and the resultant design criteria. It is also possible that the facility to be designed will have certain "**fixed**" as well as "**variable**" components. 33

5.6.1 SPACE MODULE

In the space module concept it is found that construction and operating costs are lower, additions can be more easily and harmoniously planned, space is more flexible, which is immensely important in view of the largely unpredictable and changing health facility space requirement.

Centralized Building Unit envisages a building form that is to be constructed at one time. It thus takes into account the"fixed" components not because the designers are not aware of "variable" factors but because of the type of development which is generally constrained by site conditions , financial restrictions or simply because of the nature of facility to be provided with certain fixed requirements that do not need any major modifications. 40

The flexibility of Modular planning also extends to the site planning of Master Planning, where the basis space modules can be grouped to form, rows, clusters or courts depending on topography or planning requirement.(Refer Fig. 5.2).

The incremental nature of Modular Planning has been addressed effectively by two different school of thoughts. One of them treats the design of the building as a form of art stating that it cannot have any addition or alteration. This kind of application can be found in **Le Corbusier's** design. As per the Modular System adopted by **Louis Kahn**,although the planned configuration of the building looks complete at all times, it has enough flexibility to allow addition, horizontally, vertically, or any direction and still form a good geometrical entity supporting its function and need. Hence, health facility planning has been on the basis of modular concept planning of the latter. 41

Hospital form is essentially incremental in nature. In its evolution as a built form, the "**fixed**" and the "**variable**" assume equal importance. Furthermore, hospital design has always been influenced by the technological advancement and will have to be reviewed from time to time to accommodate the "incremental". It is here that the concept of modular development becomes important in tackling such exigencies.

5.7 FUNCTIONAL PROGRAMME

Service delivery within a hospital is broadly categorised in three important parts.

5.7.1 OUT PATIENT FACILITIES

The emphasis is one the general consultancy to the patient and the equipment required to provide such a consultancy. In an **Out Patient Department (OPD)** a patient registers himself in Central Registration Area and is directed towards consultancy unit of specific specialist physician or doctors. Here he waits for his turn and then gets himself examined to be advised for further course of treatment. If the patient is required to undergo other treatment then he is admitted for the same otherwise he is treated here itself. This facility is on the outer fringe of the hospital and individual is not required to move into inner confines and hence termed as Out Patient Department. Some specialised facilities required for the OPD and Ward Patients could be common. Such facility include X-ray, CAT-scan, and such other which are of a specialised nature and used by outpatients in a very small measure.

5.7.2 IN PATIENT FACILITIES OR HOSPITAL WARD

Here the patient is confined to one particular space which is his bed and all other activities takes place around him which include the movements of the doctors, nurses and visitors during fixed hours. Special equipment relating to particular diseases are provided for the patients undergoing treatment for the same. For the sake of convenience patients undergoing treatment for one disease or a health problem are grouped together, e.g. cardiology, neurology, gynaecology etc. This helps to plan the specialist and patient interaction in a smooth and functional manner. It also help to provide Operation theatres required for such wards in a close proximity and possibly on the same floor to achieve the better movement pattern between all concerned and to achieve a best functional design.

5.7.3 OPERATION THEATRE, LABORATORY & OTHER DIAGONOSTIC FACILITIES

In these areas the patient and Doctor is mobile and the equipments and technicians are stationary. These areas are of a highly specialised nature where the design is equipment oriented, pre and post surgical facilities such as intensive care units could be provided in the proximity of operation theatre.

5.8 SPATIAL NORM

Land and the built **SPACE** are the scarce commodities and have to be used with utmost care to achieve desire utilization. **THE SPATIAL NORM** is a cubic or volumetric content per activity. The architectural space volume and the six enveloping surfaces shaping this space of walls, floors and ceiling. They hold different functions related with health care delivery.

The walls : Control light ventilation, views, partitions. Takes various services lines and the service points directive and identifying signages etc.

The ceiling : Lighting system and points, fans, air conditioning ducts and other services. Aesthetically, the indoor patient is all the time in visual/perceptual contract of the ceiling. Appropriate norms can affect the psycho semiotics of the patient in certain cases.

The floor : For general circulation movements and the equipment infact, floor planning and design plays major lion's share. While the architectural interior volumes support the activity moods and dynamics, the surfaces take specific physical and mental function. All these together form part of the functional programme for any building and in this case the hospital building.

5.9 THE METHODOLOGY

We have before us the following methodologies for consideration. [53]

a) Statistical Method

b) Expert Method

c) Experimental Method

d) Mathematical Model

5.9. 1 THE STATISTICAL METHOD

Is based on statistical records and reports on pilot studies in a selected district or town which is considered to be a typical town satisfying the medical care requirements of the population. A study is then made of the primary statistical data called out of the various records generated in the medical care establishment, the morbidity and the profile of the basic health facilities care provided to the population under study. In this way the felt needs for health services are determined. Attention is also given to any overuse of the health services i.e, any unjustified demands for care

5.9.2 THE EXPERT METHOD

The Expert Method Is used i) to supplement the statistical method by utilising the information obtained by statistical method for screening of representative samples of the population by highly qualified specialists and ii) to study both the " Under use" of the health services due to unfelt needs and the " overuse" due to unjustified demand. The results obtained by expert method can be used to validate the results worked out by means of statistical methods.

5.9.3 THE EXPERIMENTAL METHOD

Can be used to develop optimum norms and standards which are essential tools for a scientific basis for long term health planning. The **Spread Sheet Model** helps in presenting the collected data and arriving at certain specific decision. In pilot areas, resources can be allocated and organized in such a way that effective and efficient health care is provided. It can be used to determine the most efficient method of organizing Medical care, drawing up staffing plan, improving record keeping system, reporting system and incentive employed are assessed and used as the basis for norms and standards.

5.9.4 MATHEMATICAL MODEL

Mathematical Model Is a representation of a system or process in mathematical form, equations being used to simulate the behaviour of the system or process represented.

A mathematical model explicitly states the mathematical structure which relates the input (controllable variable, constraints and parameters) to the output (values for the criterion as expressed through the objective function.

Models are used in the place of real system for many reasons however economy and range of experimentation being two important ones.

There are two possible form of mathematical models

5.9.4.1 DETERMINISTIC

In the Deterministic Model, the relationship among the components is considered to be fixed.e.g such a model might state that one paediatrician care for fifteen patients during a four hour shift in an outpatient clinic.

5.9.4.2 PROBABILISTIC

In the Probabilistic model it might be shown that the relationship among component will vary in accordance with the contexts or with some sort of statistical distribution.

5.9.4.3 SIMULATION MODEL

In Simulation model a simplified mathematical representation of a system through which a number of alternative choices can be run whereby the outcome of the various choices can be demonstrated. Simulation Model also infers the idea from other contexts/fields to explain and bring about the idea/hypothesis and tries to postulate in a pursued study.

5.9.6 SPREAD SHEET MODEL

In order to achieve a measure of simplicity and easy adaptability at any level of application, **THE STATISTICAL METHOD** with spreadsheet model is found to be most satisfactory for application since it does not involve a complex process of mathematical modelling and could be understood at any level of application

5.10 GUIDING COMPONENTS

Two important parameters that form the basis of all further classifications and analysis are "FIXED" and 'VARIABLE' components.

Case 1 : Typical case of Out Patient Department where the Specialists/Doctor is Fixed component and patients become mobile.

Case 2 : Typical case of a Ward where the patient is stationary and doctor other clinical services become mobile.

Case 3 : Typical case of an Operation Theatre, a Laboratory, or a Diagnostic, where Equipment plays a vital role depending upon the development process in the Medical Diagnostic field. The whole scenario changes as per the type of equipment used., Here the Equipments/Technicians are fixed and the Patients & Paramedical Staff are mobile.

5.10.1 TYPES OF VARIABLE

The Variable component which has maximum impact in space planning consideration is identified as follows:

5.10.1.1 CLIMATE

The important variable of the **CLIMATE** is already discussed in 5.8.1 and 5.8.2. however in Agro climatical zones, at a certain level are variable, in a given situation are fixed.

5.10.1.2 THE DOCTOR PATIENT RATIO

The other variable which plays an important role is **THE DOCTOR PATIENT RATIO** (Annexure 5.2) which indicates the ratios in various states and Union Territories. It is noted that the Union Territories and different States cannot be compared due to the various factors such as the land area, the population and most importantly the major metropolitan city attached to it.

The Doctor patient ratio indicated in the annexure 5.2 can help us in concluding the total number of zones required to be considered as the figure indicates in various states. The analysis clearly indicates that a norm set for one state cannot match the other. However, few of them can be grouped together. [23]

The grouping of the various states shall have the common criteria of land, population and climate, Health and Medical needs of the region based on the occurance of health problems (Bio climatic) which is reflected in the Doctor Patient ratio.

5.10.1.3 POPULATION PRESSURE

To relate the "Population Pressure" of different states, as it varies from state to state, we can group them in two basic zones -

1)	Plateau;	Medium populated
2)	Desert/Mountain:	Thinly populated

Thus the Doctor Patient ratio for the states of the entire country can be grouped into two different zones and the third group for the Union territories owing to the reasons mentioned above. [23]

5.11 DISASTER PLANNING

In India country there is a history of hurricanes, tornadoes, flooding earth quakes or other regional disasters which are localised in the form of Epidemics. and thus Norms become non-applicable, thus additional amenities are always required in the hospitals to meet such requirements . which varies from region to region at any given period of time.

5.12 ADMINISTRATIVE CONTROL

Administrative control is also equally important as health is a State subject although the financial outlay, after finalisation at the Centre gets transferred to the State level, the Centre invariably uses some control to monitor the programme right from Primary Health Care to the Tertiary level.

5.13 SPACE PROGRAMMING

The definition of Space Analysis is the individual study of the elements of an operation & their functional relationships as well as the evaluation of such study. Space Programming means a course of action based on those results and the final determination of SPATIAL requirements and needs for a determined problem. It can be stated that **Analysis** means study and evaluation, **Programming** means d decision and determination.

Cyril M. Harris defines "Programme" in his Dictionary of Architecture &Construction as: "A statement prepared by or for an owner with or without an architect's assistance, setting forth the condition and objectives for a building project including its general purpose and detailed requirements. Such as a complete listing of rooms required, their sizes, special facilities etc." [32]

5.13.1 **Architectural Programming** is a process which sets forth the requirements for Architecture of a specific project which includes space analysis & space programming as its main element and site analysis, budgeting growth & change projections, forms part of it. (Figure 5.3)

A built form is then achieved by the process through which the spatial & functional requirements for the structure of a given project are set forth. This is based on series of conceptual diagrams applied to the spatial analysis evaluation of all major factors involved in the operational functions to be performed within the spatial parameters. This is applicable for interior or exterior programme for such structure.

It sets objectives, goals, develops data frame work and data sets. It establishes priorities and relationships of man, situation, services & projected environmental envelop. It sets up the process of physical & environmental transformation of Ideas, element, symbols pattern & systems.

5.14.3 SALIENT FEATURE

The salient feature of the space programme are:

a) It merges service, function & design criteria to form a statement of current and future space needs.

b) The programme provides an itemization of every space within a facility.

c) It quantifies the need for new or expanded spaces by converting them in to area units used in systematic planning.

d) It compares existing requirements vis a vis future requirement.

e) It makes possible the accurate estimation of construction & project costs.

f) The Spatial programme thus translate strategic and functional objective of each department and health care facility as a whole in to an architectural statement. The programme becomes integral part of the total database allowing rapid adjustment to changing space needs. [40]

5.14.4 CONCLUSION

The basic outline of planning process and programming are as per Fig.5.5

It is concluded that :

a) The development of a system which define programming, steps in direct interaction with determining factors.

b) A system which establish programming steps in a linear sequence covering everything from investigation and analysis procedure to volumetric design.

The number of activities involved in Project programming is indicated in fig-5.3

5.15 FLEXIBILITY IN METHODOLOGY

The ideal methodology is one that offers flexibility of use in the generality of cases and still contains within its structure characteristics which enable it to become a specialised format of programmatic data & determinations.

5.15.1 BASIC STRUCTURE OF PROGRAMMING

The basic structure of all architectural programming methodologies is determined by factors involving ***Man, Time*** and ***Space***. [40]

The basic condition which will cause, shape, modify, and define every portion of any programming activity is determined by above factors & the these conditions are referred as **HUMAN, TEMPORAL** and **SPATIAL**.

By nature of their structure , each one of these compliance conditions is subdivided in the following categories.

HUMAN :	Functional :	* Purpose * Activities * Movement *Flexibility * Scale -*Use * Manpower
	Physical :	* Measures & Scale * Sex * Age * Health *Hygiene * Security
	Psychological :	* Ego * Privacy * Authority * Aesthetics *Style *Scale* Habits * Phobias * Image * Character * Indivisuality * Impact * Isolation * Behaviour* Territory * Personalization * Status
	Sociological :	* Culture * Creed * Race * Demography * Economic Status * Class * Impact
	Regulatory :	* Government * Private Policies and Systems * Legal and Contractual conditions * Codes * Related Agencies * Commissions * Associations * Special Interest Groups * Violations * Variances
	Economic :	* Quality * Cost * Purpose * Investment * Return * Interest * Depreciations * Capital Gain * Economic *Trend* Projections * Operating Costs * Maintenance* Sales * Budget * Land - Acquisitions *Taxation
TEMPORAL :	Past :	* Historic Value
	Present :	* Preservation * Schedules
	Future :	* Change * Growth

SPATIAL : Natural :		* Site *Surroundings *Region *Urban Locations * Functional placement * Accessibility * Natural Conditions *Elements * Weather * Seasons* Energy and Resources
	Environmental :	*Temperature *Light *Sonic condition *shelter *Environmental impact *Preservation *Pollution

The Architectural programming thus summarized in a tabular form Fig 5.4

5.16 INVESTIGATION METHOD

STRUCTURED INTERVIEW & QUESTIONNAIRE

This method is extremely helpful in preparing a programmer for the task he must perform during the analytical activities. A questionnaire was prepared (Ref Annexure 5.3) and number of government run hospitals were visited and the concerned head of the departments/ Specialists/Technicians were interviewed based on the questionnaire & the data inputs thus received were analysed. [1]

5.16.1 EXISTING REFERENCE RESEARCH

With the help of executed projects, a lot of pertinent information was obtained. The reference were not detailed but were general guidelines since it is acknowledged that no single reference material can apply exactly to any specific problem other than the particular one it illustrates :

These reference materials were in the form of publications, documentaries, brochures, previously executed project drawings and project reports and even the verbal advice from various health experts and administrators. [40]

Notwithstanding the necessary data input which simplified and facilitated the research work, references were never a substitute for experience ,hence, the experience in the field of health facility planning of the author (as stated in the beginning of thesis before) has complemented the above mentioned reference, research, time and again.

After analysing the questionnaire & the literature research the "**Activity Analysis**" chart is prepared to arrive at the specific of the research work related to any specialized department of the hospital. Following symbols have been used for classifying the specific usage same are indicated below :(Ref. Annexure 5.4)

`A'	Architectural Planning information, such as activities or functions, occupancy, location, spatial relationship, building element, such as flooring, walls, ceiling, doors and windows.
`S'	Services such as Mechanical, Plumbing, Water supply, Air movement, Air treatment, equipment & piped services.
`E'	Electrical Services, such as Illumination levels, communications, power supply, disturbance factors (noise level) & special consideration.
`F'	Furniture, Equipments, recommended & optional (Group I) & major movable (Group II) including representative manufacturers.

5.16.2 OBJECTIVES DEFINITION

After the activity analysis chart the scope & the objectives are determined. A specific area, is identified, the spatial distribution is worked out, the sequence of operational activity is established & the Do's and Don'ts of the whole process are identified (Refer Fig. 5.10) **39**

5.16.3 ANALYTICAL PROCESS

The relevant data sheets checklists, activity analysis sheets and spatial relationship formats are studied together to arrive at programming process.(Refer Fig 5.5) The first step in the process is the logical and systematic separation of constituents. This separation accomplishes two very important things. The first is the analysis which could be executed within a framework of organized grouping. The second, is that the basis structure of the operation can be understood more clearly. Logically such groupings will enable us to understand the primary functions they represent and the relationships they maintain among one another and with the whole i.e Interrelationship of these component and their constituents.

5.16.4 PROGRAMME OUTLINE

It is a statement of varying activity ranging from a simple problem description to a complete net work of presentation techniques . While developing programme outline the factor to be borne in mind is that it should be simple, clear and should be brief. The programme outline should be finalized first before beginning the design phase as programming and designing are two definite sequential steps.(Fig. 5.11, 5.12)

5.16.5 PROGRAMME REQUIREMENT

This is the basis for final programme statement, design approaches, solutions and evaluations. They can be classified as quantitative or qualitative depending up on its nature. needs or wants based on their structure. Based on function they can be subdivided in direct relations to the compliance objective they define.

"Due to complexity of operational requirements, a programme becomes more than the simple layout of specific problem, it will be the human response to the elements surrounding it and the germ of the solution outlined by its limiting characteristics. Thus a programme translates the first questions of "what?" & "How?" in to clearly defined answer."[40] **(Fig. 5.13)**

The Roll of an Architect or Architectural Organization in the entire procedure is more as a consultant than as executive agents (Fig. 5.14) and most of them like other professional design organization, follow the general layout of operational functions.(Ref. Fig. 5.15)

5.16.6 SPATIAL ANALYSIS

The rudimentary core of architectural programming is spatial analysis. It forms the singlemost significant aspect which determines the programme, and governs its other constituents. The method of spatial analysis comprises two sections, viz., spatial component characteristics and spatial component relationship. Every activity or operation contains major subdivisions which represent in varying degree, the essential description of its structure.(Refer Annexure 5.5)

5.17 SUGGESTED METHOD

The methodology of spatial analysis is to be comprehended necessarily in two discourses. These avenues run concurrently and have a direct and dynamic bearing on the eventual Design Brief which ensues from within these discourses. One of these two components is **'space utilisation'** and the other is **'functional suitability.'** It is pertinent, here, to solve into them individually to cohere the specific aspects of these two approaches and consequently, understand their bearing on the **Design Brief.** (Fig. 5.16)

5.17.1 SPACE UTILIZATION

This discourse addresses the **user identification** component of the design requirement. It essentially demarcates the users of the function, which might comprise one, some or all of the following: the patient, the doctors, the paramedical personnel, the visitor or the storage exigencies. 14

After the player in this major act of utilization are identified, the information is further enacted in the light of **work load tendencies**. Such analysis is carried out on the basis of prior survey/s. It is here that the factor of optimization predominantly figures. The result of the process of studying work load tendencies helps configuring the'**staffing.' The pattern of staffing**, thus, would vary from case to case depending upon the ambient situations. For instance, a hospital in a particular area can exhibit predominantly more number of dental ailment. This would, in turn, affect the work load tendency for this centre to reflect the specific pattern of its patients and their therapy. Hence, it could eventually, indicated enhanced staffing to ameliorate this situation. In numerical terms, the conclusion would be more numbers of orthodontists in the staff structure.

The implications is that such analysis indicate the numerical component of spatial requirement. Thus, from the space utilization component of the methodology of spatial analysis, the actual numbers of rooms of every type is obtained.

It is to be noted, here, that from time to time this information is updated and the **'spreadsheet method'** is utilized whereby the number of consulting and examination rooms is determined as explained in Chapter 3 (3.13 & 3.14)

5.17.2 FUNCTIONAL SUITABILITY

Chapter five refers to the major categorization of the hospital into out-patient department, in-patient departments and operation theatres. This categorisation is the first broad step of this discourse where the service delivery areas are noted. This step is to assimilate the entire gamut of service delivery to subject it to **'Operational Policy'.**

Operational policy is the tool which governs the various exigencies of a hospital activity. It is necessary to find out the work flow of individual activities. [13]

For instance, the activity of the entrance of a patient is subject to the operational policy which considers the following exigencies:

a) Patient enters walking.

b) Patient enters with a stick.

c) Patient enters in a wheelchair.

d) Patient is wheeled in on a trolley/stretcher.

The analysis component of the activity responds to the following:

a) Door width

b) Double lobby (to prevent from temperature variation in a cold climates)

c) Levels in plinth, provision of a ramp

d) Reception

e) Signages

f) Lighting

g) Security controls

It is evident that the range of opportunities and possibilities of the specific activity decides the resultant spatial configuration. However, the dynamic nature of the work flow calls for a more detailed analysis to arrive at optimal spatial dimensions, which takes into account the various possibilities of activities, viz., the two levels, **activity unit** and **activity sequence.**

Activity unit is essentially where work flow is contained within one spatial unit. (Ref. Fig. 5.17)

Activity sequence refers to instances where both the patient flow and the work flow occur through more than one space. Such a sequence through the OPD is depicted in table below :

Patient Reports at Registration/Reception

Patient Waits

Consulting with the Doctor

Any of this] Patient Undresses --examined
or All of this] Patient weighed
or None] Blood Pressure taken
Lab test request

Doctor Discusses further action

Patient Dresses & makes Next appointment

Dr. Writesnote & calls next patient

5.17.3. PROCESS

The crucial step at this stage is to cohere the functional sequence to arrive at a spatial requirement, taking account of both macro and micro level conditions. The process is, thus, delineated as follows:

1. Extract information on all main work flow of the sections and departments.
2. Elaborate and divide into broad sequences of activity -- the macro level experiences.
3. Identify all individual activities to occur along the work flow path -- the micro level experiences.
4. Establish user requirements for every activities accounting for people, things (furniture, equipments etc.), environment and building services.
5. Group the activities which can take place in the same spatial unit/room.
6. Establish space requirement including critical dimension. [15]

   (Ref. Annexure 5.6 for Activity Data Method)

5.17.4. ROOM SCHEDULING

At this juncture, further inputs which influence the physical dimensioning of a spatial unit should be considered. Hence, the optimum size of the room must be worked out and related to relevant structural technology, viz., economical span.

5.17.5 OPTIMUM SHAPE OF ROOM

The final optimum shape of the room is thus based on key dimensions related to functions.(Fig. 5.18)

5.17.6 ROOM DATA

The conclusive scenario is captured in the comprehensive room data, which categorically states the performance requirements of each space:(Ref. Annexure 5.6)

Functions

Participants

Durations and frequencies of use

Furniture and equipment

Environment

Engineering services

Finishes

Space requirement

5.17.7 EXAMPLE: STEP BY STEP METHOD

Step by Step method is presented here as a systematic approach to the sizing of body stores in a Mortury, the health authority will need to take into account any local needs which may have a bearing on individual projects.

Body Store Spaces

Projected Population	Data
Decide on death rate assumption/1000/ pop/pa	On National figures, modified by local demography and Projection.
Calculate Expected total deaths/annum	Total deaths/annum = death rate/annum x pop in 1000 s
Decide on % of hospital deaths	Make Allowance for "declared dead on arrival"
Estimate future body store occupancy& length of stay	80% body store occupancy and 4 days length of stay is currently regarded as a reasonable target. Allow for Week-ends,Bank Holidays, Maintenance, Seasonal demands and contingency periods. These estimates could be greatly influenced by efficiency factor of local undertaker service.
Calculate number of body spaces	No. Of Spaces $= \dfrac{\text{total bodies estimated x length of stay}}{\text{365 x space occupancy}}$

Worked Example - Figure 2

Projected population	Say 220,000 District Population
Decide on death rate assumption/1000 pop	11.3 National data
Calculate total deaths/annum	= Death rate/annum x pop in 1000s 11.3 x 220 = 2486 deaths / annum
Decide on % of hospital deaths	55% of total deaths = .55 x 2486 = 1367 hospital deaths / annum
Agree expected body store occupancy and length of stay	80% occupancy 4 days length of stay
Calculate number of body spaces	No. of spaces $= \dfrac{\text{total bodies x length of stay}}{\text{365 x space occupancy}}$ $\dfrac{1367 \times 4}{365 \times .80} = 18.685$ body space

Deep Freeze Provision: Additionally 3 deep freeze storage body spaces should be allowed for longer holding of bodies, infected cases etc. (i.e one compartment).

*SOURCE : Health Building Note DHS& Weslh Office. U.K.

5.18 APPLICATION OF THESIS FINDINGS

5.18.1 DEEN DAYAL UPADHAYAY HOSPITAL (CASE STUDY 1)

In chapter IV we have already discussed about the inception and functioning of Hospital with various features.

Having finalized the methodology of Norm making when same is applied on the existing Hospital we could conclude the following.

5.18.1.1. CORRIDORS

Corridors in the Hospital are of equal width irrespective of their location and Of people using it e.g I) Corridor in OPD. Where patient, visitor or accompanying person, Paramedical staff and Doctors are moving.

Ii) The corridors of Laboratory & Procedure area where only paramedical staff is moving

Conclusion: The load on the corridors of OPD & Wards are heavier than the procedure area thus we could save around 40% of area used on corridors.

5.18.1.2. OUT PATIENT DEPARTMENT (OPD)

Huge OPD with various specialities have been provided on Ground & 1st floor of OPD Block. The timing of OPD is from 9.00a.m. to 1.00pm in the morning & rest of the time building or space provided for O.P.D. is empty.

Conclusion: Proper timing & distribution of staff and support services for functioning of OPD will serve space almost by 50% as the OPD of certain speciality can function in the morning hours and the second shift in the afternoon can cater for the rest of the speciality thus reducing load on corridors, staff and support services.(This is based on operational policy)

5.18.1.3. IN PATIENT ADMISSION

Waiting time for admission for surgical intervention or operations has a longer queue length due to non availability of procedure records/Operation Theatre.

Conclusions: Introducing Day Surgery & sorting out patient who require minimal time in Hospital need not be retained hence reductions in Hospital admission load. The case like Cataract and minor surgical procedures can be attended in day care centre and can be discharged on the same day. Hence no more number of Operation Theatres required but they should be utilised to its optimum level.

5.18.1.4. STRUCTURAL GRID

Selection of Correct structural grid will have a saving of space by about 30 to 35%. In X-ray rooms, ultrasound room, laboratory, the effect can be felt. The structural grid to be flexible and should be carefully selected as we could see in this Hospital that one Grid was too large and half of the grid was too small. Hence the result was either rooms were too cramped or too spacious.

Conclusion: The right flexible structural grid gives you space saving about 35%.

5.18.1.5. CHANGE OF POLICY

By increasing the bed strength from 300 to 500 Bed has lead to separate ward block with long corridor connection thus wastage of space by 20% on circulation.

5.19 MAIDESTONE HOSPITAL (Case Study - 2)

Since the hospital is enclosed in a mechanically controlled enviornment, the space standards is suffiecient in almost any given location throughout the country.

In India, however, **variable** like **climate, population pressure, doctor patient ratio,** fluctuate between extreme degrees affcting the resultant scenario.

Hence the norm making procedure in India assumes a more significant and necessary role in manifestation of healthcare facility than the counter part accross the Europe.

5.20 SPATIAL COMPARISON

Spatial comparison between Government hospitals and the Private run hospital

	GOVERNMENT HOSPITAL	PRIVATE HOSPITALS (Centrally air-conditioned)
OPD	* The number of specialist consultants depends on the Operational Policy of the govt. and also based on the staffing norms.	* The number of specialists are based on the specific requirement of the hospital on demand and supply basis. The operational policy in this regard is based on the commercial returns
	* The entry of the patient is unrestricted during the permissible hours of the OPD.	* The entry is mostly by prior appointment. Hence optimum utilisation of space with more number of consultants in the similar volume of space as in govt hospitals.
IPD(Wards)	* More number of general wards and less numbers of single room and double rooms.	* More number of single rooms and double rooms and less number of general wards hence 25% to 30% of more area depending on the choice of configuration of beds.
OT,Lab,X-ray	* Air-conditioned space	* same as general hospital

LIST OF FIGURES :

CLIMATIC ZONES IN INDIA
(REGION WISE)

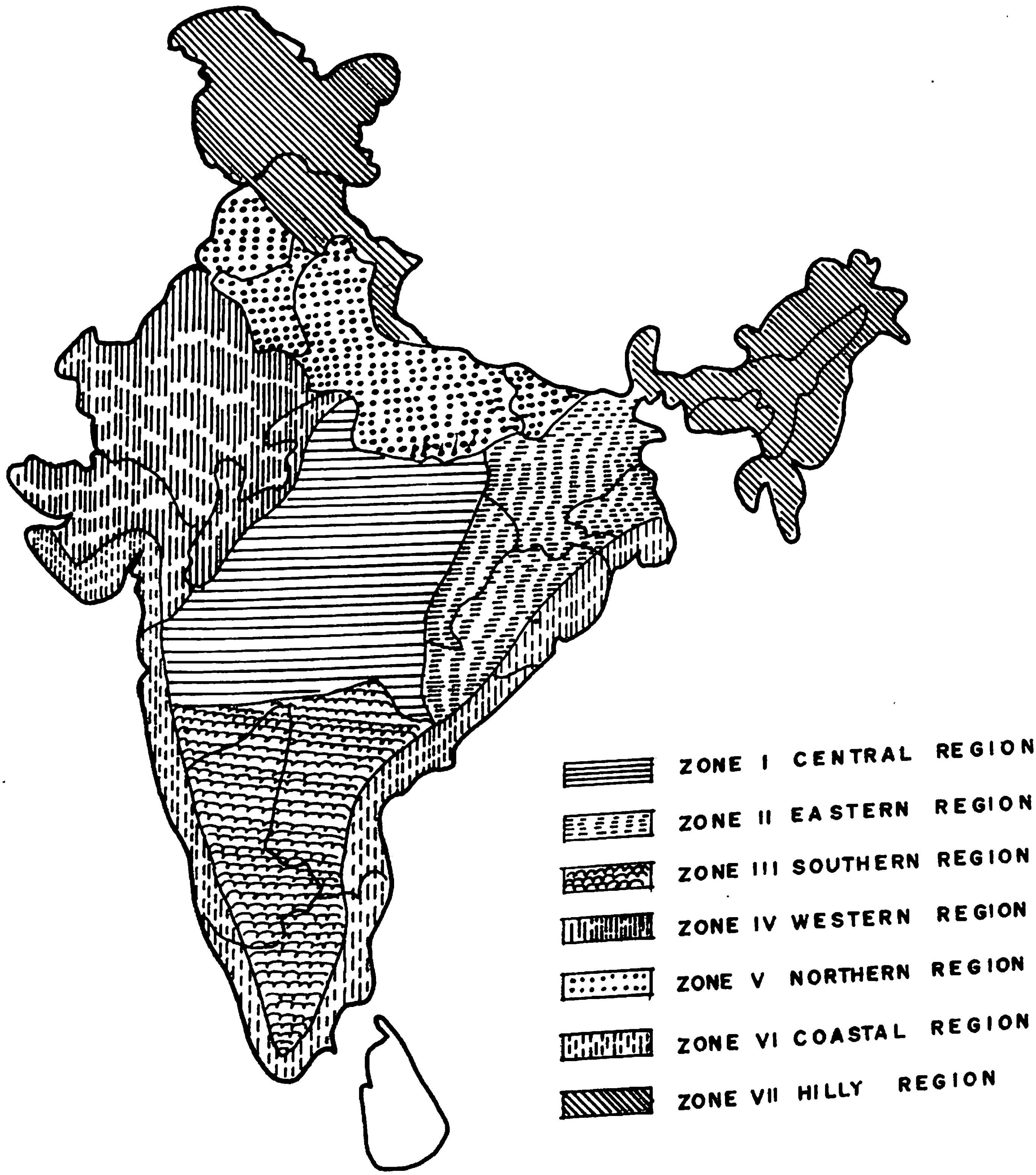
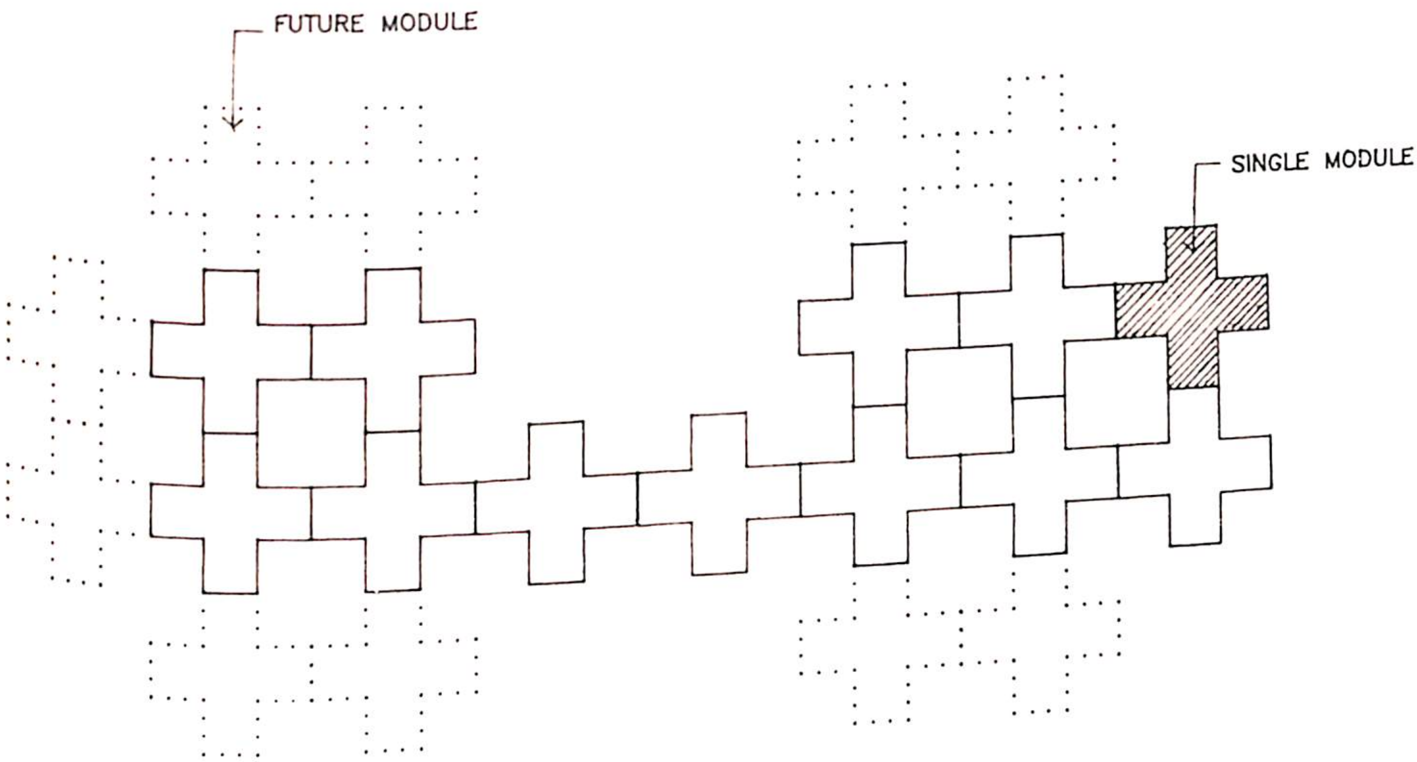


FIG. 5.1



MODULAR PLANNING

FIGURE NO 5.2

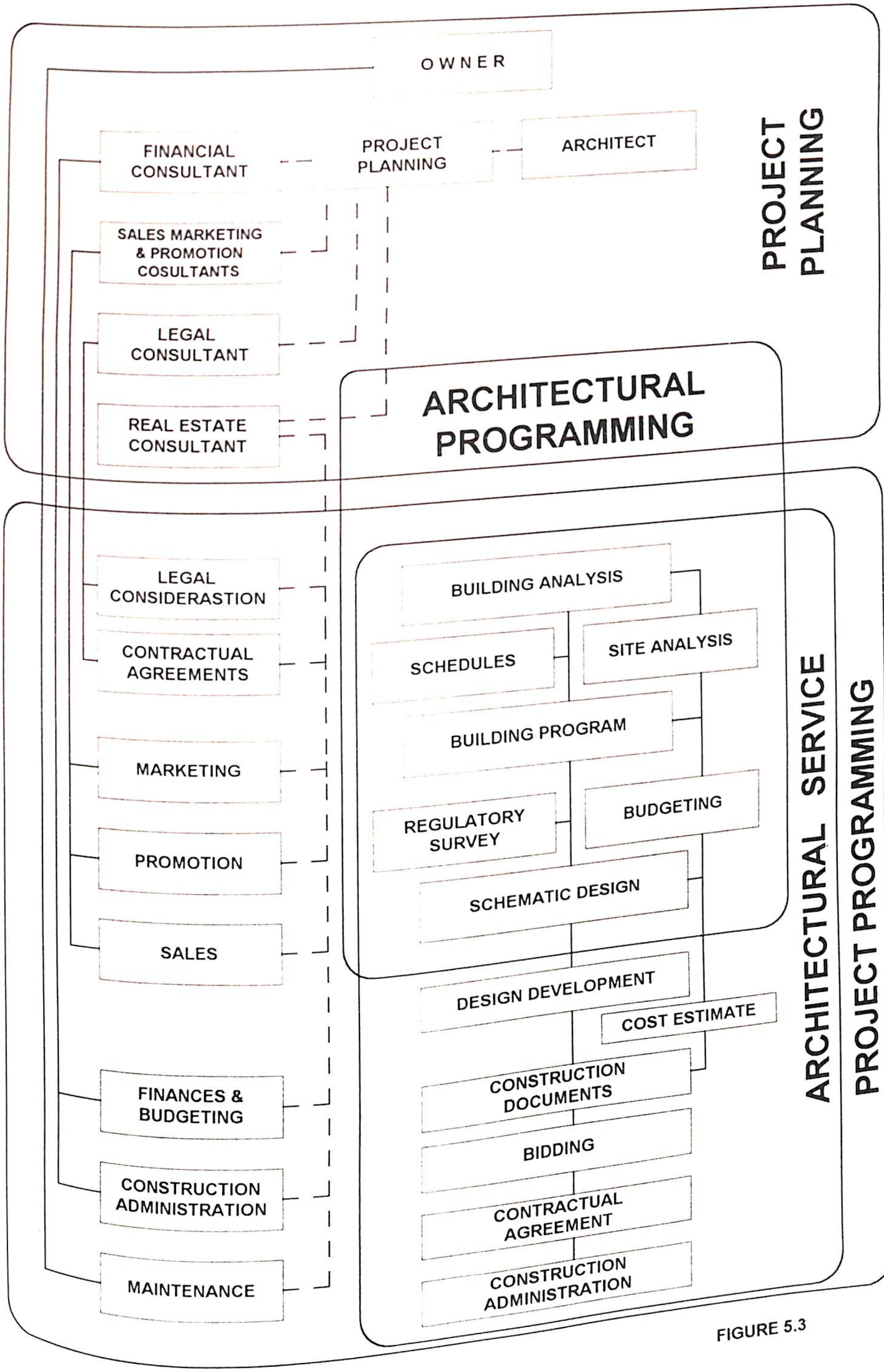
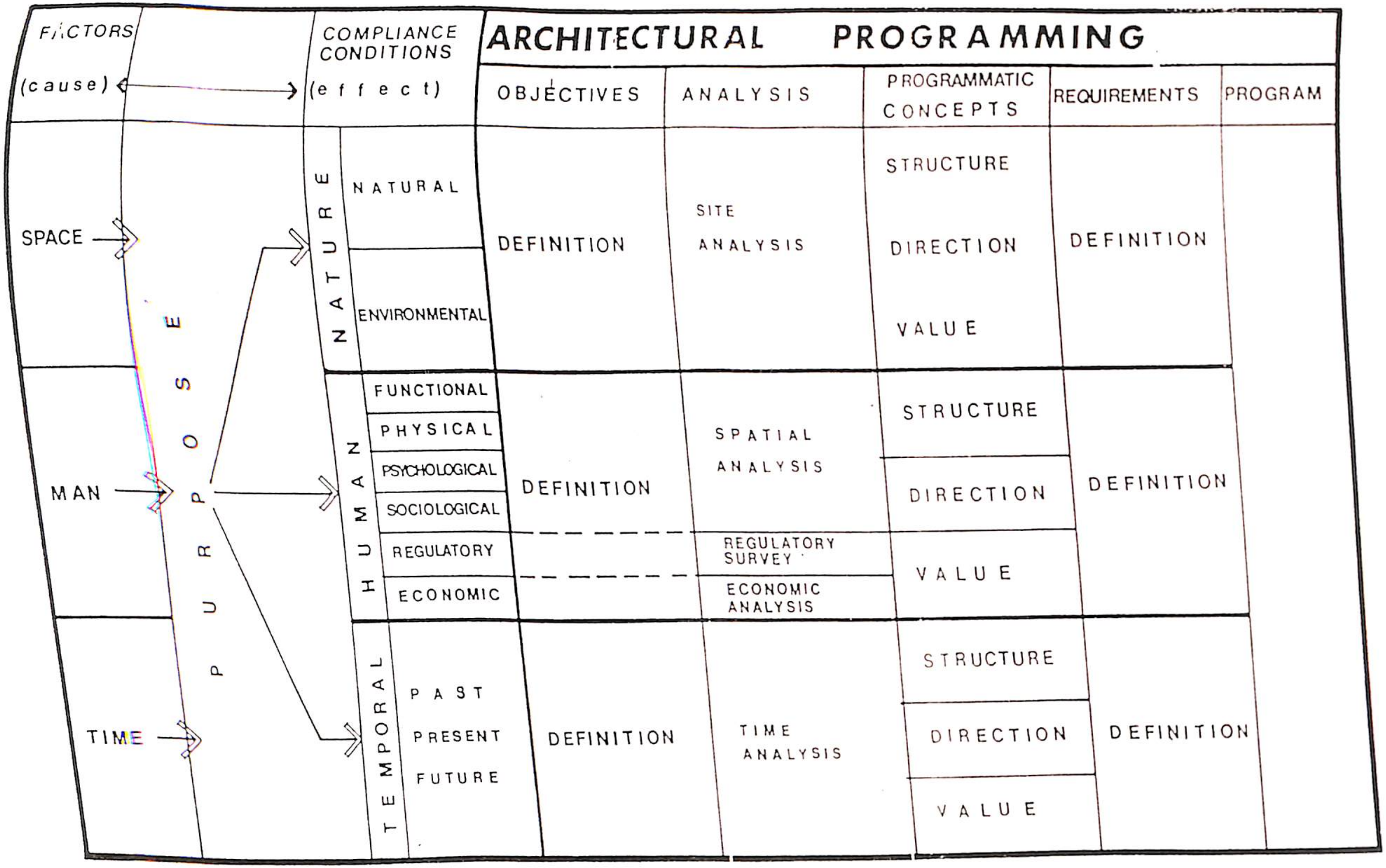

OWNER
FINANCIAL CONSULTANT
PROJECT PLANNING
ARCHITECT
PROJECT PLANNING
SALES MARKETING & PROMOTION COSULTANTS
LEGAL CONSULTANT
REAL ESTATE CONSULTANT
ARCHITECTURAL PROGRAMMING
LEGAL CONSIDERASTION
CONTRACTUAL AGREEMENTS
MARKETING
PROMOTION
SALES
FINANCES & BUDGETING
CONSTRUCTION ADMINISTRATION
MAINTENANCE
BUILDING ANALYSIS
SCHEDULES
SITE ANALYSIS
BUILDING PROGRAM
REGULATORY SURVEY
BUDGETING
SCHEMATIC DESIGN
DESIGN DEVELOPMENT
COST ESTIMATE
CONSTRUCTION DOCUMENTS
BIDDING
CONTRACTUAL AGREEMENT
CONSTRUCTION ADMINISTRATION
ARCHITECTURAL SERVICE
PROJECT PROGRAMMING

FIGURE 5.3



*SOURCE: SPACE OPERATION ANALYSIS
MANUEL MARTI JR.

FIG. 5.4

ARCHITECTURAL PROGRAMMING PROCEDURES

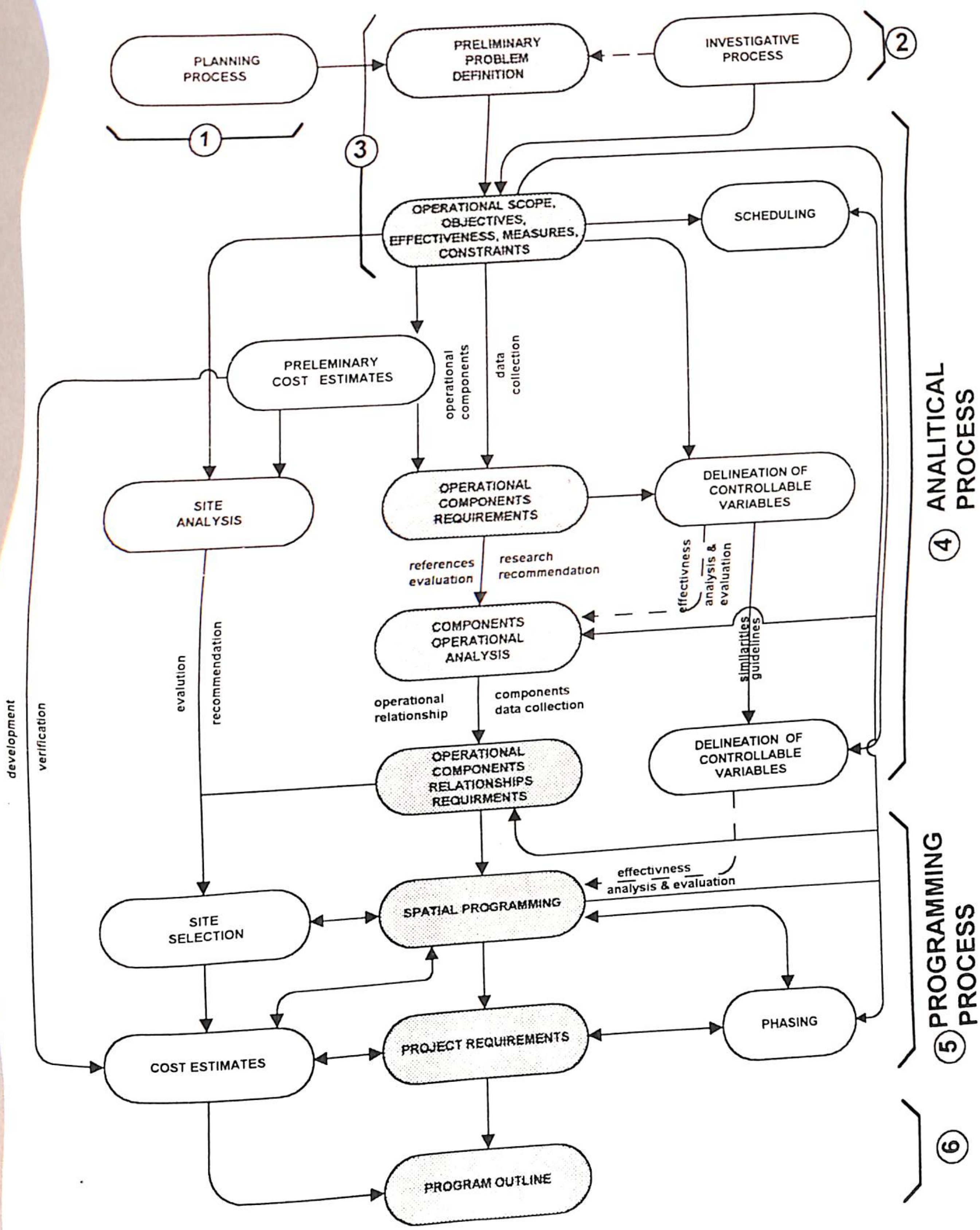


FIGURE 5.5

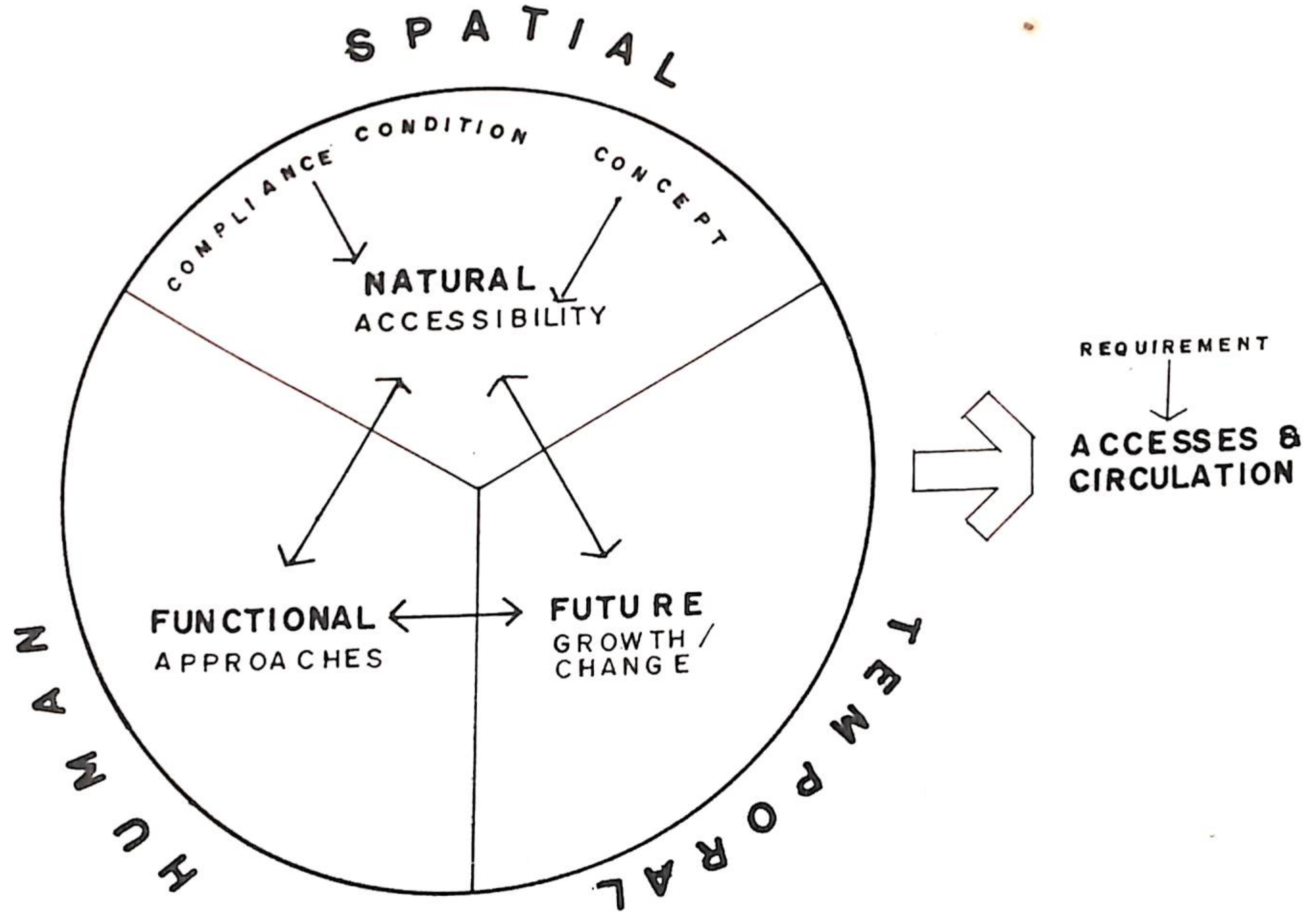

SPATIAL
COMPLIANCE CONDITION
CONCEPT
NATURAL
ACCESSIBILITY
FUNCTIONAL
APPROACHES
FUTURE
GROWTH /
CHANGE
HUMAN
TEMPORAL
REQUIREMENT
ACCESSES &
CIRCULATION

FIG. 5.6

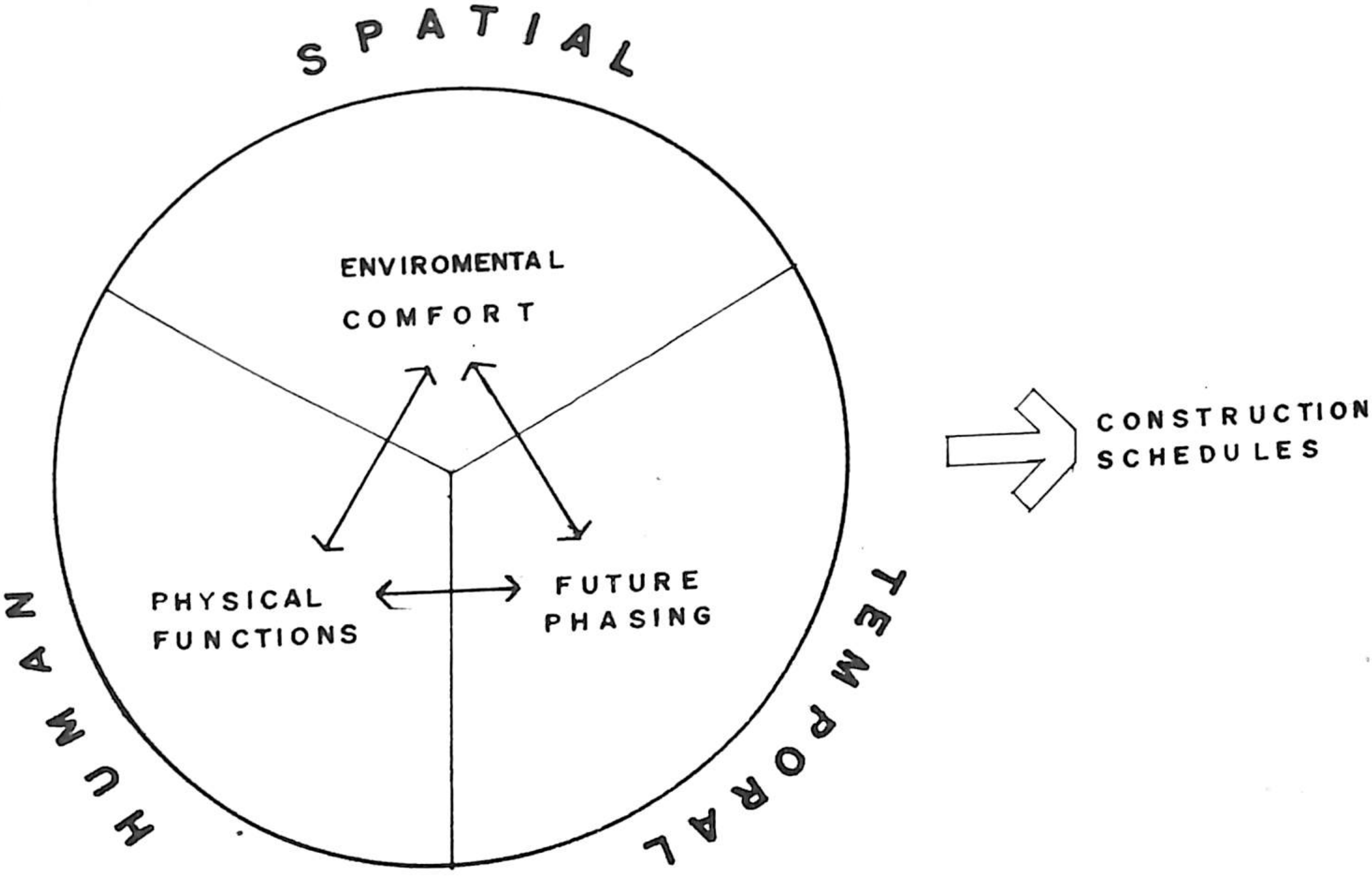

SPATIAL
ENVIROMENTAL
COMFORT
PHYSICAL
FUNCTIONS
FUTURE
PHASING
HUMAN
TEMPORAL
CONSTRUCTION
SCHEDULES

FIG. 5.7

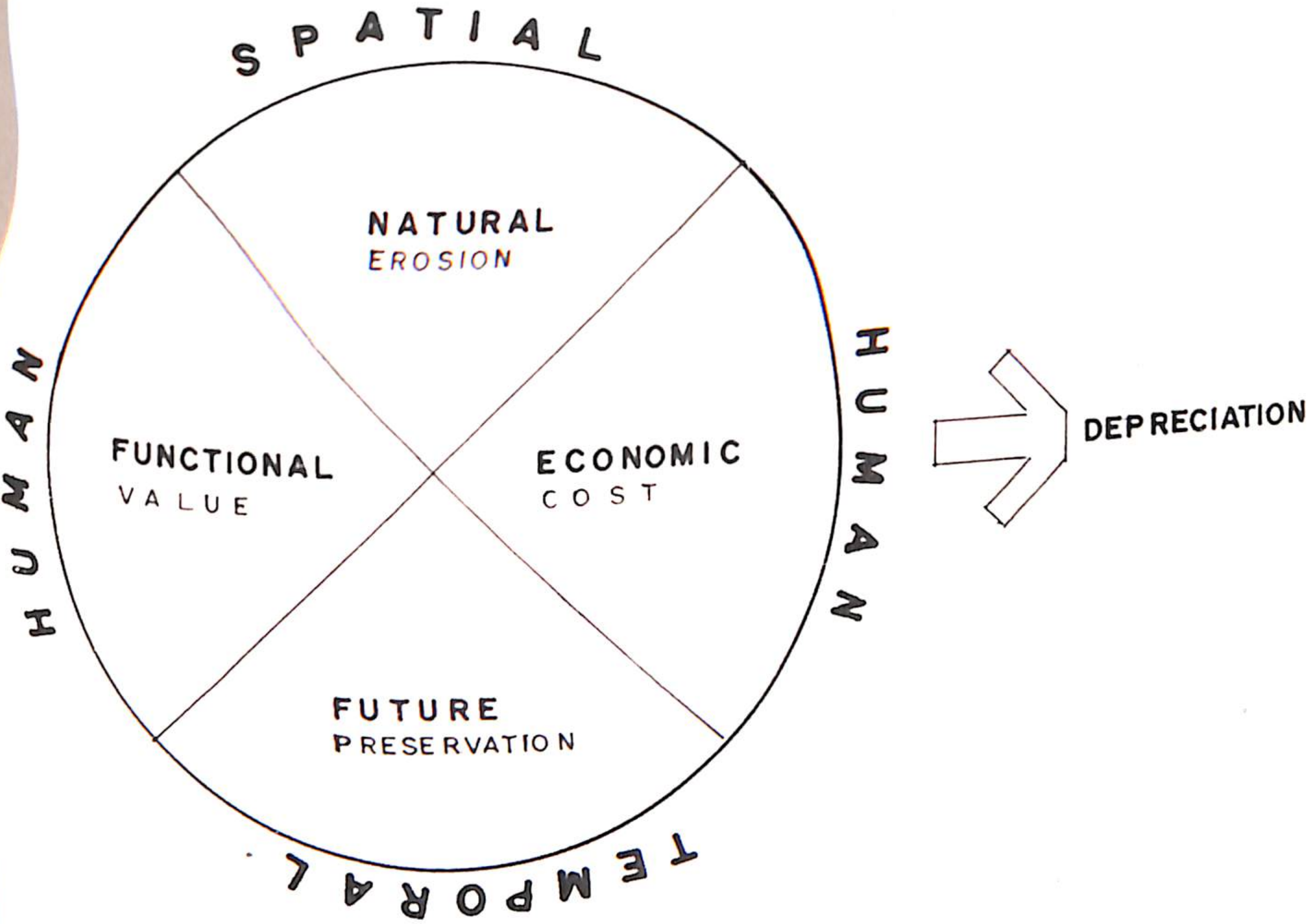

SPATIAL
NATURAL
EROSION
FUNCTIONAL
VALUE
ECONOMIC
COST
FUTURE
PRESERVATION
TEMPORAL
HUMAN
HUMAN
DEPRECIATION

FIG. 5·8

RADIOLOGY.

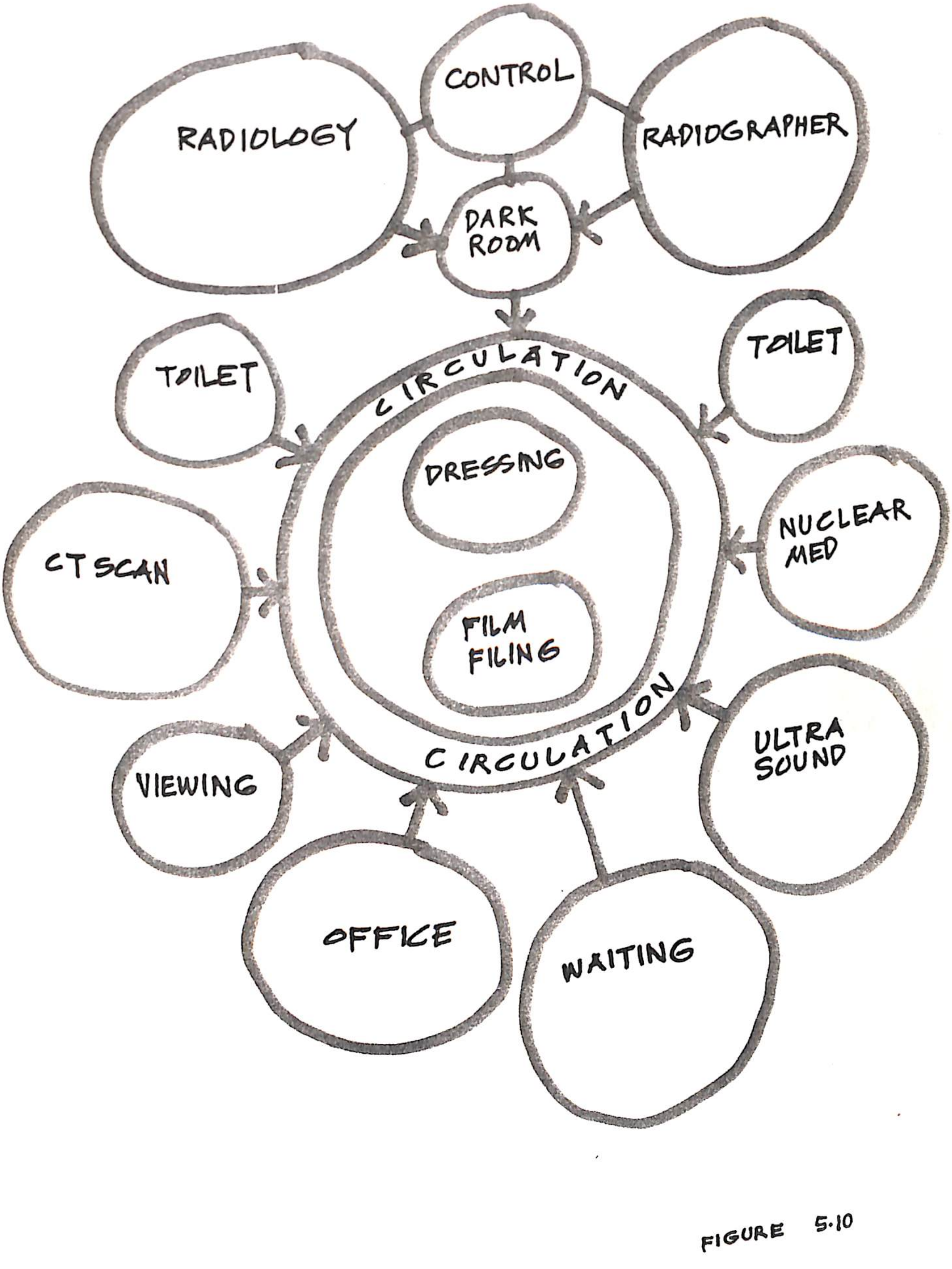
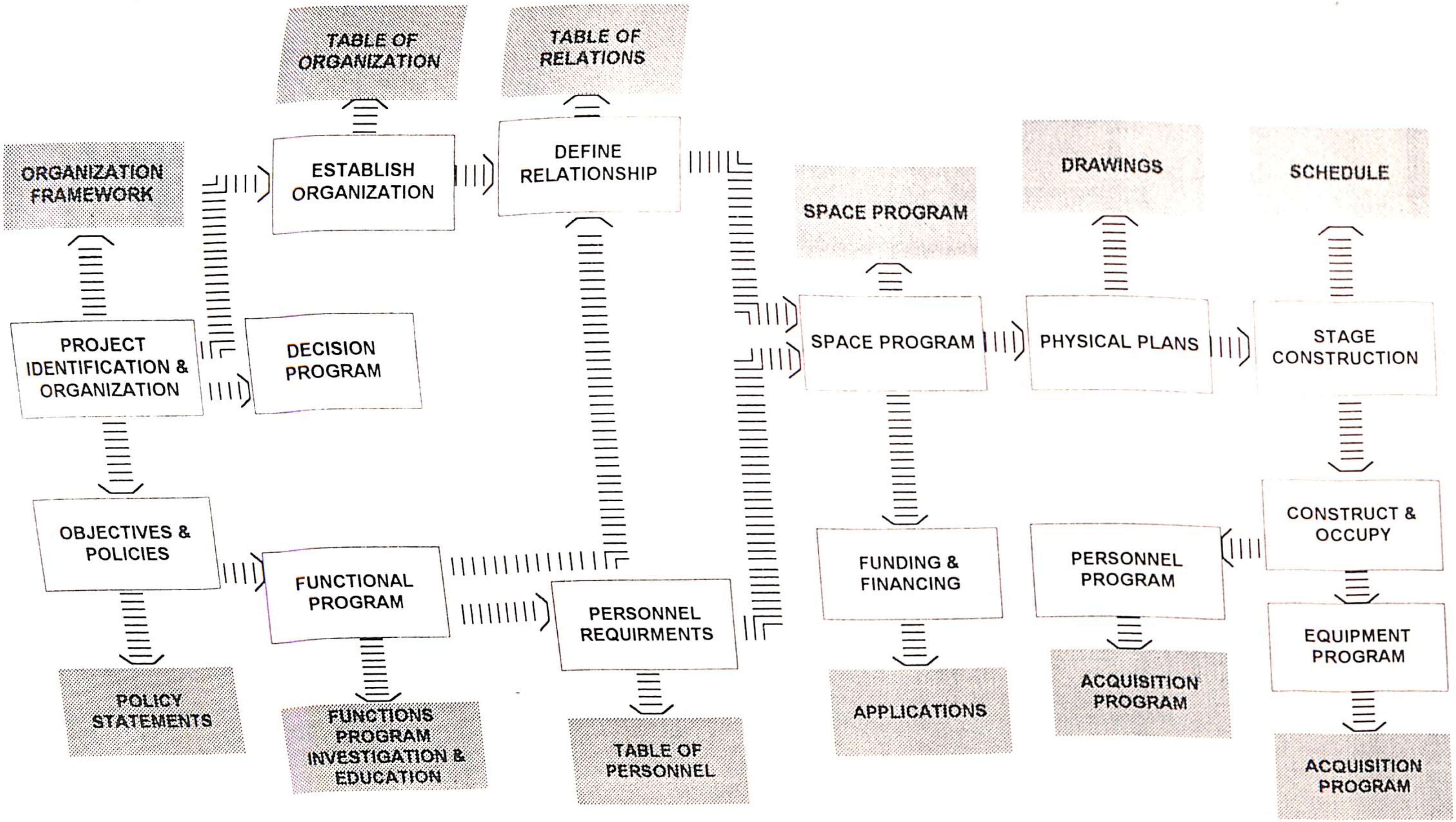


FIGURE 5.10



PLANNING PROCESS (PROGRAMME OUTLINE)

FIGURE 5.11

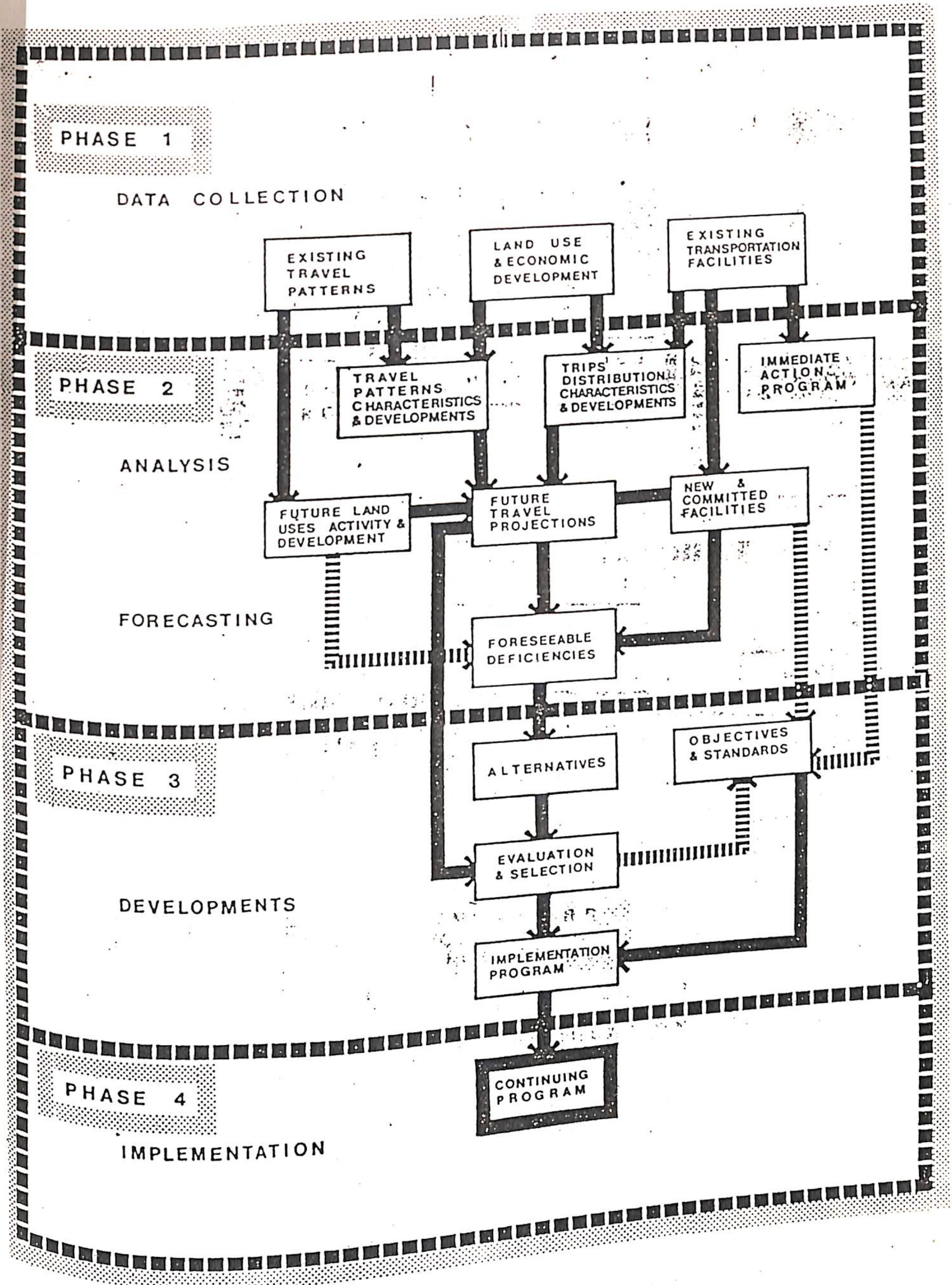
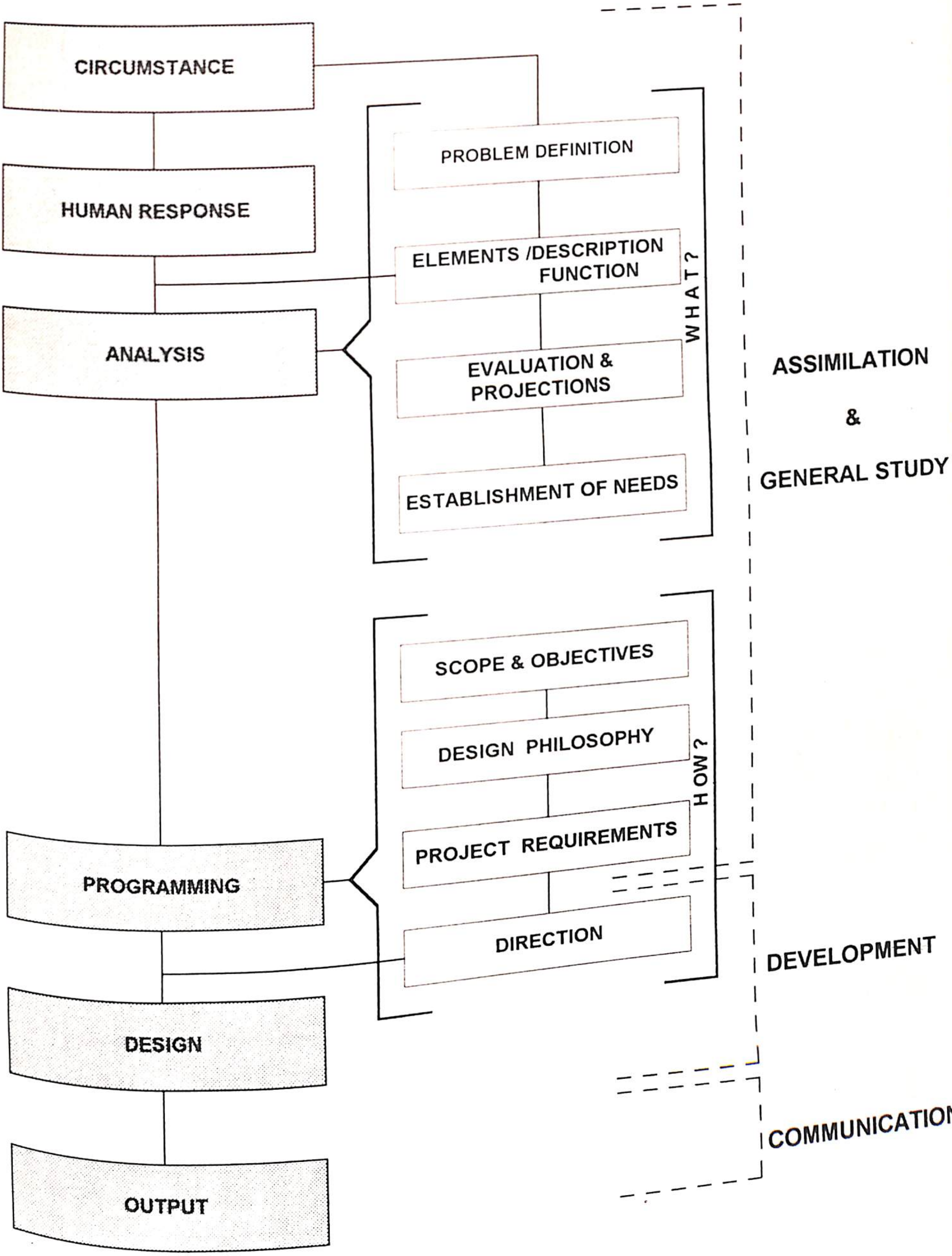


FIG. 5.12

PLANNING PROCESS
(PHASING)


CIRCUMSTANCE
HUMAN RESPONSE
ANALYSIS
PROBLEM DEFINITION
ELEMENTS /DESCRIPTION FUNCTION
EVALUATION & PROJECTIONS
ESTABLISHMENT OF NEEDS
WHAT?
ASSIMILATION
&
GENERAL STUDY
SCOPE & OBJECTIVES
DESIGN PHILOSOPHY
PROJECT REQUIREMENTS
DIRECTION
HOW?
PROGRAMMING
DEVELOPMENT
DESIGN
COMMUNICATION
OUTPUT

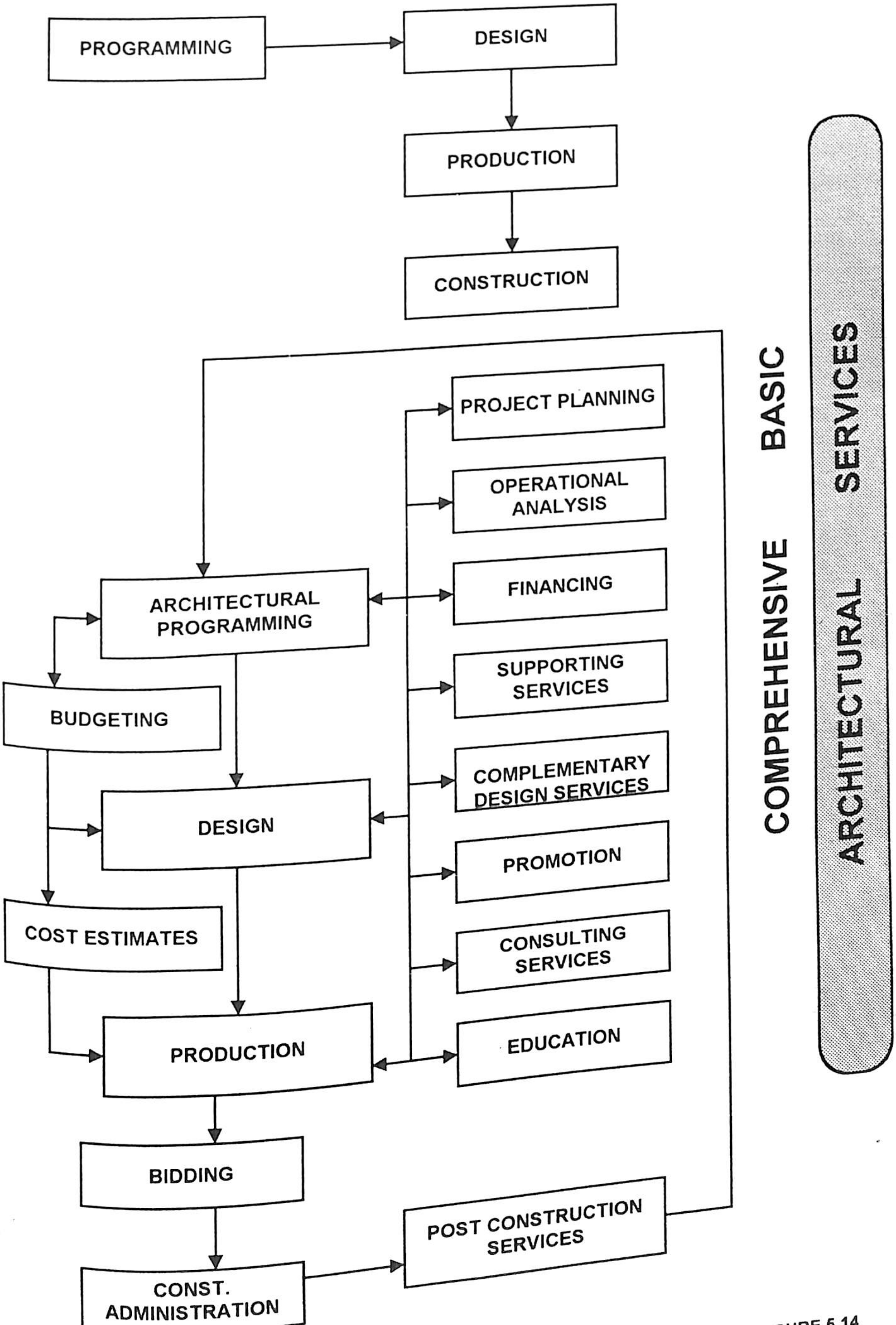

PROGRAMMING
DESIGN
PRODUCTION
CONSTRUCTION
BASIC
COMPREHENSIVE
ARCHITECTURAL SERVICES
PROJECT PLANNING
OPERATIONAL ANALYSIS
FINANCING
SUPPORTING SERVICES
COMPLEMENTARY DESIGN SERVICES
PROMOTION
CONSULTING SERVICES
EDUCATION
ARCHITECTURAL PROGRAMMING
BUDGETING
DESIGN
COST ESTIMATES
PRODUCTION
BIDDING
CONST. ADMINISTRATION
POST CONSTRUCTION SERVICES

FIGURE 5.14

ARCHITECTURAL OFFICE OPERATIONAL FUNCTIONS

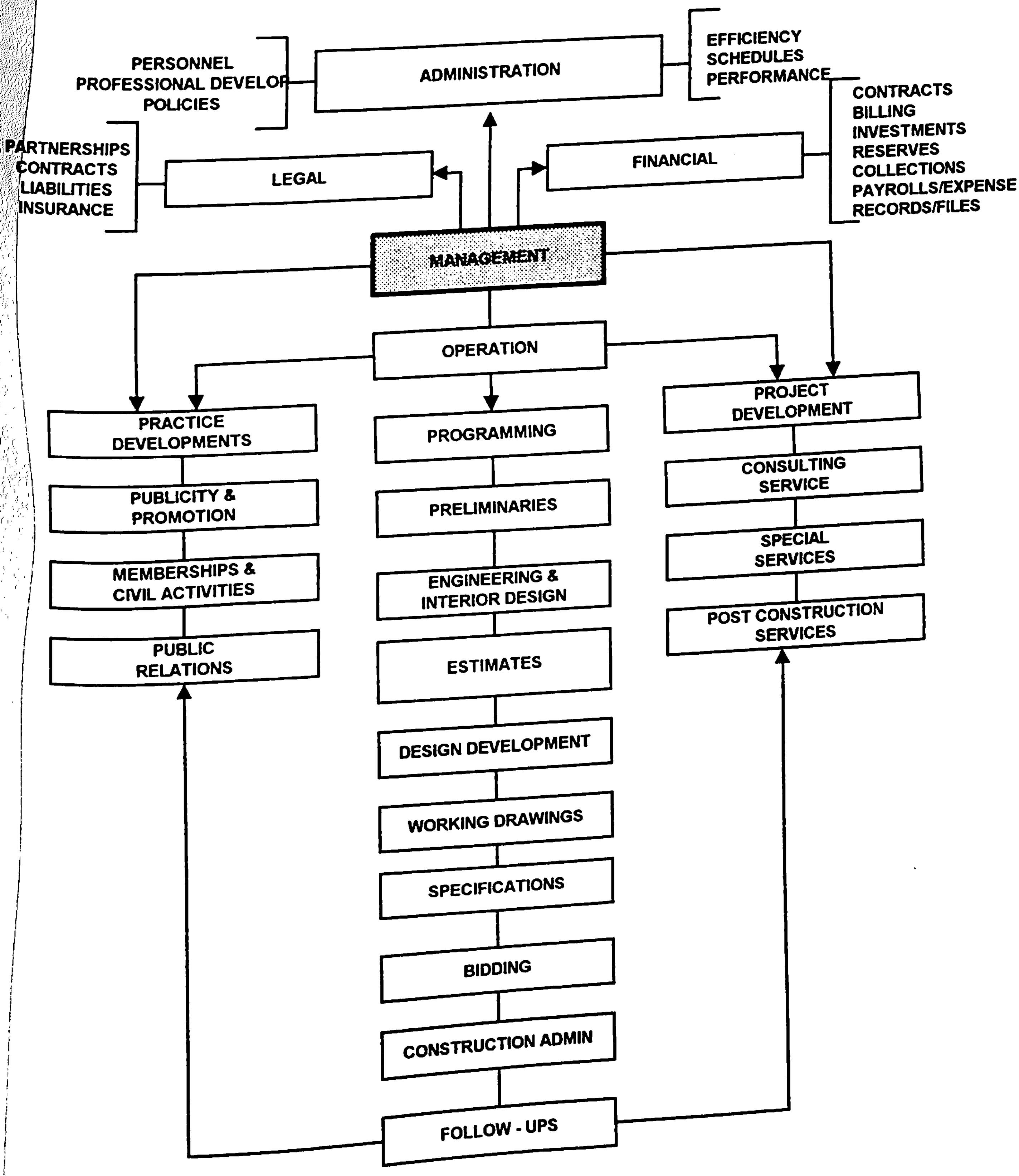


FIGURE 5.15

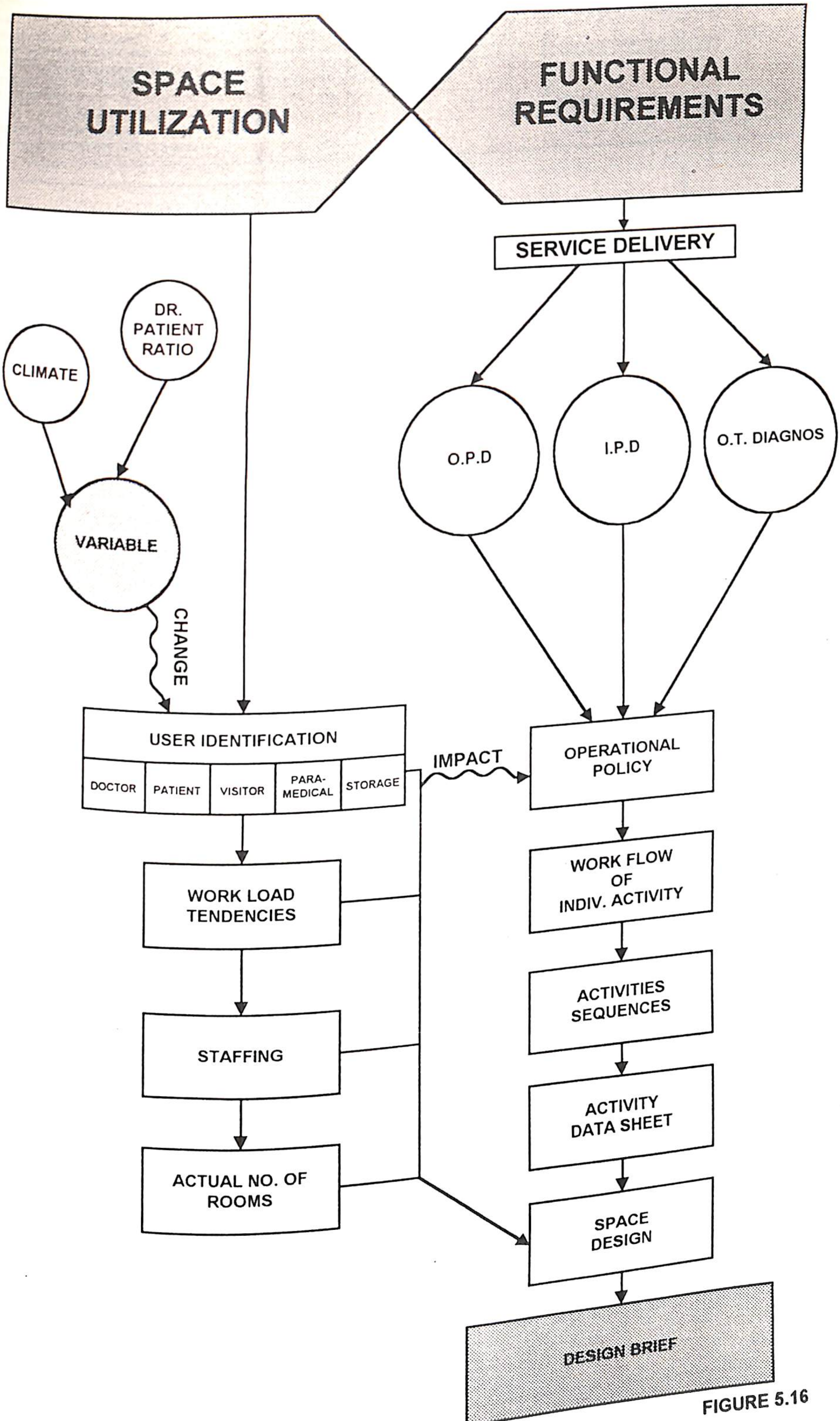

SPACE UTILIZATION
FUNCTIONAL REQUIREMENTS
SERVICE DELIVERY
CLIMATE
DR. PATIENT RATIO
VARIABLE
CHANGE
O.P.D
I.P.D
O.T. DIAGNOS
USER IDENTIFICATION
DOCTOR
PATIENT
VISITOR
PARA-MEDICAL
STORAGE
IMPACT
OPERATIONAL POLICY
WORK LOAD TENDENCIES
WORK FLOW OF INDIV. ACTIVITY
ACTIVITIES SEQUENCES
STAFFING
ACTIVITY DATA SHEET
ACTUAL NO. OF ROOMS
SPACE DESIGN
DESIGN BRIEF

FIGURE 5.16

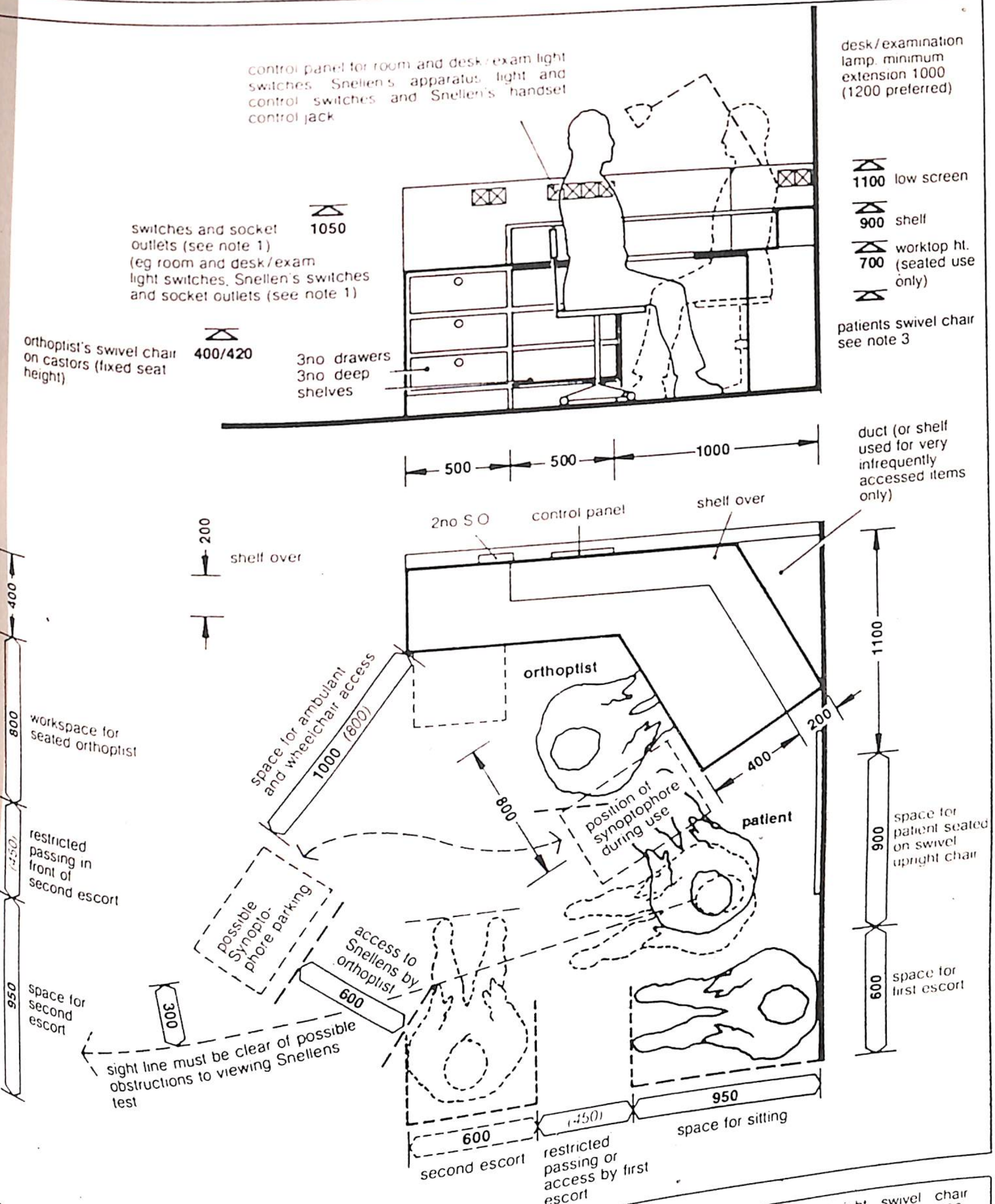
Activities
The workstation is designed to allow consultation and most of the Orthoptic tests, (including Snellens and Synoptophore tests) to be carried out at or from a single examination position

The shelves and drawers provide storage for equipment and testing apparatus accessible to a seated orthoptist (see also Synotophore & Snellen Test data sheets)

DHSS **Ergonomic data bank**
Component-user data sheet, not to scale

Orthoptist's workstation

Users
Orthoptist & patient (adult or child) with escorts - occassionally patient in wheelchair.



...table height swivel chair ...djustment; 400-

Activities

Activity space with 3no. Orthoptists workstations allowing consultation and most testing to be carried out at the individual workstations.

See also component user data sheets on-

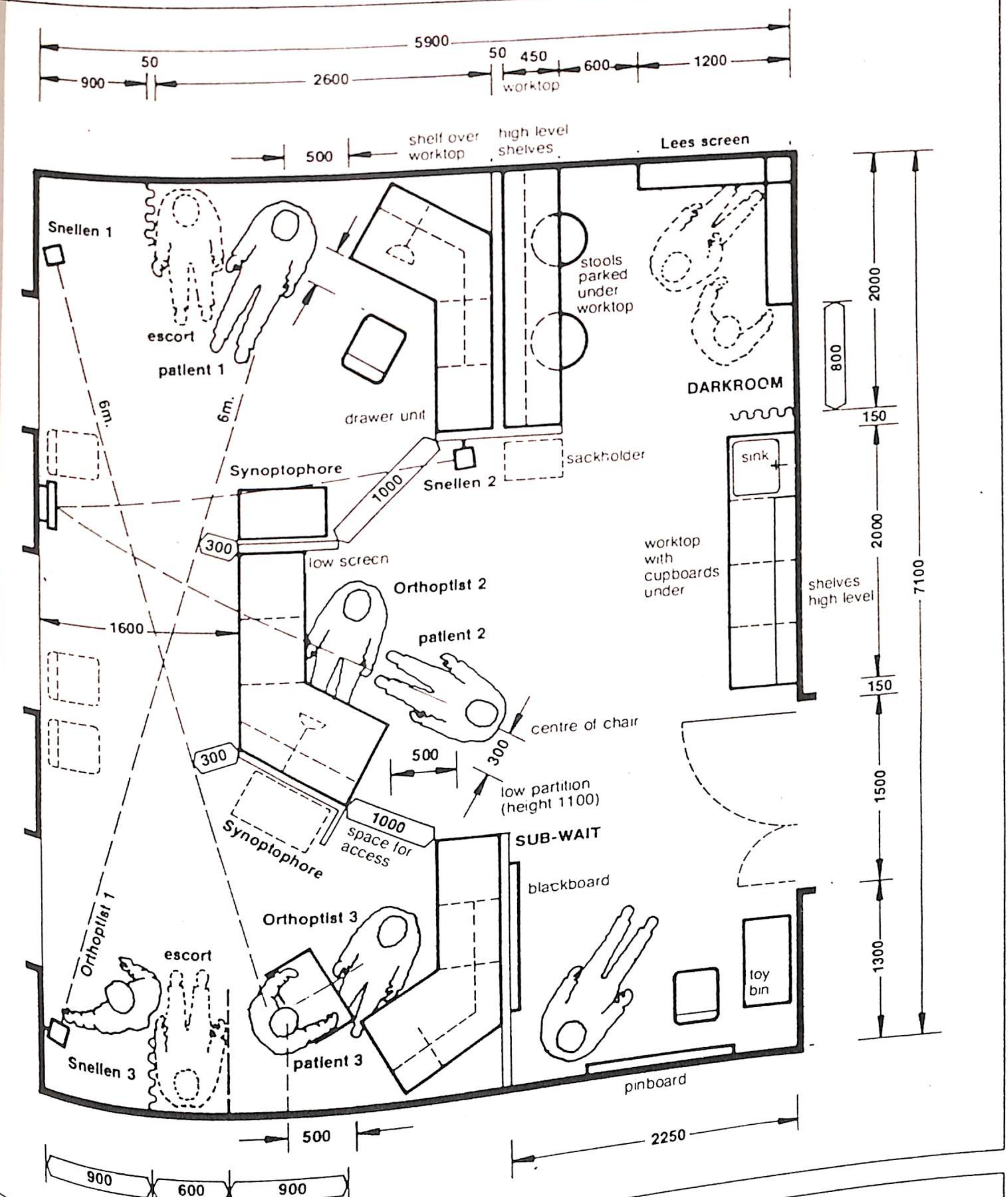
Synoptophore, Snellen test, Lees screen, Orthoptist's workstation.

DHSS Ergonomic data bank

Activity space example layout, not to scale

Orthoptist's room

for 3no. orthoptists



LIST OF PLATE:

PLATE 5.1 DRUG DEADDICTION CENTRE BECAME AN ESTABLISHED STREAM OF HOSPITAL

CHAPTER VI

6.0 OUT PATIENT DEPARTMENT

The outpatient facility is generally a separate free standing facility within a non-medical facility or part of other Health Service, except for the emergency unit, the OPD are used primarily by the patient who are capable of travelling into ,around, and out of the facility unassisted. However, this includes the handicapped, disable confined to wheel chair and occasional facility used by stretcher patient should not be considered as a basis for more restrictive institutional occupancy classification. Where the outpatient unit is part of the another facility, generally a separate entry shall be maintained and design shall proclude unrelated traffic within the unit. The main functions of the OPDs are

- Specialist consultation and examinaticn (Ref. Annexure 6.1)
- Treatment of patients who do not require an emergency services or inpatient services
- Screening for the selection of day patient and inpatient
- Following up and monitoring the condition of out patient and Day patient
- Discharging patient from the care of the hospital, with referral if necessary to other specialised Health services or recommending for in-patient admission.[4]

6.1 THE LAYOUT LOCATION AND RELATIONSHIP

The layout of the department generally should have a pleasing interior and should create friendly and reassuring environment for the patient and the accomplice to determine the size and the function, the necessary consideration should be there to study the available provision in various general hospital and also the health authorities should take account of all their capital stock which may lead to outpatient services centralised or de-centralised. While deciding the location of the outpatient service, a careful thought is required in connection with distribution of facilities within a health district, convenience to the patient and staff, the mean for support services and the size of the population of the district to be covered.

(Ref. Fig. 6.1,6.5,6.6,6.7,6.8,6.9,6.10,6.11,6.12 & 6.13)

6.2 FACTOR AFFECTING THE SIZE OF THE DEPARTMENT

Generally the outpatient department has two types of functional space i.e

a) Consultant and Examination room are combined (Fig. 6.2,6.14,6.15 & 6.17)

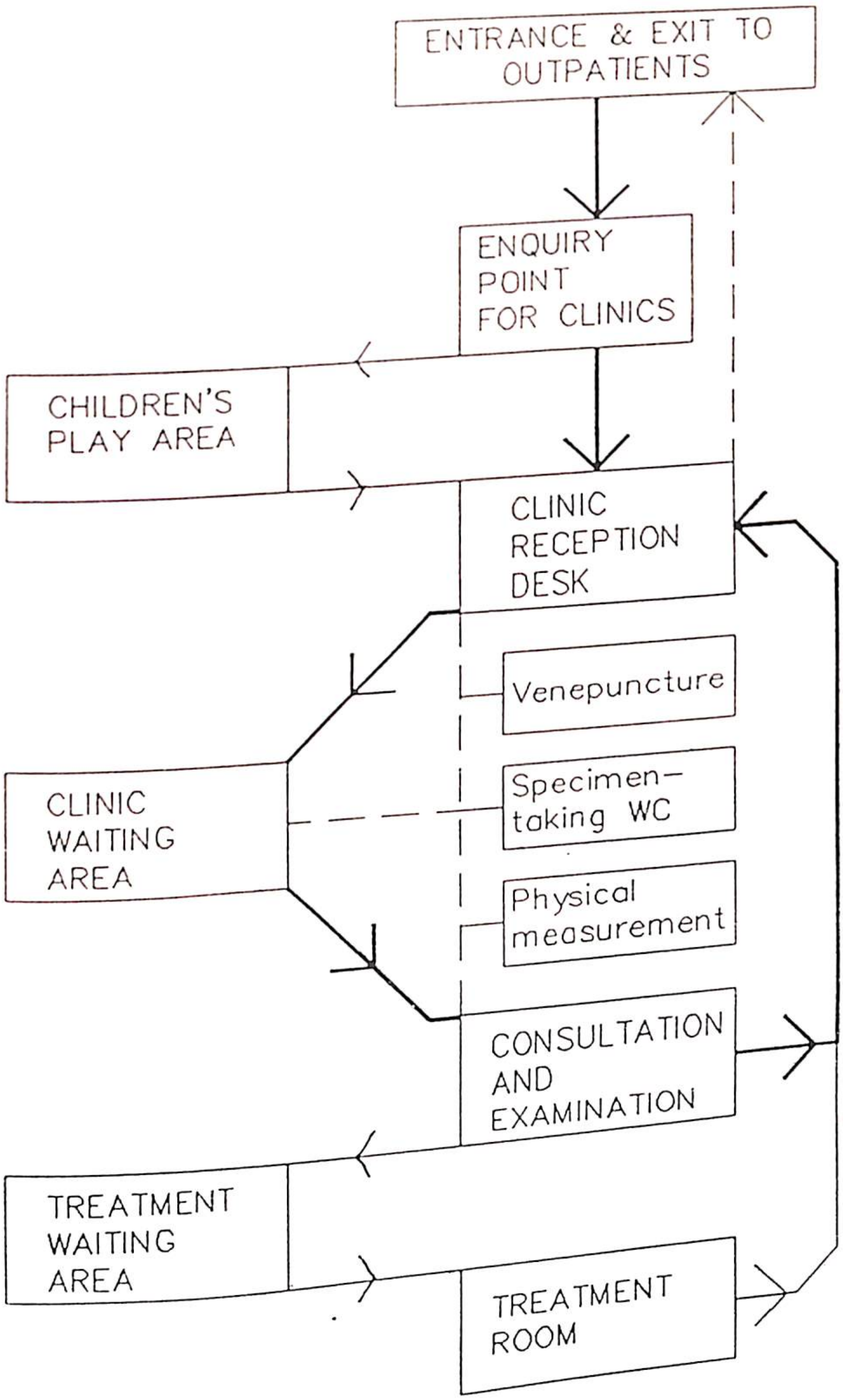
b) where the two consultation room sharing one combined examination room. (Fig. 6.3) In this particular event, the combined consulting and examination is used a s a basis for determining the size of the OPD. Following are the factors which need to take into account while assessing the need.(Annexure 6.2)

- The district profile (population characteristic, morbidity etc.) From which to derive needs by specialities.
- Estimated number of new and return patient attendances that can be dealt with each clinic session.
- Number of specialities (Fig.6.16, 6.18,6.19, 6.20)
- Number of Clinic staff to be accommodated(this includes Doctors, Nurses and other professional and technical staff)
- Number of Rooms required for each clinic, based on the working methodology of the staff concerned
- Time table used of examination and consultation room
- Availability of staff to conduct and support clinics [57]

6.3 COMMON ELEMENTS FOR OUTPATIENT FACILITY

- Entrance shall be located at convenient level and able to accommodate wheel chair.
- A reception or information counter
- Waiting spaces. Where the Paediatric service is part of the facility a separate paediatric and adult patient waiting area shall be provided.
- Conveniently accessible public toilets and drinking water
- Office space for record, administrative and professional staff.
- Multipurpose room with visual aids for conference, meeting and health education programme.
- General storage facility for supplies and equipment which is needed for continuing operation (Fig. 6.4)
- Clinical facility for general purpose examination and speciality clinics shall be provided with examination room either separate or part of the consultant room.
- Enough storage for drug and dispensing and clean storage for keeping the sterile supplies.
- Access and circulation routes to and within the OPD should be sufficiently direct and shall have a proper signage system to prevent patient losing their way within the hospital.
- The adjoining departments which have link with OPD should be easily accessible from it such as, Radiology, casualty, pathology, Pharmacy and Re-habilitation.[57]

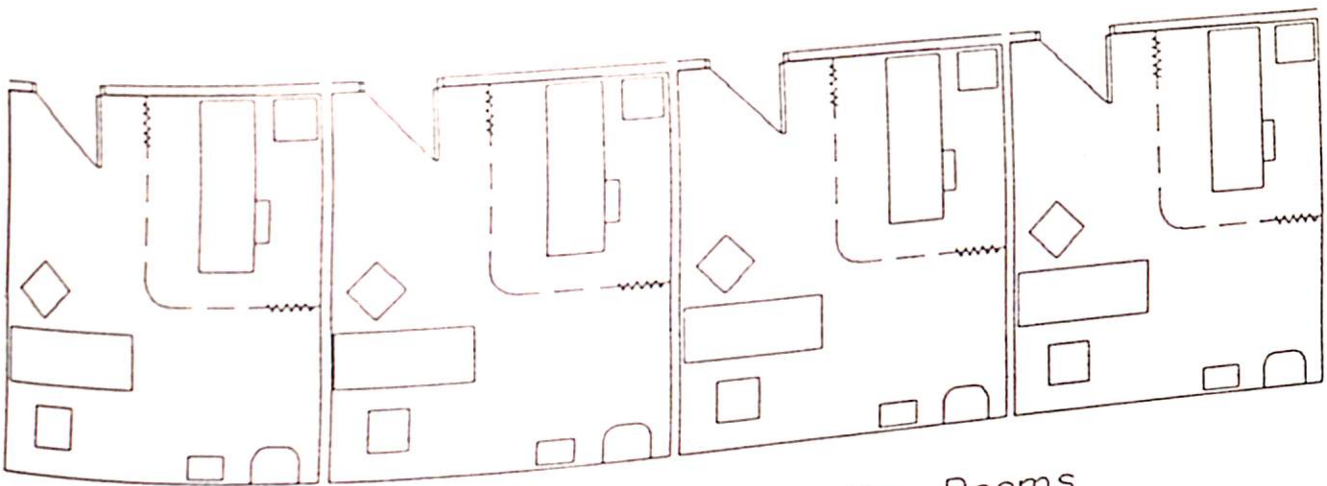
LIST OF FIGURES :



PATIENT FLOW PATTERN IN OUTPATIENTS DEPT.

FIG. 6.1

LIST OF FIGURES :



EXAMPLE A: 4 Consulting and Examination Rooms
Range of Use: 1–4 doctors
1–4 clinic sessions

EXAMPLE B: 2 Consulting and 4 Examination Rooms
Range of Use: 1–2 doctors
1–2 clinic sessions

EXAMPLES SHOWING COMPARATIVE SPACE UTILISATION IN CHOICE OF PROVISION OF CONSULTING/EXAMINATION ROOMS

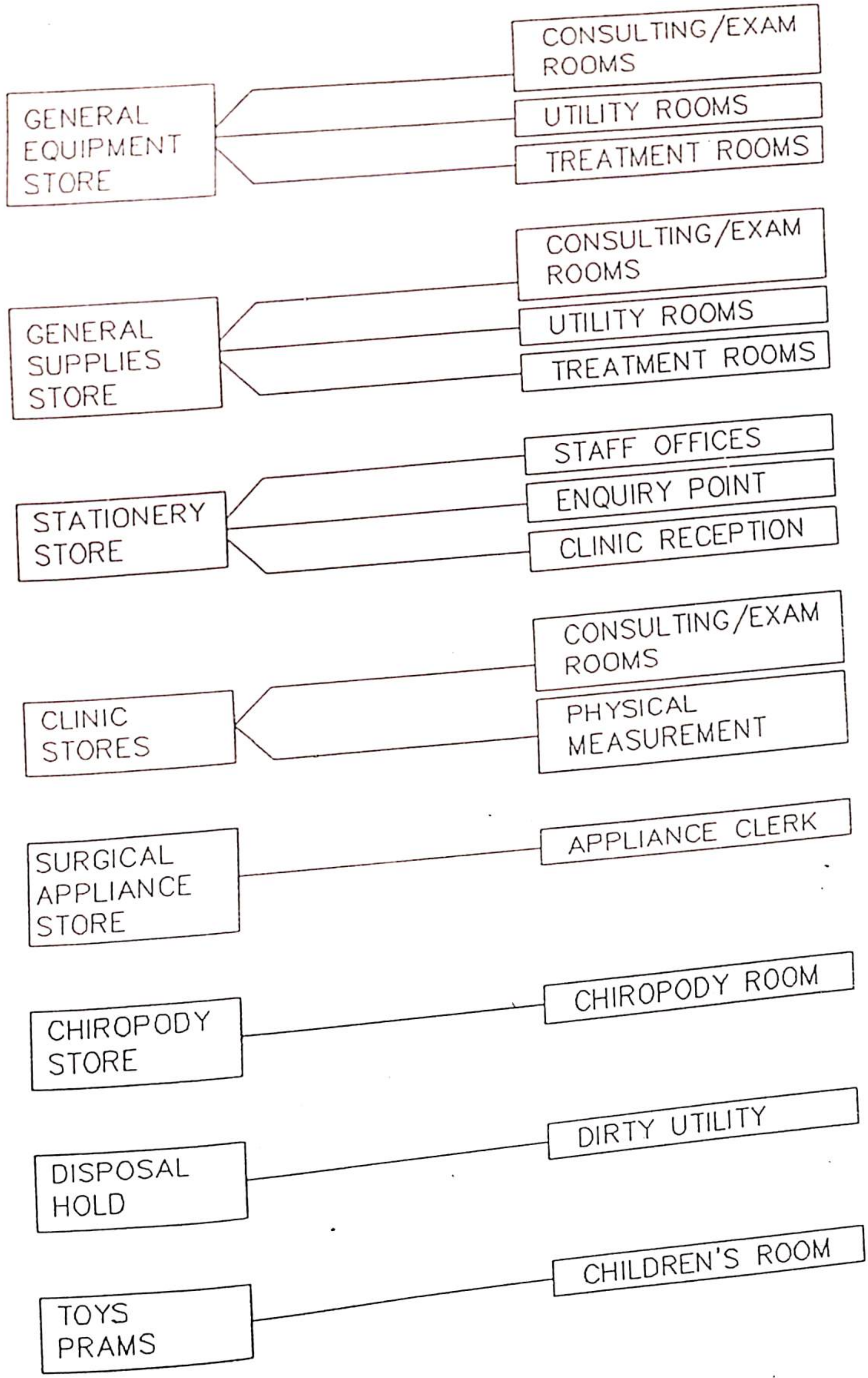
FIG. 6.2

EXAMPLE OF TYPE OF CLINIC	USE OF ROOMS	NUMBER OF ROOMS	NUMBER OF DOCTORS
PAIN	C/E	1	1
NEUROSURGERY	C/E, C/E	2	2
ANTI-COAGULANT	C, E	2	1
ORTHOPAEDIC	E, C, E	3	1
DERMATOLOGY	C, E, C/E	3	2
GENERAL SURGERY	C/E, C/E, C/E, C/E	4	1
GENERAL SURGERY	C, E, E, C/E, C/E	5	2–3
DIABETIC GENERAL MEDICINE	C, E, E, E, E, C	6	2

FLEXIBILITY OF USE OF COMBINED CONSULTING/EXAMINATION ROOMS

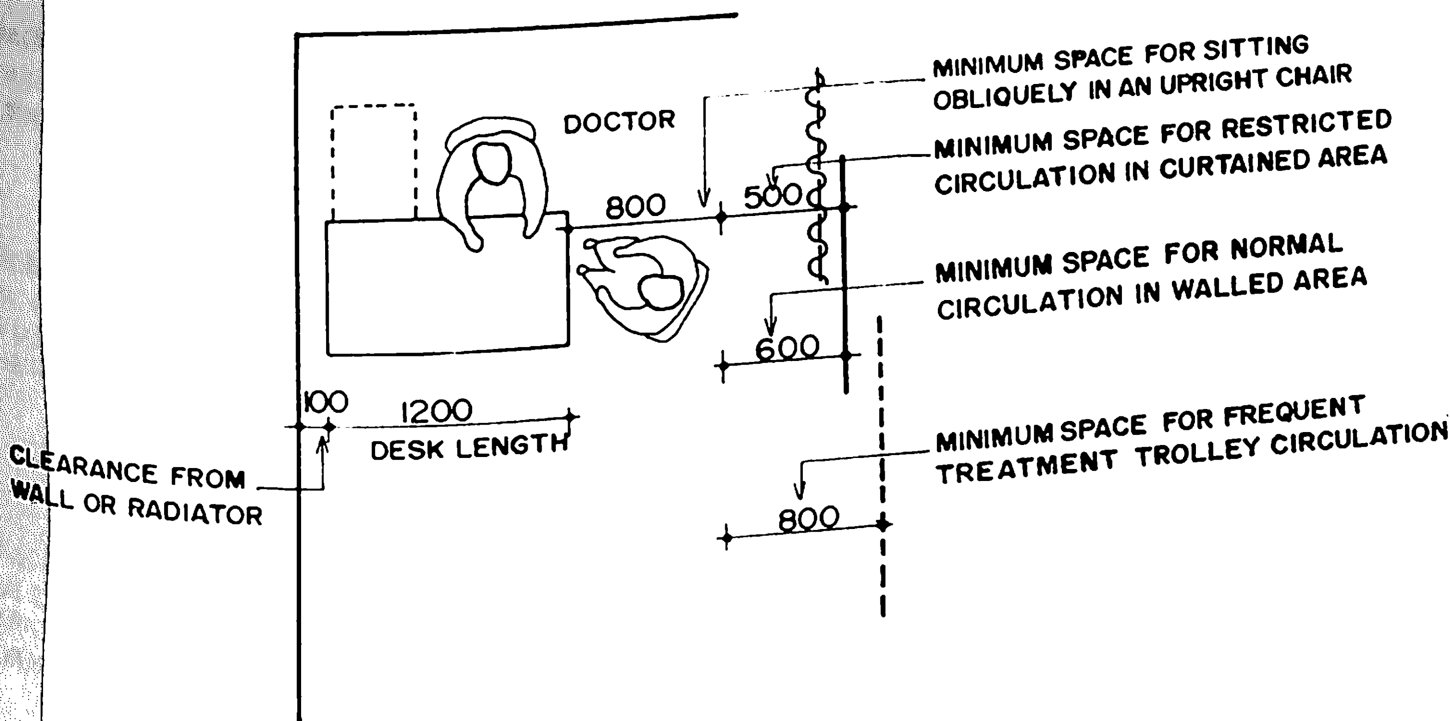
THE COMBINED FACILITY ALLOWS FLEXIBILITY OF USE AS A C/E ROOM, CONSULTING ROOM OR EXAMINATION ROOM.
SEPARATE CONSULTING ROOMS WITH EXAMINATION CUBICLES ARE BY DEFINITION LIMITED TO SINGLE PURPOSE USE.

FIG. 6.3



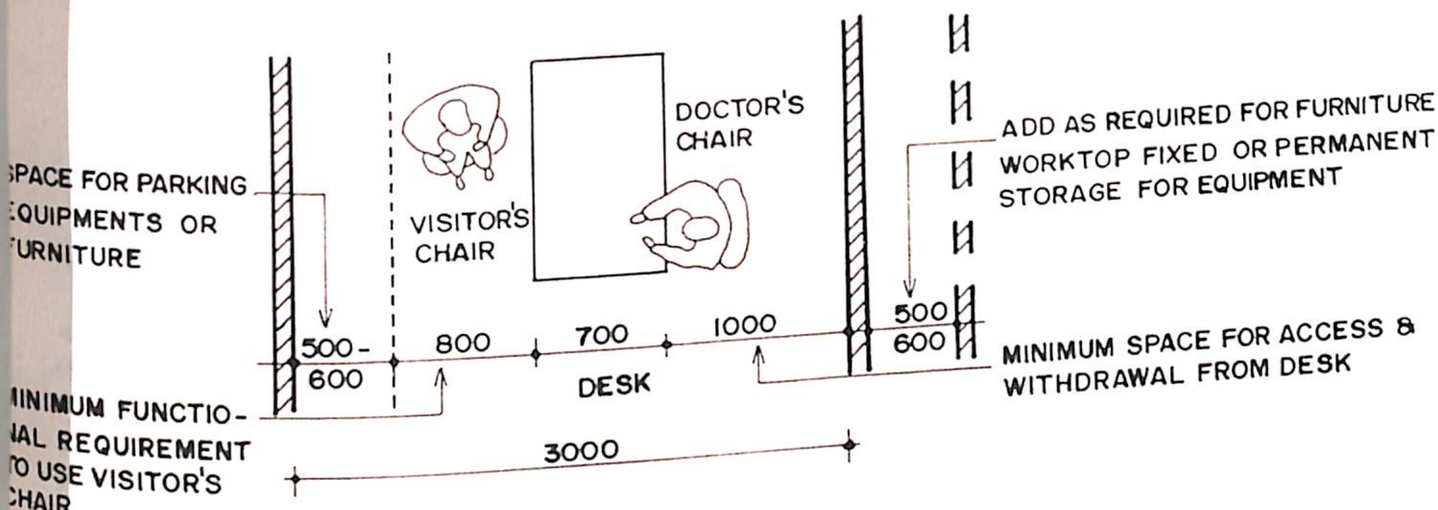
STORAGE REQUIREMENTS IN AN OUTPATIENTS DEPARTMENT, SHOWING TYPES OF STORE AND THE ROOMS THEY SERVE

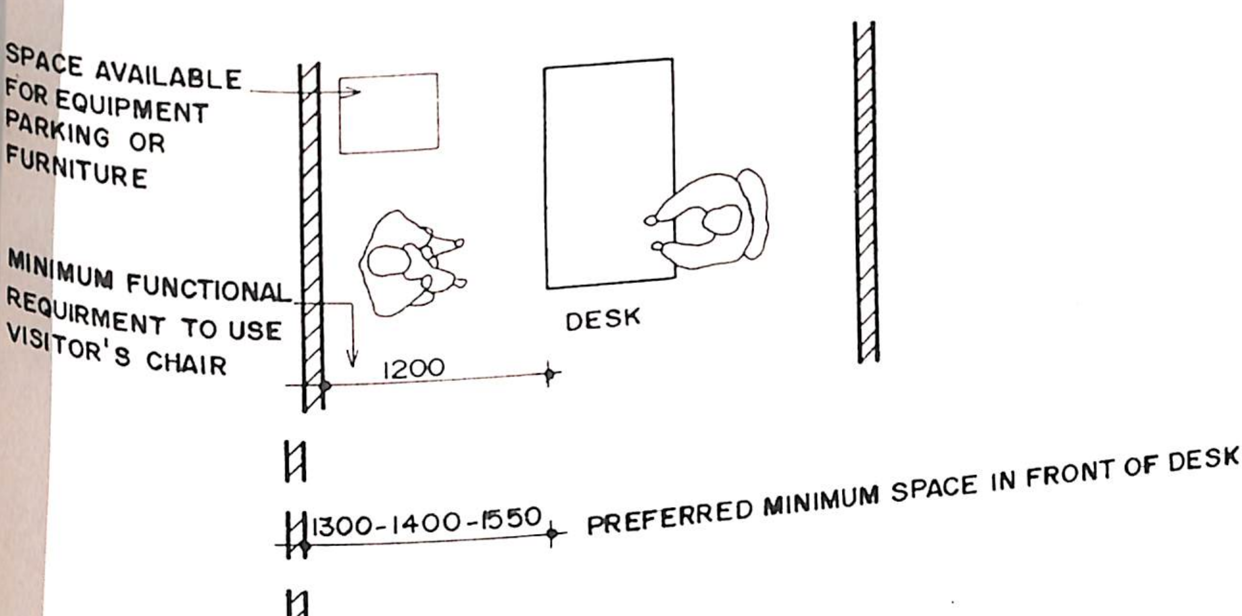
FIG. 6



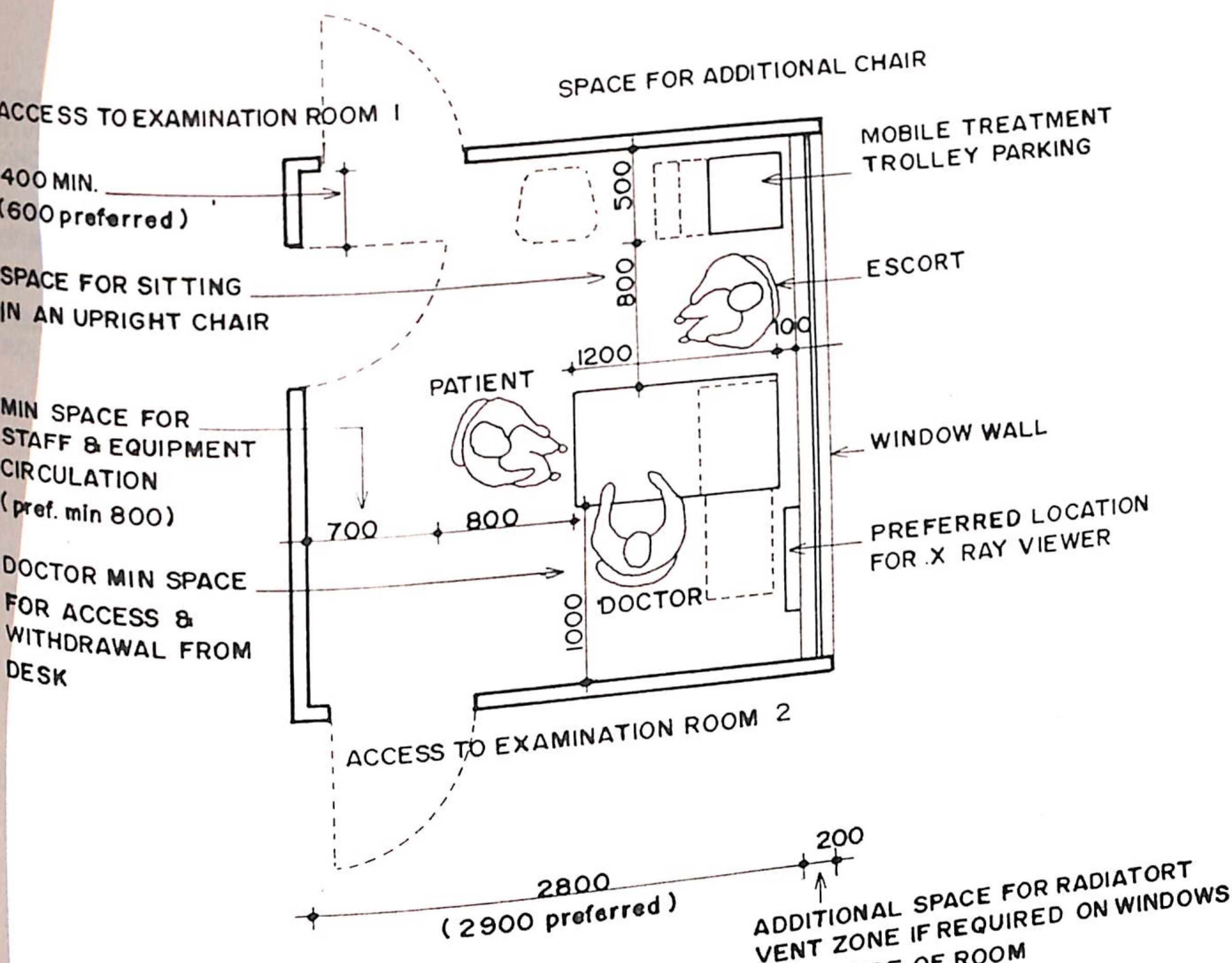
ACTIVITY SPACE REQUIREMENTS FOR ROOM DEPTH IN CONSULTING AREAS

FIG. 6.5



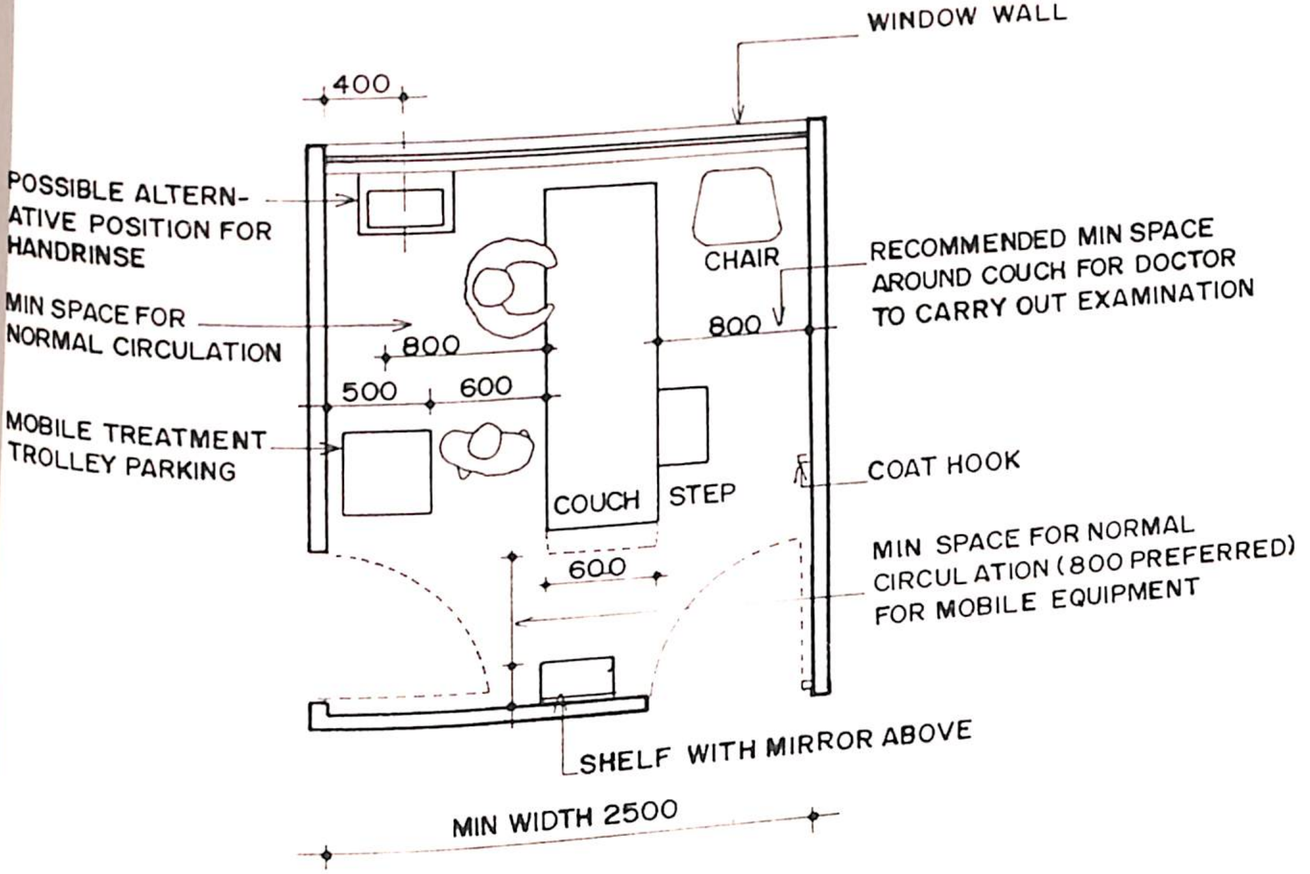


ACTIVITY SPACE REQUIRMENTS FOR ROOM WIDTH IN CONSULTING AREA



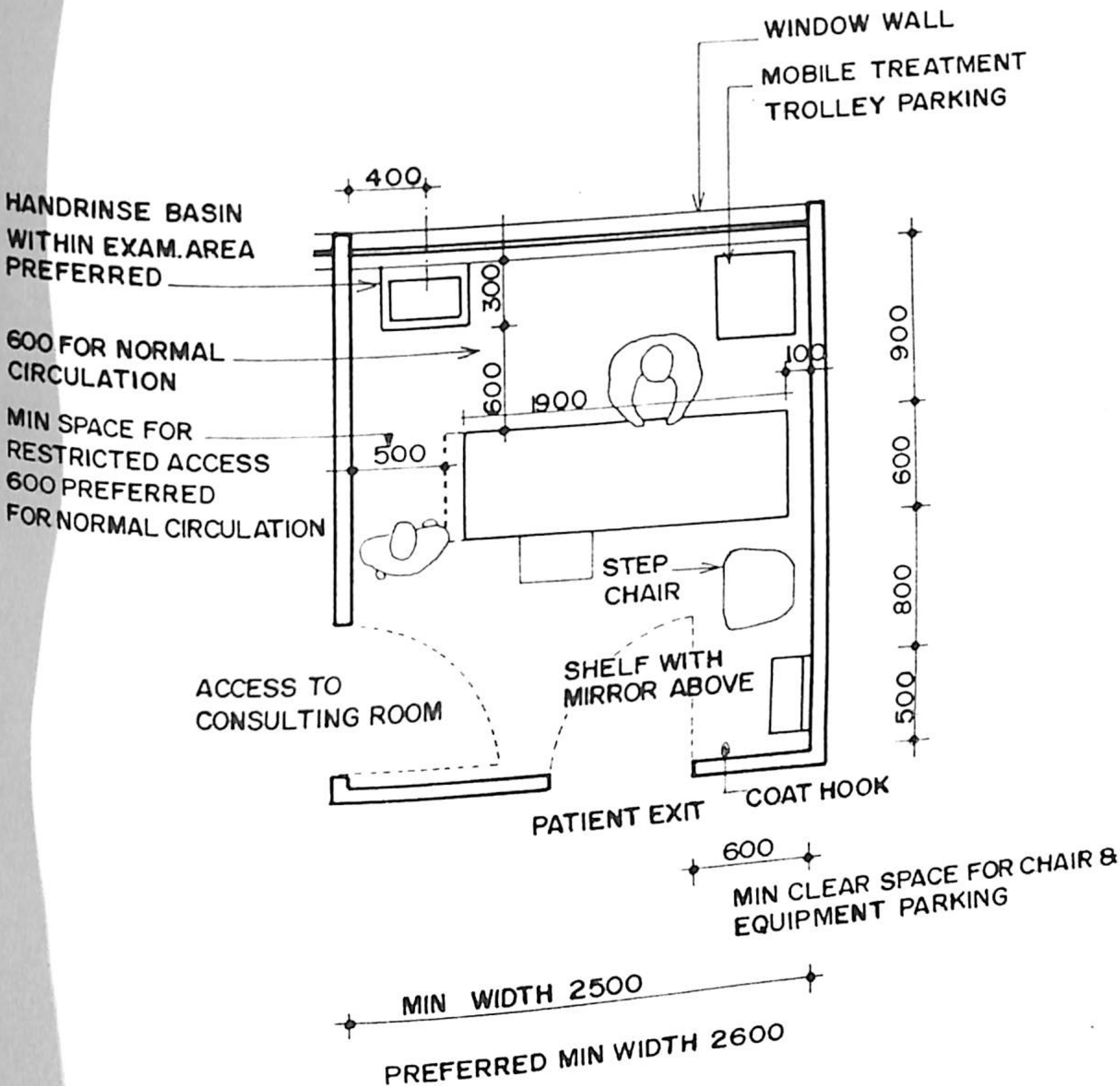
AREA 8·4 sq. mt.
AND 8·7 sq. mt.

MINIMUM SPACE REQUIRED FOR A SEPARTE CONSULTING ROOM, PREFERRED LAYOUT



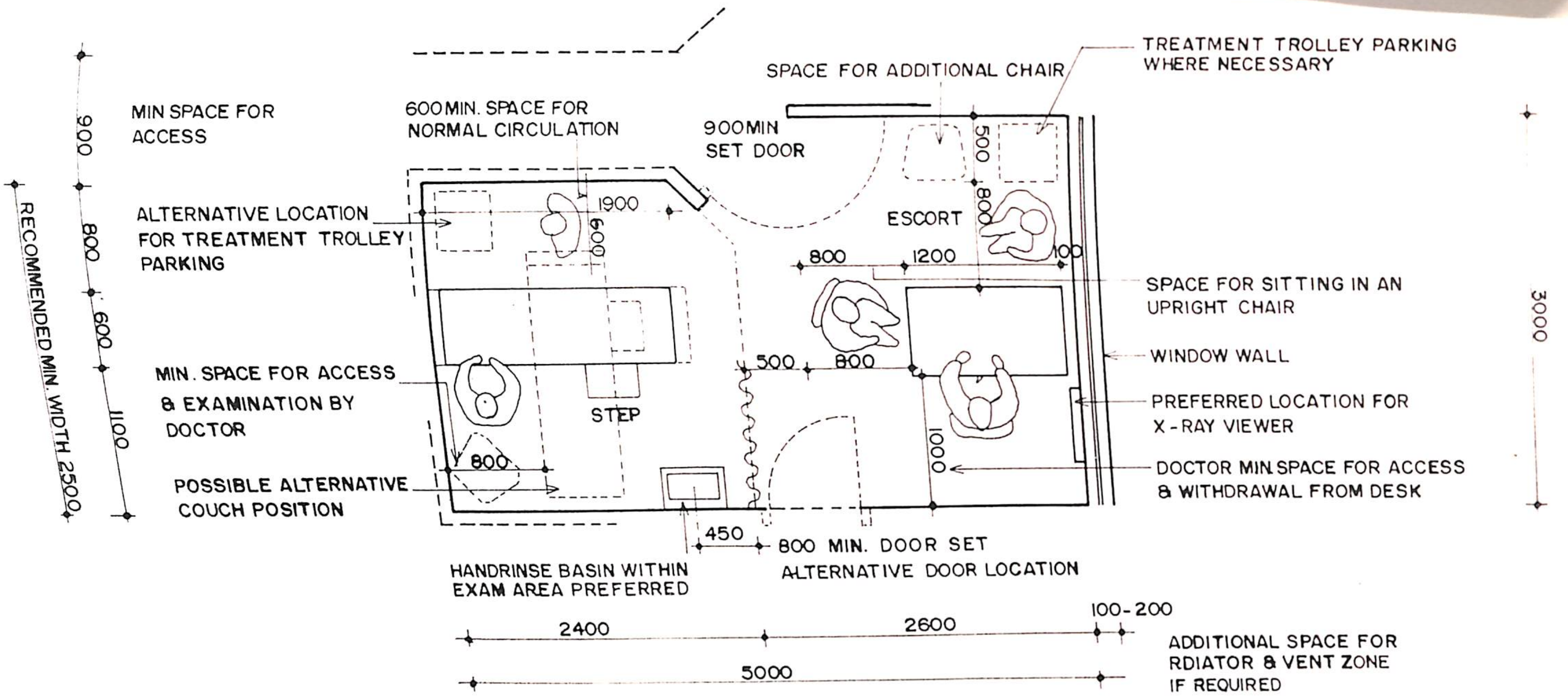
AREA = 7·0 sq. mt.
AND 7·5 sq. mt.

MINIMUM SPACE REQUIRED FOR A SEPARATE EXAMINATION ROOM (ALT. 1)

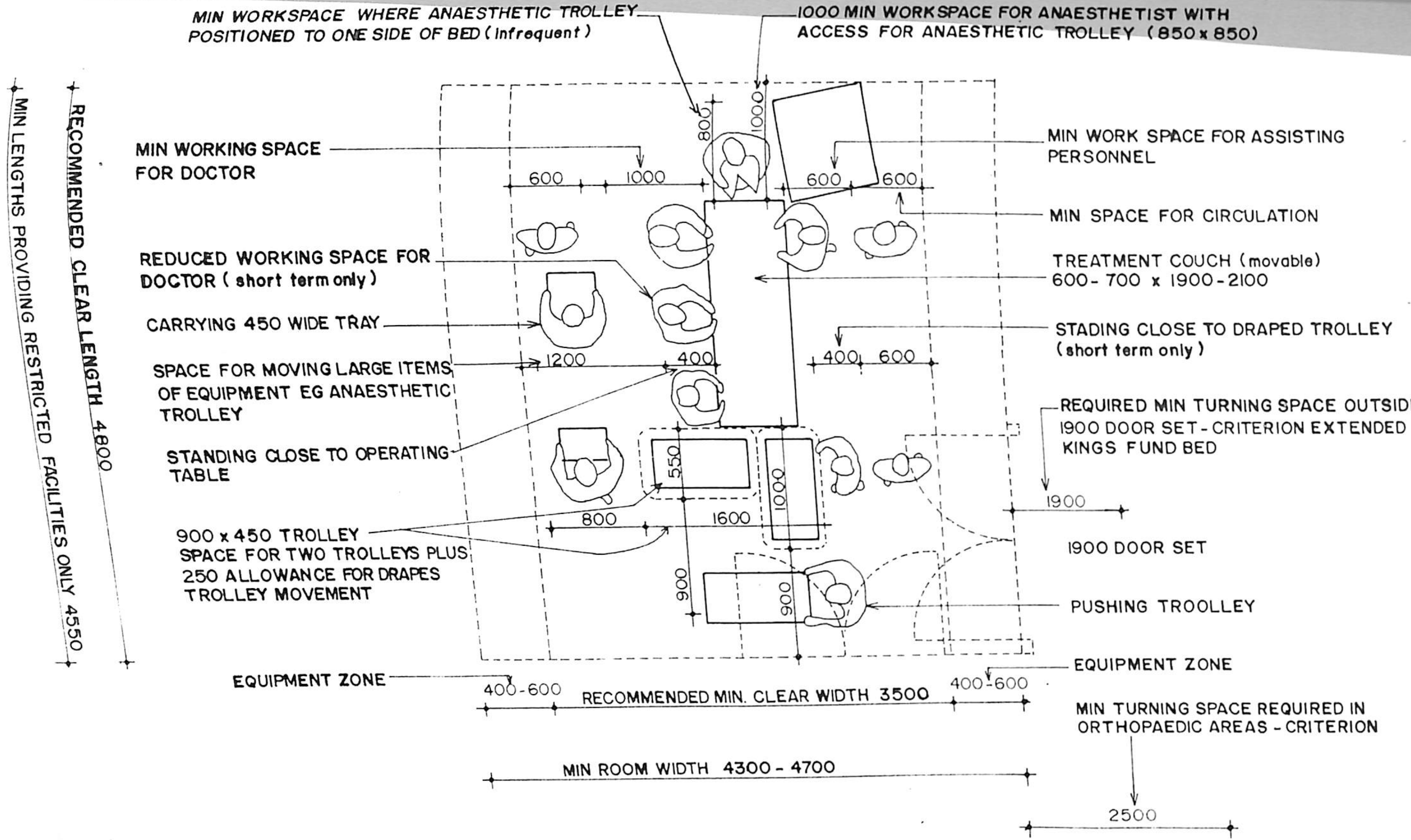


MINIMUM SPACE REQUIRED FOR A SEPARATE EXAMINATION ROOM (ALT. 2)

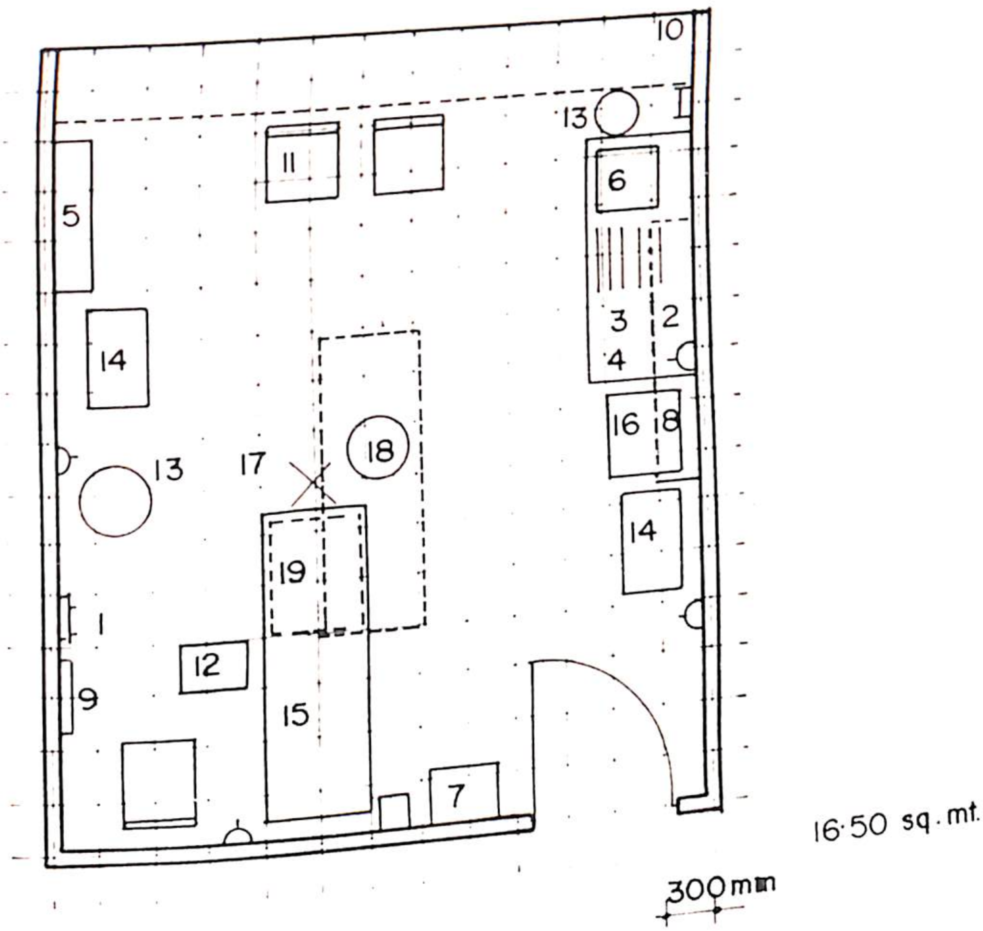
FIG. 6.9



MIN SPACE FOR ACCESS
600 MIN. SPACE FOR NORMAL CIRCULATION
900 MIN SET DOOR
SPACE FOR ADDITIONAL CHAIR
TREATMENT TROLLEY PARKING WHERE NECESSARY
ALTERNATIVE LOCATION FOR TREATMENT TROLLEY PARKING
1900
600
500
800
ESCORT
800
1200
100
SPACE FOR SITTING IN AN UPRIGHT CHAIR
3000
WINDOW WALL
500
800
MIN. SPACE FOR ACCESS & EXAMINATION BY DOCTOR
STEP
PREFERRED LOCATION FOR X-RAY VIEWER
1000
DOCTOR MIN SPACE FOR ACCESS & WITHDRAWAL FROM DESK
800
POSSIBLE ALTERNATIVE COUCH POSITION
450
800 MIN. DOOR SET
ALTERNATIVE DOOR LOCATION
HANDRINSE BASIN WITHIN EXAM AREA PREFERRED
900
800
600
1100
RECOMMENDED MIN. WIDTH 2500
2400
2600
100-200
5000
ADDITIONAL SPACE FOR RDIATOR & VENT ZONE IF REQUIRED



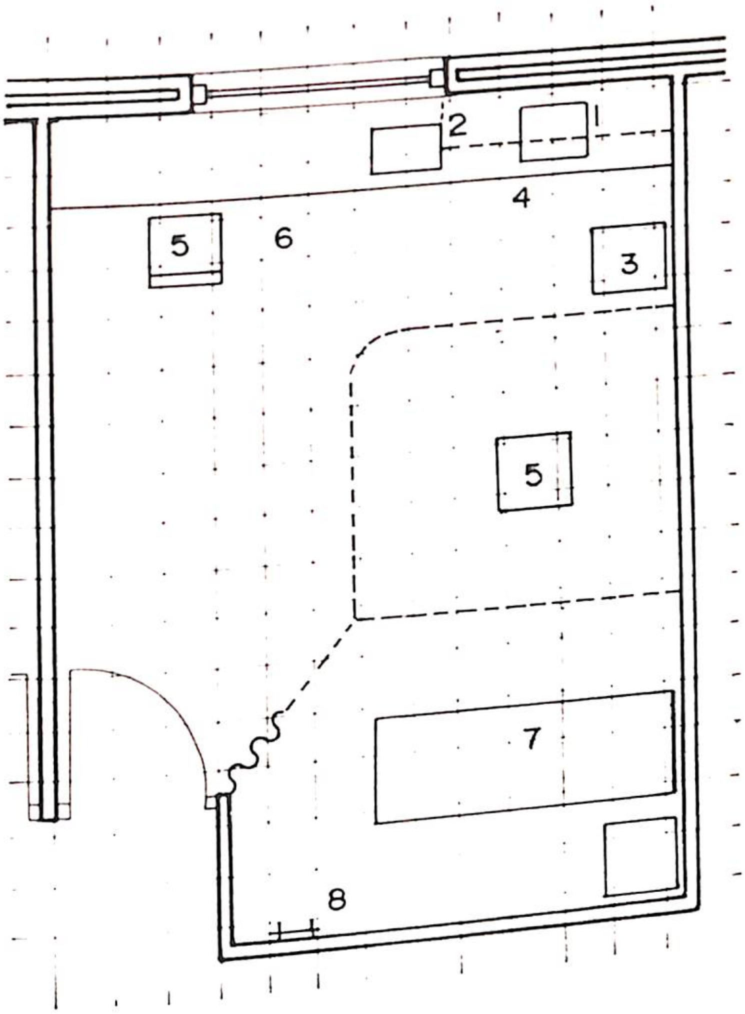
MIN WORKSPACE WHERE ANAESTHETIC TROLLEY POSITIONED TO ONE SIDE OF BED (infrequent)
1000 MIN WORKSPACE FOR ANAESTHETIST WITH ACCESS FOR ANAESTHETIC TROLLEY (850 x 850)
MIN LENGTHS PROVIDING RESTRICTED FACILITIES ONLY 4550
RECOMMENDED CLEAR LENGTH 4800
MIN WORKING SPACE FOR DOCTOR
MIN WORK SPACE FOR ASSISTING PERSONNEL
MIN SPACE FOR CIRCULATION
REDUCED WORKING SPACE FOR DOCTOR (short term only)
TREATMENT COUCH (movable) 600-700 x 1900-2100
CARRYING 450 WIDE TRAY
STADING CLOSE TO DRAPED TROLLEY (short term only)
SPACE FOR MOVING LARGE ITEMS OF EQUIPMENT EG ANAESTHETIC TROLLEY
REQUIRED MIN TURNING SPACE OUTSIDE 1900 DOOR SET - CRITERION EXTENDED KINGS FUND BED
STANDING CLOSE TO OPERATING TABLE
1900
900 x 450 TROLLEY
SPACE FOR TWO TROLLEYS PLUS 250 ALLOWANCE FOR DRAPES TROLLEY MOVEMENT
1900 DOOR SET
PUSHING TROOLLEY
800
1000
600
1000
600
600
1200
400
400
600
550
1000
800
1600
900
900
EQUIPMENT ZONE
400-600
RECOMMENDED MIN. CLEAR WIDTH 3500
400-600
EQUIPMENT ZONE
MIN TURNING SPACE REQUIRED IN ORTHOPAEDIC AREAS - CRITERION
MIN ROOM WIDTH 4300 - 4700
2500



TREATMENT ROOM (Scottish)

1. COAT HOOKS
2. HIGH LEVEL STORAGE
3. WORKTOP
4. LOW LEVEL STORAGE
5. SHELVING
6. SINK AND DRAINER
7. WRITING SHELF
8. DDA CUPBOARD
9. MIRROR
10. PAPER TOWEL DISPENSER
11. CHAIR
12. COUCH STEPS
13. DISPOSAL
14. EQUIPMENT TROLLEY
15. EXAMINATION COUCH
16. REFRIGERATOR
17. MOBILE EXAMINATION LAMP
18. STOOL
19. COUCH COVER DISPENSER
20. WARNING LIGHT

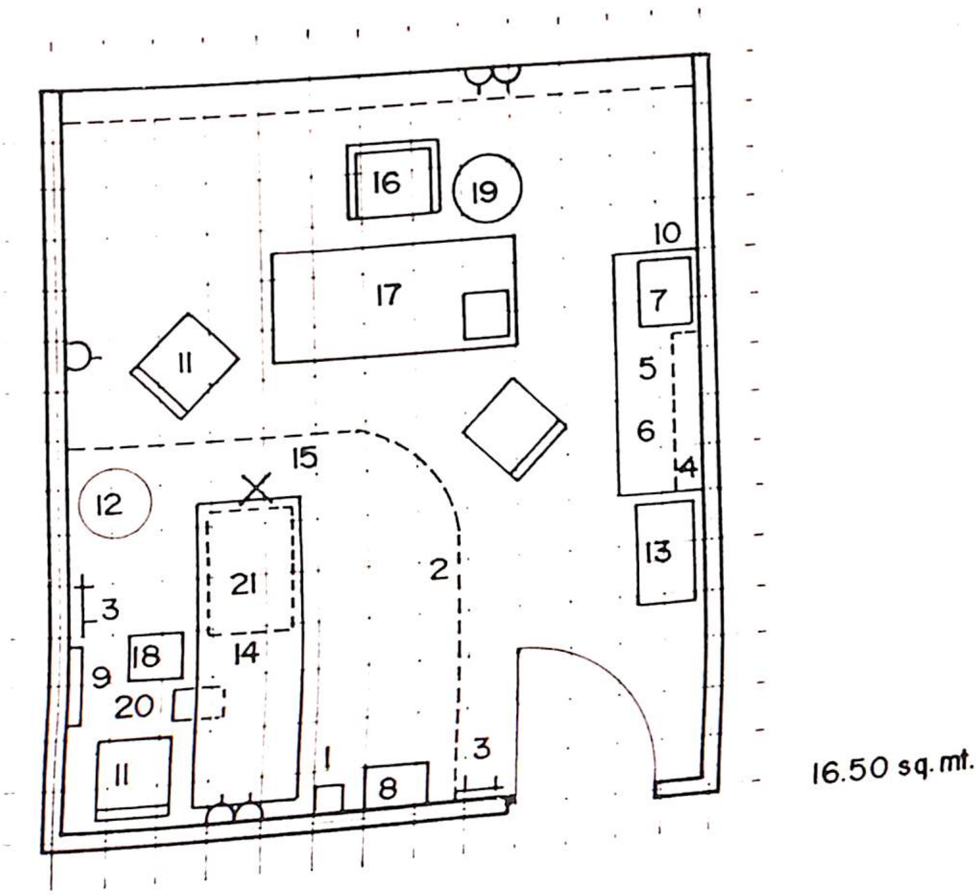
FIG 6.12



ALTERNATIVE TREATMENT ROOM (for one nurse)

1. SINK
2. WASHHAND BASIN
3. TROLLEY
4. WORKTOP WITH CUPBOARD ABOVE
5. CHAIR
6. ADMINISTRATION AREA
7. COUCH
8. COAT HOOKS

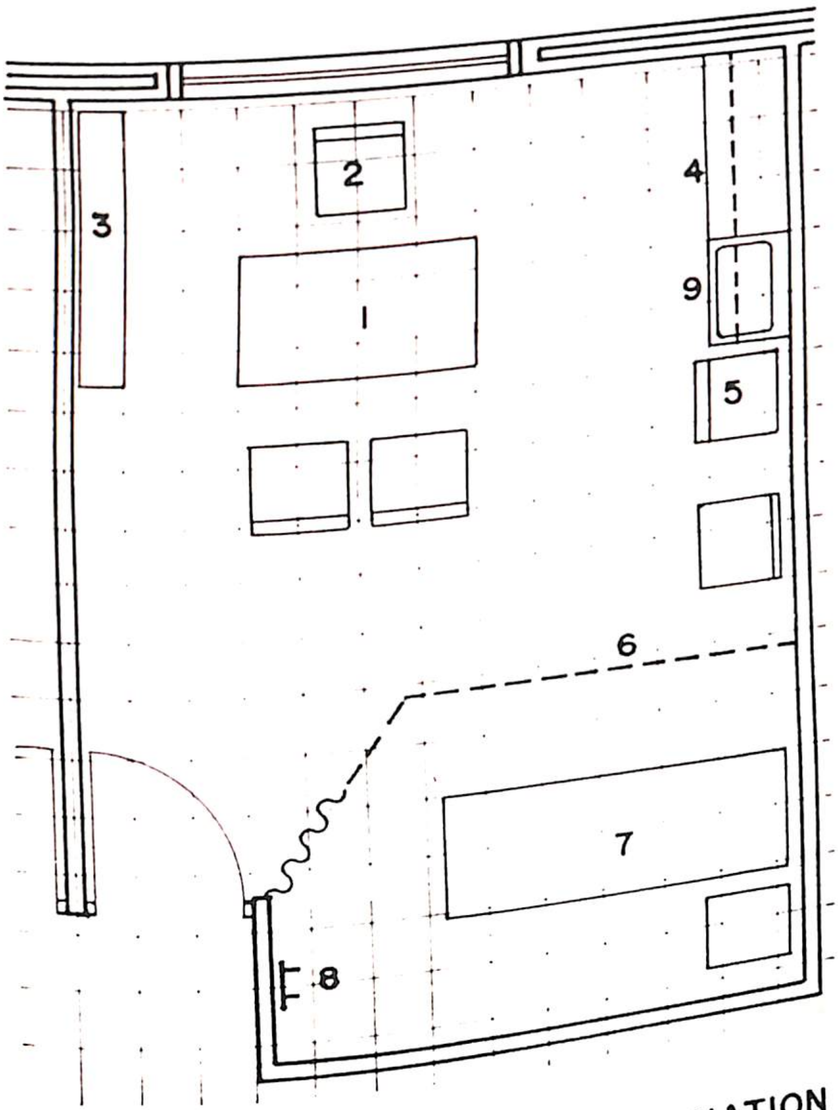
FIG. 6.13



COMBINED CONSULTING / EXAMINATION ROOM AS USED IN SCOTLAND

1. BRACKET FOR SPHYGMOMANOMETER
2. CEILING MOUNTED CURTAIN TRAC
3. COAT HOOKS
4. HIGH LEVEL STORAGE
5. WORKTOP
6. LOW LEVEL STORAGE
7. WASHHAND BASIN
8. WRITING SHELF
9. MIRROR
10. PAPER TOWEL DISPENSER
11. CHAIR
12. DISPOSAL
13. EQUIPMENT TROLLEY
14. EXAMINATION COUCH
15. MOBILE EXAMINATION LAMP
16. SWIVEL CHAIR
17. DESK
18. COUCH STEPS
19. WASTE PAPER BIN
20. SCALES
21. COUCH COVER DISPENSER

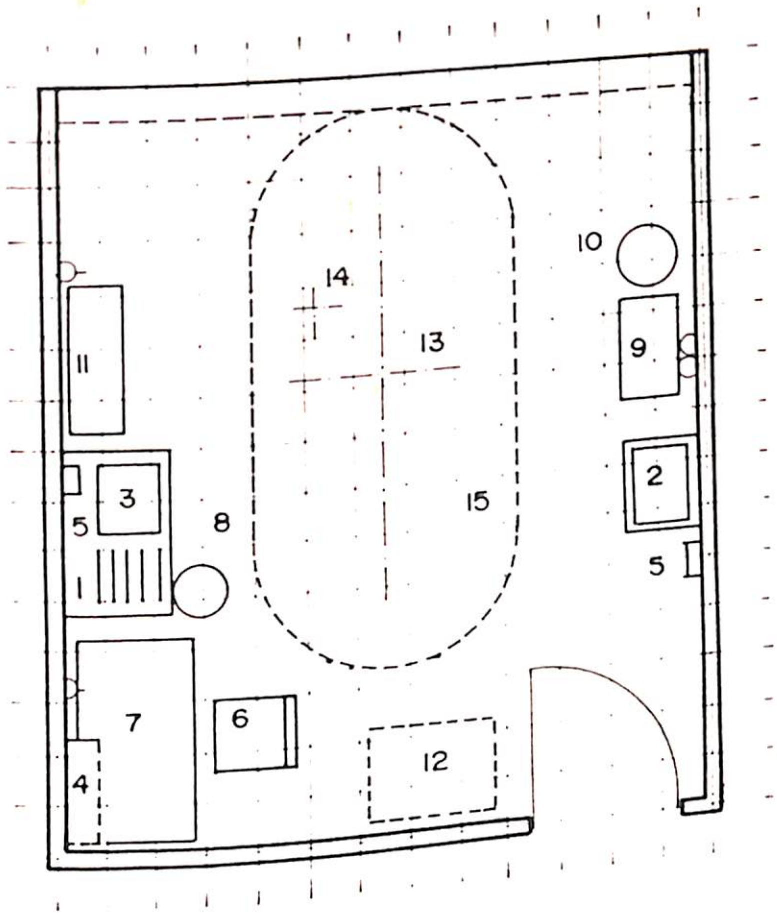
FIG .6 .14



ALTERNATIVE PLAN OF CONSULTING / EXAMINATION ROOM

1. DESK
2. SWIVEL CHAIR
3 BOOKCASE
4 WORKTOP WITH CUPBOARD ABOVE
5. TROLLEY
6. CEILING MOUNTED CURTAIN TRAC AND CURTAIN
7. COUCH
8. COAT HOOKS
9. WASHHAND BASIN

FIG. 6.



DENTAL SURGERY (Scottish)

1. LOW LEVEL STORAGE
2. WASHHAND BASIN
3. SINK AND DRAINER
4. LOCKABLE CUPBOARD FOR SCEDULED POISONS
5. PAPER TOWEL DISPENSER
6. CHAR
7. DESK
8. DISPOSAL BIN
9. INSTRUMENT TROLLEY
10. PEDAL WASTE BIN
11. DENTAL EQUIPMENT CABINET
12. SPACE FOR ANAESTHETIC MACHINE
13. DENTAL CHAIR
14. DENTAL UNIT
15. DENTIST'S SEAT OR STOOL

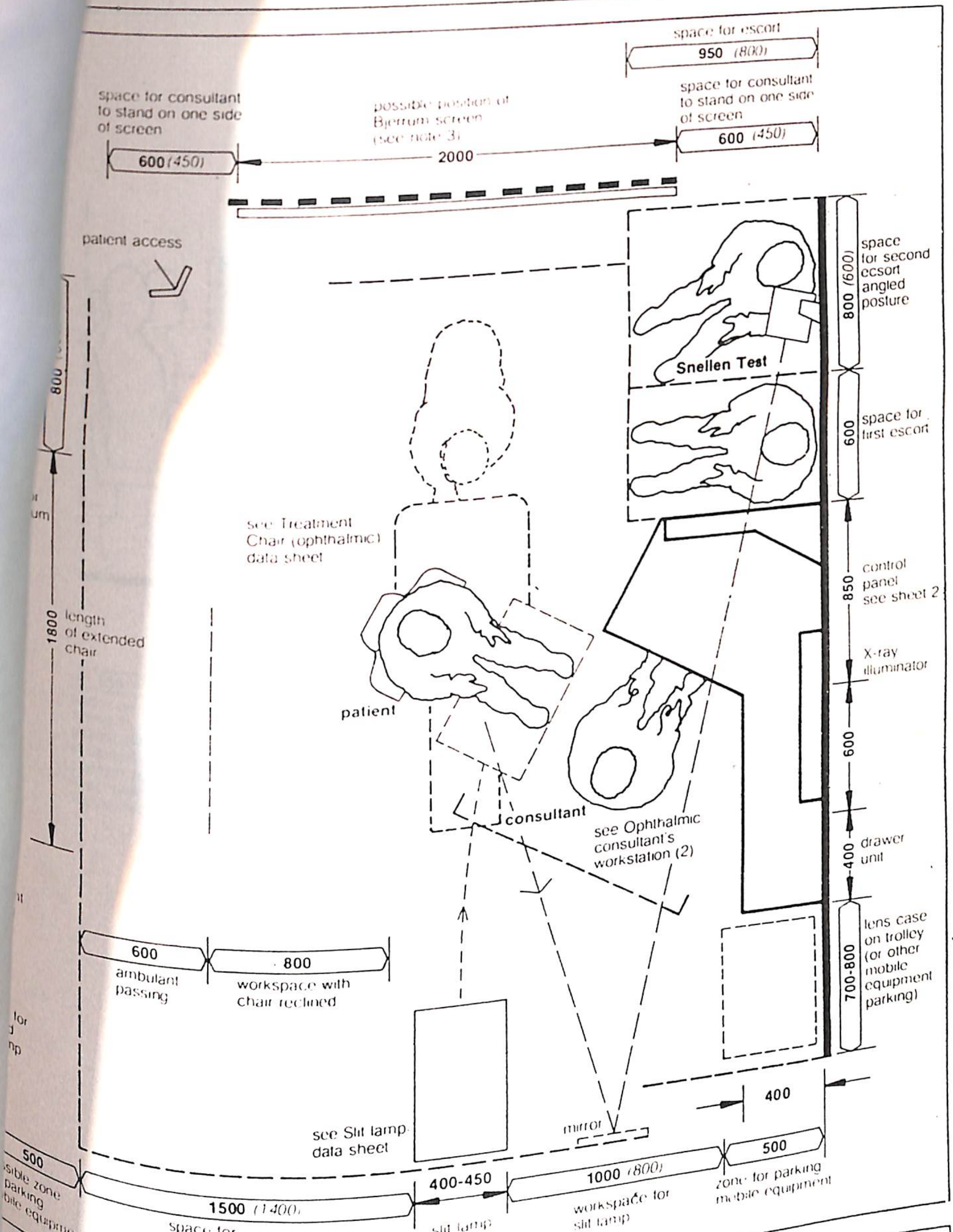
FIG. 6.16

, consultation including
using Slit lamp, Snellen
nd other apparatus, and
of the eye

ata sheet
a sheet, not to scale

Ophthalmic consultant's workstation (1)

Users
Consultant, patients — adult and children



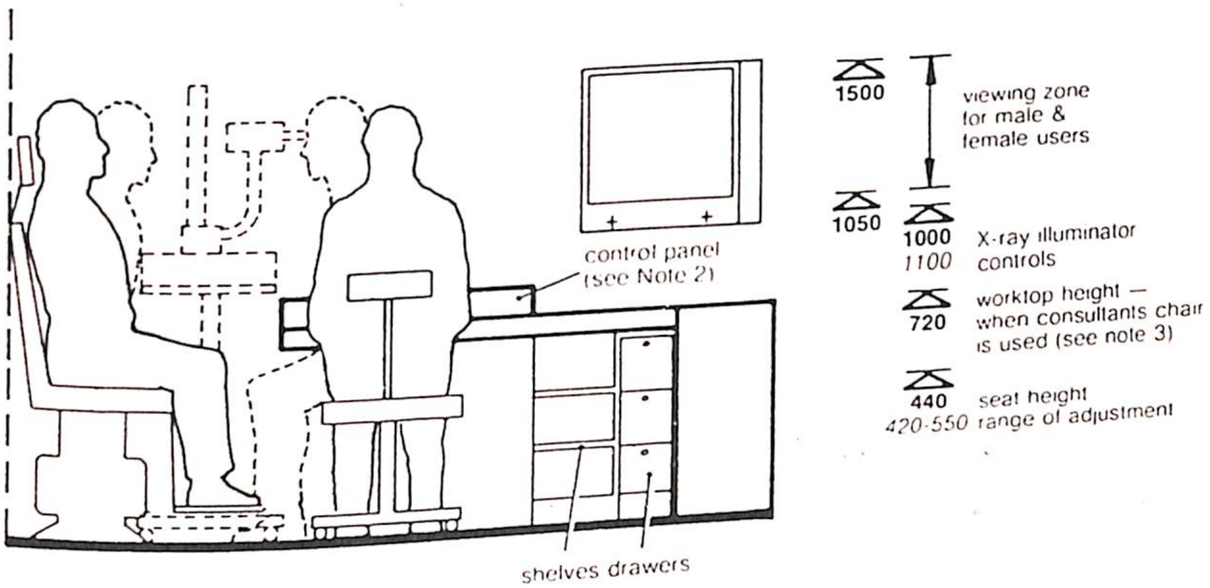
...otation of prone patient is obstructed
... Full rotation of chair if
... position

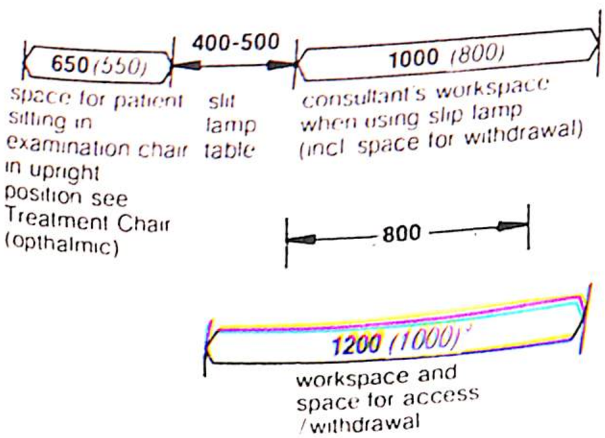
Activities
Writing up notes etc consultation including examination of the eye using Slit lamp, Snellen test, Bjerrum screen and other apparatus, and also minor treatment of the eye.

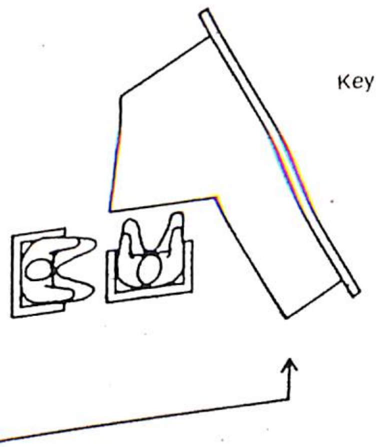
DHSS **Ergonomic data bank**
Component-user data sheet, not to scale

Ophthalmic consultant's workstation (2)

Users
Consultant, patients — adult and children







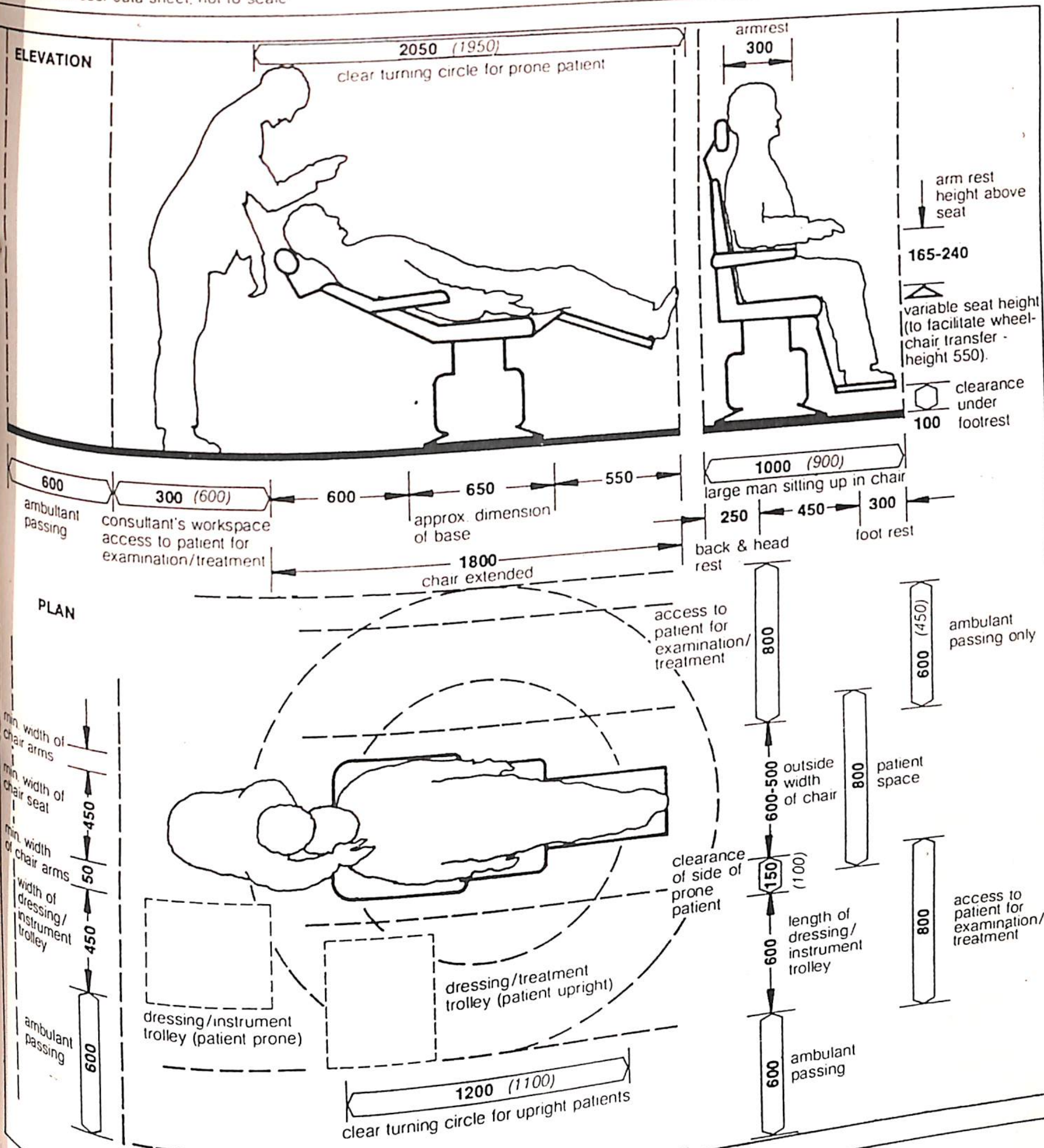
Activities
Examination and treatment of patients eyes in reclined position

DHSS **Ergonomic data bank**
Component-user data sheet, not to scale

Treatment chair

Ophthalmic
Chair with adjustable height and angle of recline

Users
Consultant, adults, children (see note 1)



No...

...ultant's

100

...d rest adjustment

CHAPTER VII

7.0 DIAGNOSTIC IMAGING

7.1 INTRODUCTION

During the last two decades there has been an increasing concern about the patient as a multi- system organism with diverse and intricate medical and nursing needs. The patient has again become the highest priority in the hospital. On the other hand development in medical science and equipment technology have offered many diagnostic and therapeutic modalities which are more reliable and precise and easy to use and apply. Many of these techniques and modalities have special physical requirement including controlled environment, energy & other supplies. Since most of these techniques and modalities are capital intensive, there has been an increasing concern to effect economy in their use. Functional workflow equipment and environmental requirements of clinical, diagnostic, therapeutic and support services have been better understood and there location and relationships to one another have largely been dedicated by factors influencing efficiency, economy and humanity in patient care. Development in imaging techniques including **ULTRA-SONOGRAPHY COMPUTERISED TOMOGRAPHY and NUCLEAR MAGNETIC IMAGING** have led to the evolution of a new discipline waiting, x-ray of imaging in place of radiology. Relationships between patient reception and rooms, technicians consoles, dark rooms and reporting and filing faculties have greatly patient throughout in the highly capital intensive imaging Department. While centralisation of such facilities has received over-riding priority for reasons of economy, decentralisation of intra-operative imaging, coronary angiography, and bedside imaging has been adopted for efficiency and humanity.[51]

A quick and accurate diagnosis to treat effectively is the key to the success of any health care institution.

The other influencing factors of course are experienced Doctors, efficient Nurses & sound adiminstrative policies.

But the salient support to all is the **'Diagnostic Unit'.** The Doctors professional skill combined with advanced medical engineering facilities have led to remarkable developments in the field of medical sciences.

7.2 THE SYSTEM

In addition to physical observation the Doctor depends on a number of tests before giving any decision regarding the patients ailment. These tests are carried out in different ways depending upon the nature of the request by the Doctor. These can broadly be classified under two heads;

- IN VITRO (in glass or test tube)
- IN VIVO (in person)

7.2.1 IN VITRO -

In this the use of laboratory is involved where samples of blood, urine, stool, sputum or tissues are analysed manually or on auto analyzers etc. Here the samples are only required. The presence of the patient at the time of analysing is not essential.

7.2.2 IN VIVO -

Here the inside of the patient's body is looked into by taking different types of images with the help of types of equipment. The process itself says that the patient has to be present in person during this process.

The **IN VIVO** system can further be classified under:

- INVASIVE DIAGNOSIS
- NON INVASIVE DIAGNOSIS.

7.2.2.1 INVASIVE DIAGNOSIS

In this process as the name itself indicates, the patients body is invaded with a foreign object which can be either in the form of a fluid taken orally/injected or exposed to certain form of radiation to pass through the body and expose some film or cast shadows on a screen. A few examples of invasive diagnosis is X-rays, fluoroscopy, CT scan etc.

7.2.2.2 NON-INVASIVE

In contrast to the invasion of foreign object this process involves the use of high frequency sound waves or magnetic waves. The process is absolutely harmless & used where even a small dose of radiation is harmful. The examples of this are ultra-sound, nuclear magnetic resonance (NMR) etc.

7.3 DIAGNOSTIC RADIOLOGY

Provides internal images of patient either on film (radiography) or on CATHODE RAY TUBE (CRT-fluoroscopy) must be provided for outpatients and inpatient both for routine examinations and for emergencies department therefore has relationship to OPD medical, intensive care and surgical units.

Separation of inpatient, typically on trolley, stretcher or wheelchair, from outpatient in street clothes and often bloody, should be maintained as long as possible, certainly then also through radiographic procedure and exit.

X-ray procedure room so arranged that patient travel path does not cross that of radiology technician until they meet in procedure room. Easy trolley/stretcher access to x-ray table is essential. Department is so planned that technician travel time is kept minimum particularly between room and film processing area.

Simple x-ray to locate fractures or position of catheter take less than 10 minutes; more complex or intermittent procedures involving barium swallows or radio opaque injection may take up to 3 hours to complete while patient waits in or near department..

7.3.1 THE IMAGING PROCESS

In both invasive and no-invasive diagnostic systems the basic aim is the same i.e., viewing into the inside of the human body to determine the effect or the cause of the ailment. The deference lies in the equipment used and the process involved in-viewing. Each equipment has its own limitations. Different types of systems are followed for different purposes.

7.3.2 X-RAYS

More than century has passed between the epoch making discovery of W.C. Roentgen in 1895, and the present scene. Significant innovative contribution have been made over the century still this has remained the most common tool in the hand of the physician for the benefit of the sick.

A part of the body is exposed to x-rays that penetrate the body tissues and casts an image on a film placed on the other side. Since our body constituents like bones, fats, fluids etc absorb different amount of radiations, it makes different exposures on the film or the plate in comparison to its surroundings. Thus an image is formed allowing the Doctor to observe the defects in the internal body parts. In this process a fracture, dislocation of bones, tuberculosis chest disorders etc can be diagnosed. (Ref. Plate 7.1 & Fig. 7.1)

7.4 RECENT DEVELOPMENTS

7.4.1 NUCLEAR MEDICINE (NM)

The passage of an injected pharmaceutical with a radioactive isotope is tracked by a gamma camera to identify functional problems in areas such as the brain, skeleton, heart and lungs. Nuclear medicine suites are usually found in large teaching hospitals, Radiation levels are low.

7.4.2 POSITRON EMISSION TOMOGRAPHY (PET)

PET is usually confined to large university hospitals. Need a cyclotron and radio-chemicallaboratory. Physiological molecules are labeled with introduced positron emitting radionuclides then detected, located and measured within the body. The precision of locating the carrier molecule is much greater than in NM. The tomograms produced and the computer techniques are similar to those used in CT and MRI processes.

7.4.3 COMPUTERISED TOMOGRAPHY (CT SCANS)

CT scans take X-ray slices or tomograms of the body. Different body tissues have different absorption values. The absorption value of air is - 1000, water is 0 and dense bone is +3000. Detectors convert the x-rays into electrical data & compute it digitally into an image. Radiation levels are higher than for a conventional. CT scans have reduced the need for exploratory surgery.(Ref. Plate 7.3)

7.4.4 ULTRASOUND SCANS

Non-invasive technique using high frequency sound waves which bounce off internal organs. Atransducer placed against the skin transmits and receives the returning sound signals. The time taken and the strength of the signals are measured. The imaging system then produces a composite image displayed on a monitor. Doppler scanning, measures the time taken of any moving point in the body, so the size of the frequency change can give the speed of blood flow & so identify obstructions. (Ref. Plate 7.4)

7.4.5 THERMOGRAPHY

An infrared sensitive camera picks up heat emission patterns given off by the body. Diseases causing abnormal heat patterns can be identified.

7.4.6 FLUOROSCOPY AND IMAGE INTERSIFIERS

An image intensifier is an evacuated glass tube. The front surface is coated with phosphor which absorbs the x-ray, amplifies the patterns electronically and produces and image on the back of the intensifier tube. It can be displayed on a monitor and recorded on video. It views dynamic events and with the aid of contrast medium can show vascular flow or gastro-intenstinal function. (Ref. Plate 7.2)

7.4.7 DIGITAL CARDIAC IMAGING (DCI) OR DIAGNOSTIC CARDIAC ANGIOGRAPHY (DCA)

DCI is a real- time moving image via x-ray fluoroscopy displayed onto a monitor and recorded on film or tape over 3 to 4 minutes, rather than a static image on a x-ray film. It is achieved via a pulsating stream of x-rays through a patient onto a image intensifier during an invasive procedure. A common procedure caught on film is when radio-opaque dye is squirted into the patient during cardiac catheterisation.

7.4.8 MAGNETIC RESONANCE IMAGING (MRI)

By placing the patient in a strong magnetic field, *(0.02-3 tesla 30,000 times stronger than the earth's magnetic filed) the atomic nuclei in the bodies cells are lined up. Radio-waves are then introduced making the different nuclear fields rotate at different rates. The electrical signals detected are then built into images by the computer where abnormalities can be identified. There are three types of electro-magnets used, resistive, cryogenic, and permanent.(Ref. Fig. 7.2)

<u>*NB The unit measurement for magnetic density is the gauss. The earth's magnetic field is 0.6 gauss. A new unit the tesla equates to 10,000 gauss. The gauss line surrounding the MRI magnet indicates where access must be controlled.</u>

7.4.9 PICTURE ARCHIVING AND COMMUNICATION SYSTEM (PACS)

PACS is a filmless electronic network system for viewing and storing x-rays and other diagnostic images. Lower x-ray doses are used to produce an imprint onto a reusable photo-stimulable storage phosphor plates. Manipulation of the digital image on the monitor is then possible. Short term storage (STS) is a fast shared file needing 40 gigabyte of RAID (random array of inexpensive disks) and is connected via optic fibres to many workstations. ODJ (optical disk juke) boxes contain the long term archival storage by terabytes for 15 years. Each juke box or ODJ needs 3.6 sq.m of floor space, the equivalent to 604.6sq.m of old hard copy x-ray film. There is a floor space saving ration of 1:168.

7.5 EXTERNAL FACTORS AND FUTURE TRENDS

NM & PET: Nuclear medicine although growing in the United States has stayed in the teaching Hospitals in the UK. The numbers of teaching hospitals and medical research establishments is not set to rise. Some are fighting against closure. With the advent of MRI it is unlikely that their diagnostic value will increase. A static state in nuclear medicine with limited up-dating of present facilities seems likely.

CT SCANS: Computerised tomograms which revolutionised the work of diagnostic imaging are fast being overtaken by magnetic imaging. A Trusts realise the benefits of **MRI** over **CT scans**, further **CT scanners** will not be commissioned.

ULTRASOUND SCANNING:is gaining in popularity and usage. Although it is less hazardous to use, less cumbersome to install and the capital outlay is not as horrendous as other imaging equipment the resolution and image quality can not match other techniques. The use of Ultrasound scanners is already readily available. Growth will continue. The impact on the built environment is minimal and requires the use of a dedicated examining room.

DCI: Cardiac diseases have been highlighted as a major health problem and a preventable cause of premature deaths. Several acute general hospitals are hoping to expand and improve their cardiac facilities. It is likely that new cardiac units will include **DCI** rooms and **Ultra-Sound** rooms.

MRI : The interest in **MRI** suites will continue to grow. In spite of its capital outlay and difficult environmental building needs.

PACS: The reporting, storage and retrieval problems of x-rays, in an acute hospital with a fast throughput of patients, is making the cost and upheaval of **PACS** look more and more attractive to overwhelmed hospitals. Many hospitals who are undertaking process re-engineering are looking closely at **PACS** systems. Many hospitals undergoing the **P+FI** process for new buildings are likely to specify for **PACS.** The installation of **PACS** will profliferate as long as the pilot schemes are successful.[58]

7.6 SPECIFIC DESIGN REQUIREMENTS

7.6.1 NUCLEAR MEDICINE

- They should be positioned away from an MRI system, outside the 1 Gauss line.
- Size of Gamma camera room with an image processing computer is usually between 25sqm.m/3.5sq.m.
- Special provision for the storage, control, handling & waste disposal of the radio-active isotopes.
- A hot-lab or access to a radiopharmacy where the isotopes are prepared is required.
- Carefully designed patient friendly areas, taking into account sitting distances between patients and tiolet usage, restrictions, and disposal.
- Adequate staff areas are of particular importance.

7.6.2 CT SCANS

- Protective x-ray shielding walls, doors and windows.
- High voltage electrical generator for power consumption between 35kVA to 115kVA
- A small system requires a one room of 25sq.m, a larger system with three rooms requires 40sq.m.
- A gantry at a height of 1.8 sq.m to 2.4 sq.m to take weights of 800 kg to 2,000 kg.
- Housing for specified manufactures equipment; X-ray tubes, collimators, patient table, operators console and computer.
- An oblique view of patient from the console.
- Take into account maximum manufactures standard length cabling distances between pieces of equipment.
- Non-condensing atmosphere with humidity between 40% to 70% and a maximum temperature of 28 c
- Non-threatening interiors with sensitive design detailing.
- Separate waiting areas for the dressed and undressed.
- Space for manoeuvreability of beds, hoists and other activities.
- Reception and staff areas.

7.6.3 ULTRASOUND

- Small portable scanning machines
- No radiation, magnetic, or electrical shielding required
- Small comfortable room, with privacy required, containing a bed or longer, room for operator and trolley with scanner.

7.6.4 THEROMOGRAPHY

- Conventional X-ray room with X-ray shielding walls.

7.6.5 FLUOROSCOPY

- Conventional X-ray room.

7.6.6 DCI

- Protective x-ray shielding walls, doors and windows.
- High voltage electrical generator.
- X-ray tube, collimator, image intensifier, a C or L arm.
- A Carbon fibre cantilevered computer controlled patient table.
- Image processing & display system.
- Patient monitoring systems recording electrical and physiological patient data.
- Gantry, cabinets, workstations.
- A power injector synchronised to squirt the opaque medium with the pulsating x-ray.
- Operating Theatre requirements for the invasive procedures.
- Cable management and multi-service integration.

7.6.7 MRI

- No X-ray are involved and no radiation is needed.
- The MRI magnet needs to be shielded with copper or aluminium from outside magnetic fields from moving metal objects such as cars, lifts, trolleys, and external radio frequency (RF) energy.
- Equipment within 5-6 gauss, such as clocks, watches, disks, tapes, credit cards and pacemakers are at risk from the magnetic field produced by theMRI.

- The magnetic field size, physical size, weight, cryogenic deliveries and ventilation need to be determined.
- Non-threatening interiors with sensitive design detailing.
- Separate waiting areas for the dressed and undressed.
- Space for manuverability of beds, hoists, ventilators and other activities and equipment.
- Domestic power supply for other electrical equipment.
- Reception and staff areas.

7.6.8 PACS

- No need for films, processing chemical or cabinets, dark rooms, film storage, retrieval or transport systems.
- Cavity floor space for the cabling and wiring.
- **PACS** outlet drops.
- Diagnostic workstations (in place of the old viewing light boxes) in wards clinics consulting rooms and teaching/seminar rooms.
- Need to specify security measures:-

  Access level, user name, passwords, screensavers and time-out defaults.
- Need to decide on:-

  The required size of the STS and ODJ

  The number of workstations

  The site of workstations.

LIST OF PLATES :

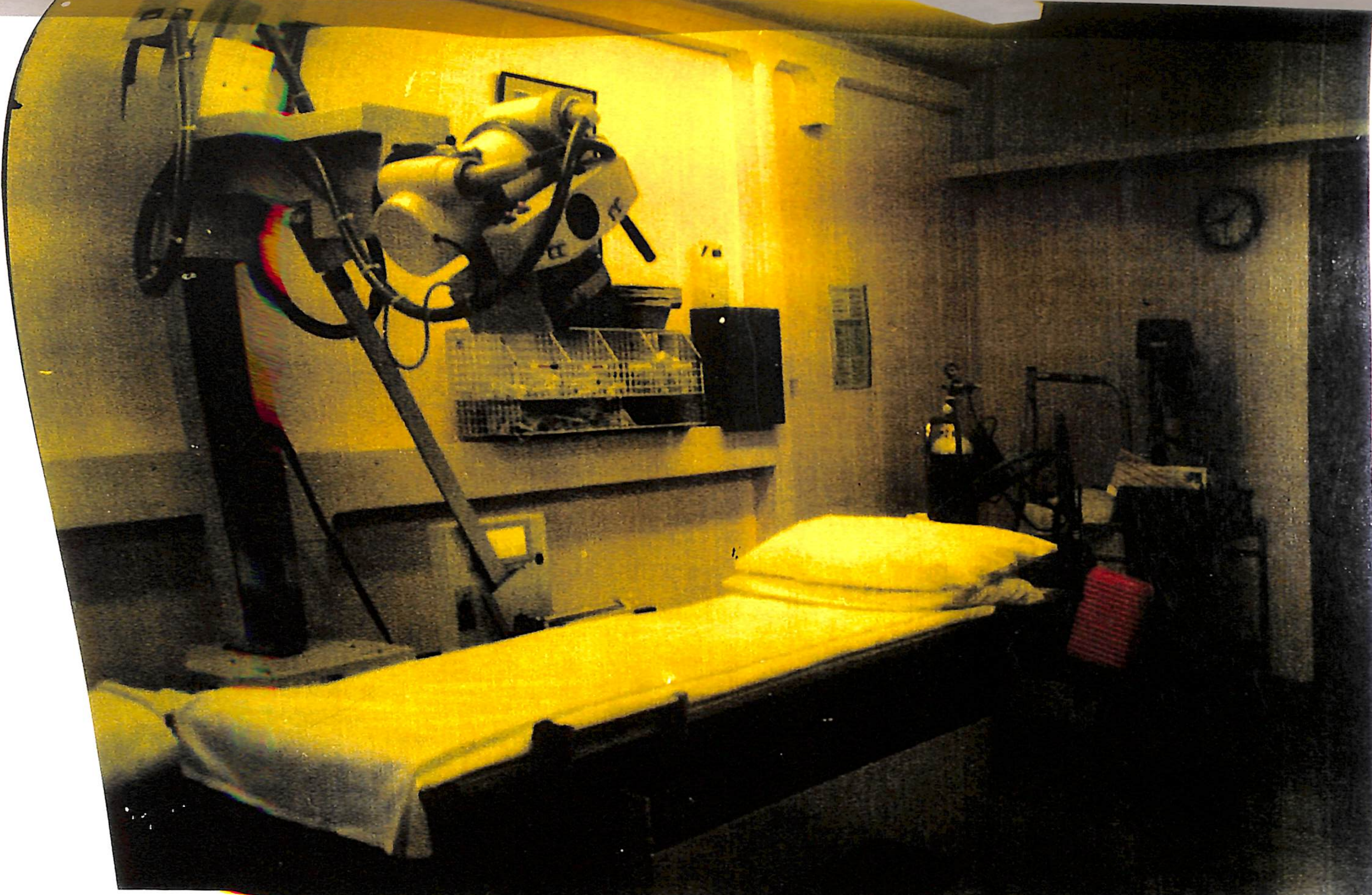


PLATE 7.1 X RAY ROOM

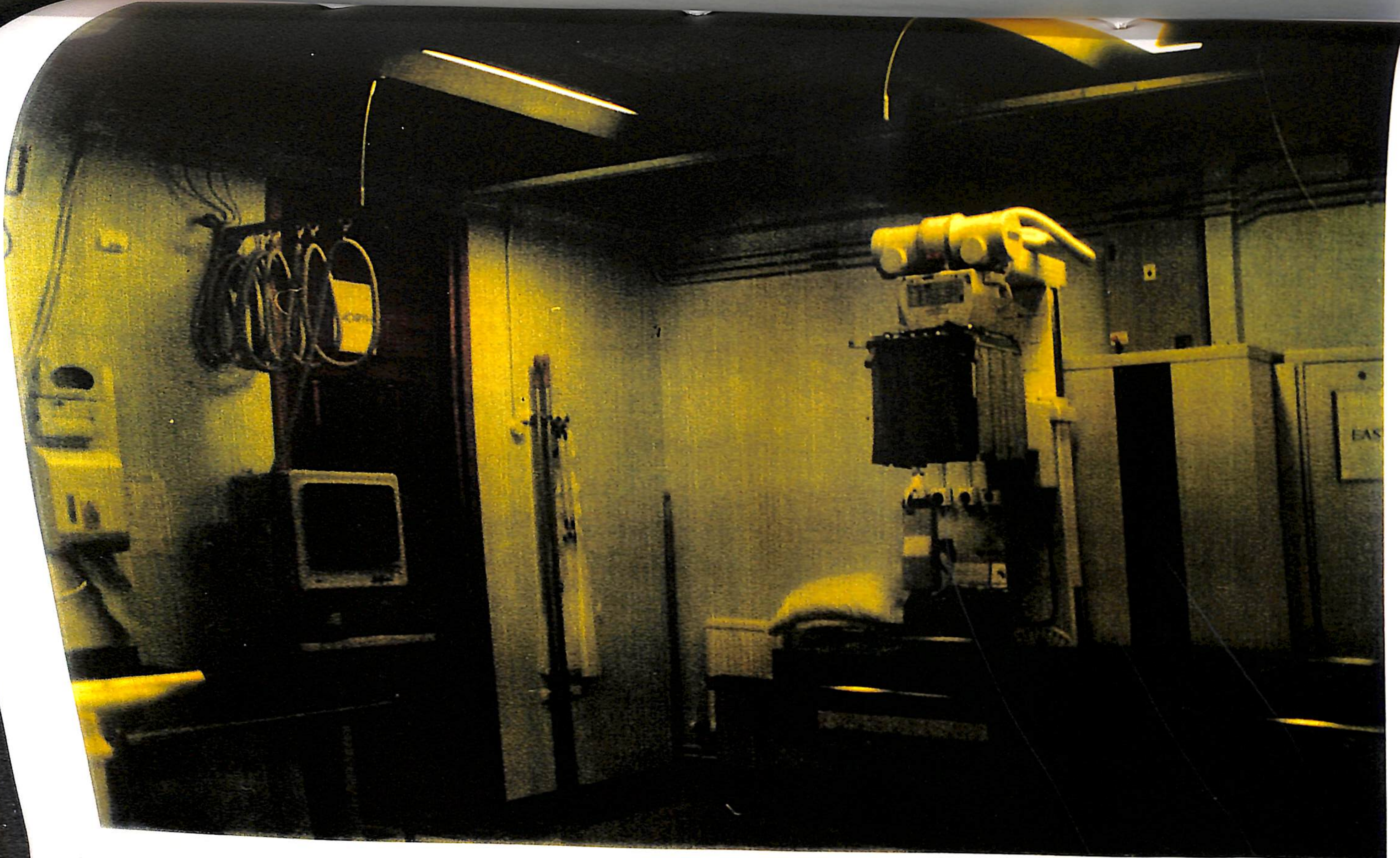
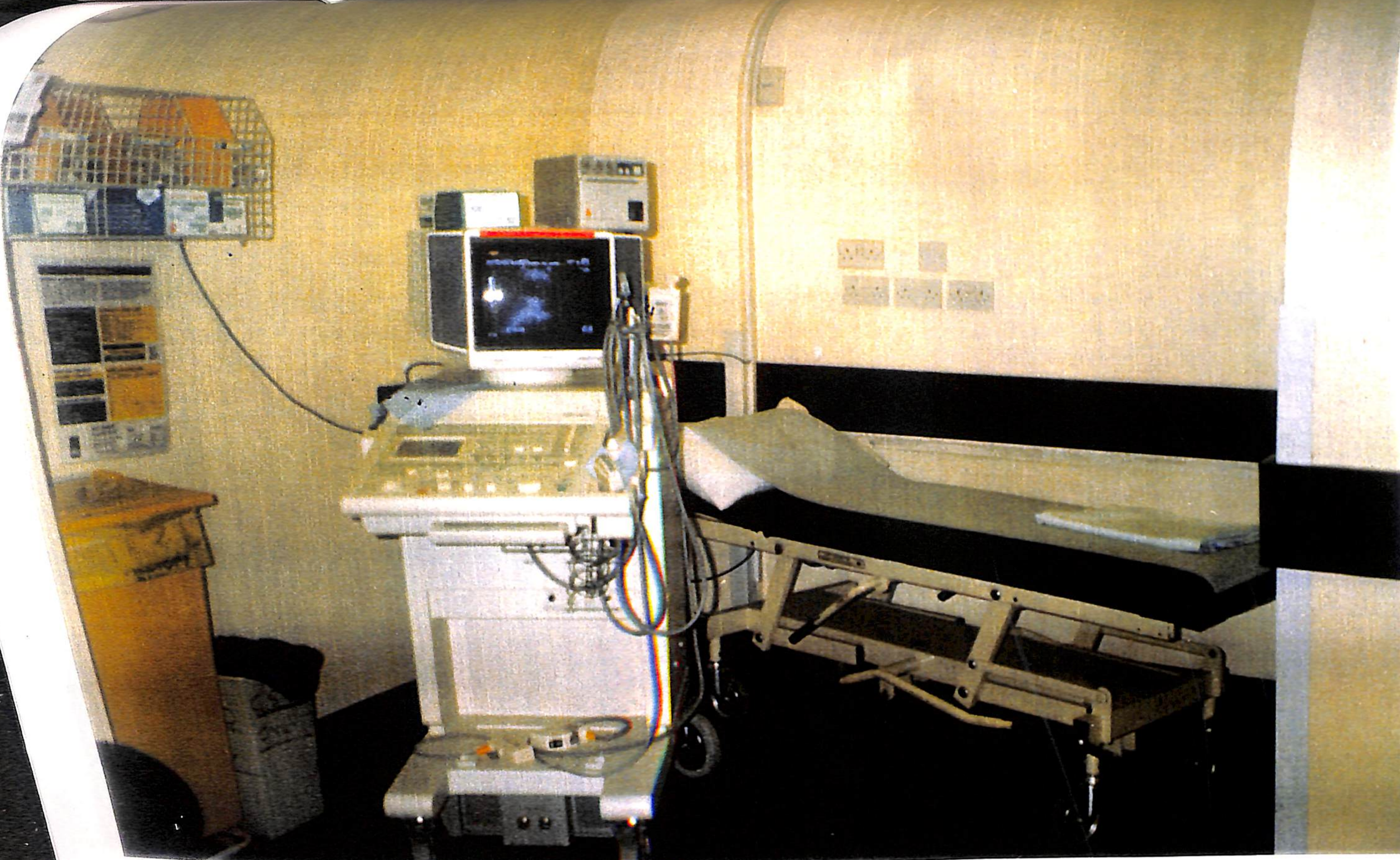
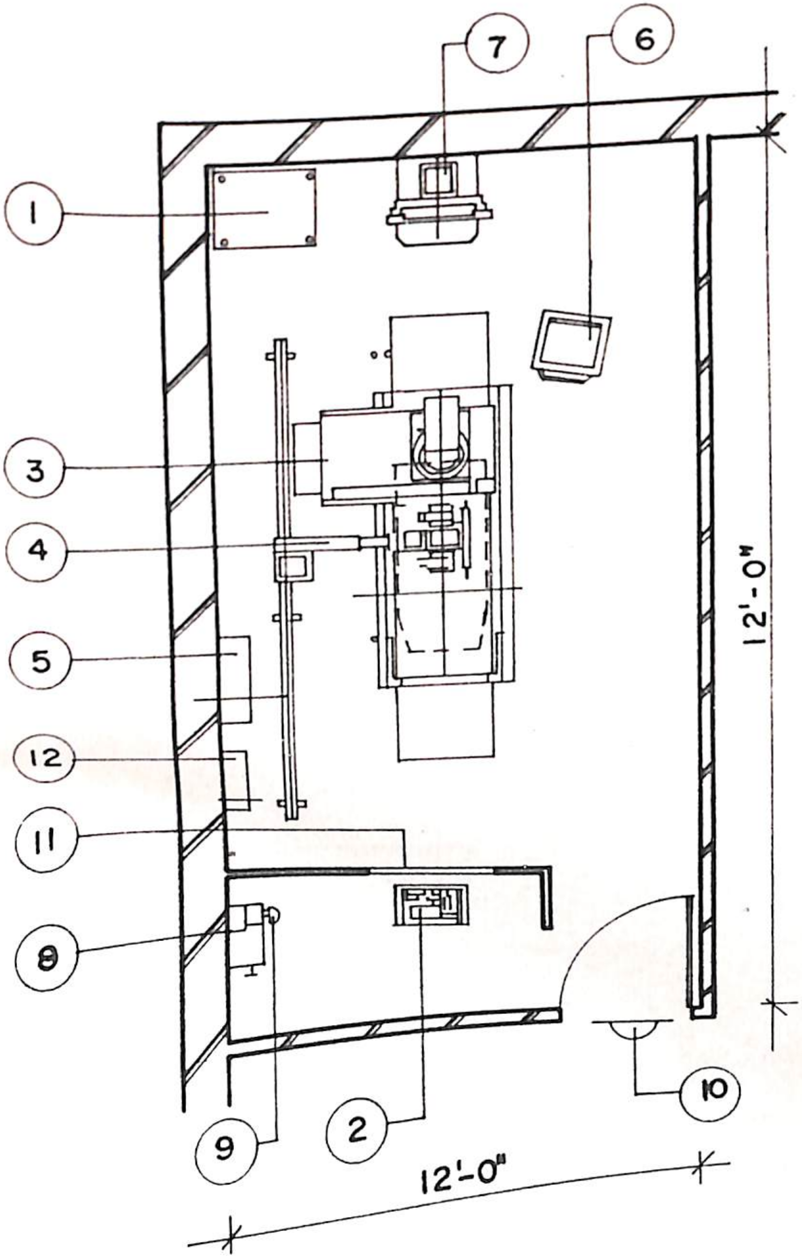


PLATE 7.2 IMAGE INTENSIFIER


SIEMENS
SIEMENS





1. GENERATOR N500 ST
2. N500 ST CONTROL DESK
3. TABLE TBM 5
4. C2RM COLUMN
5. COLUMN CABINET
6. MONITOR
7. WALL BUCKY PM1
8. ELECTRICAL BOX
9. URGENCY STOP BUTTON
10. RED/YELLOW LIGHT
11. X RAY PROTECTION GLASS
12. MONITOR CABINET

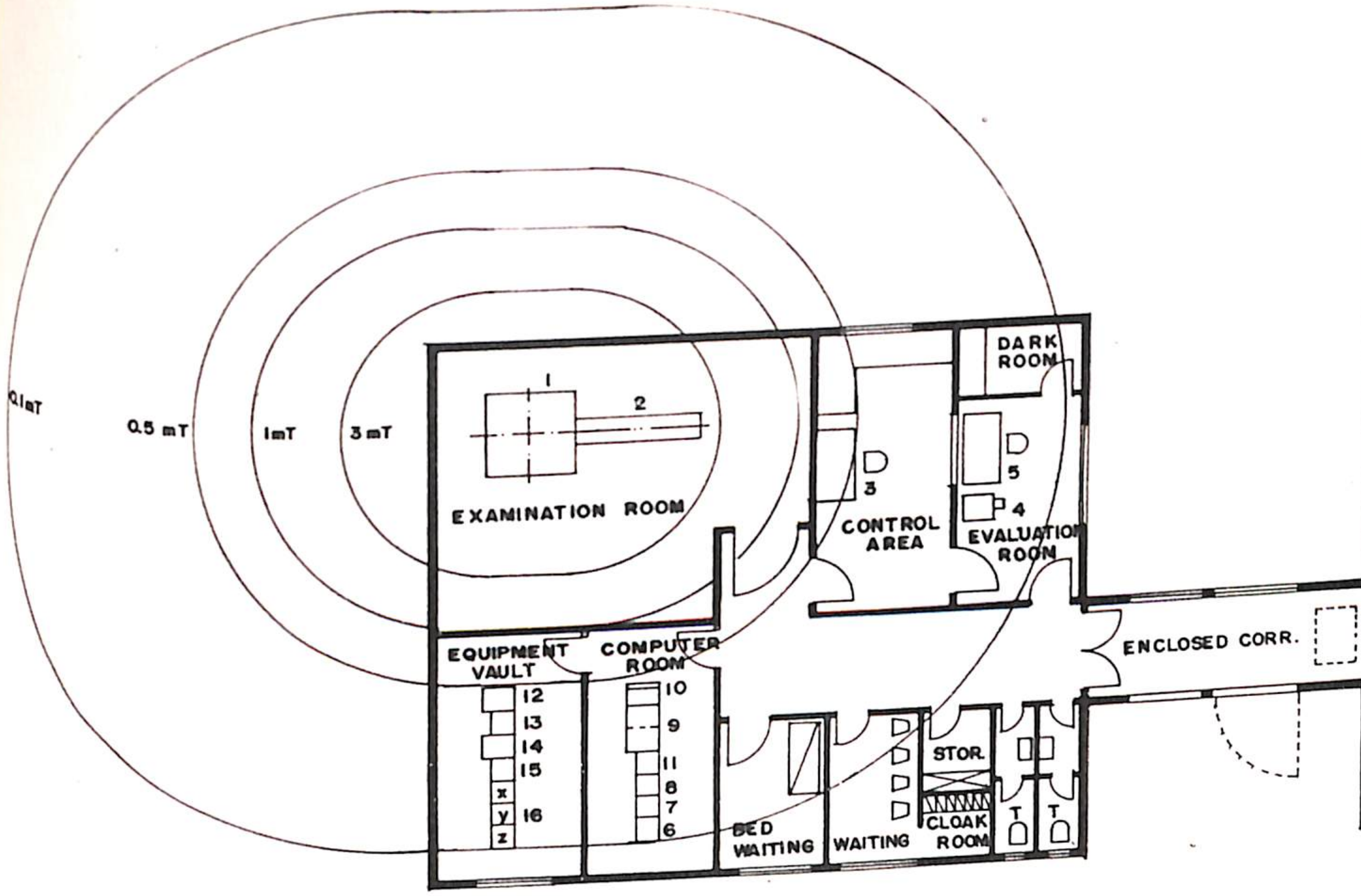


FIGURE 1.

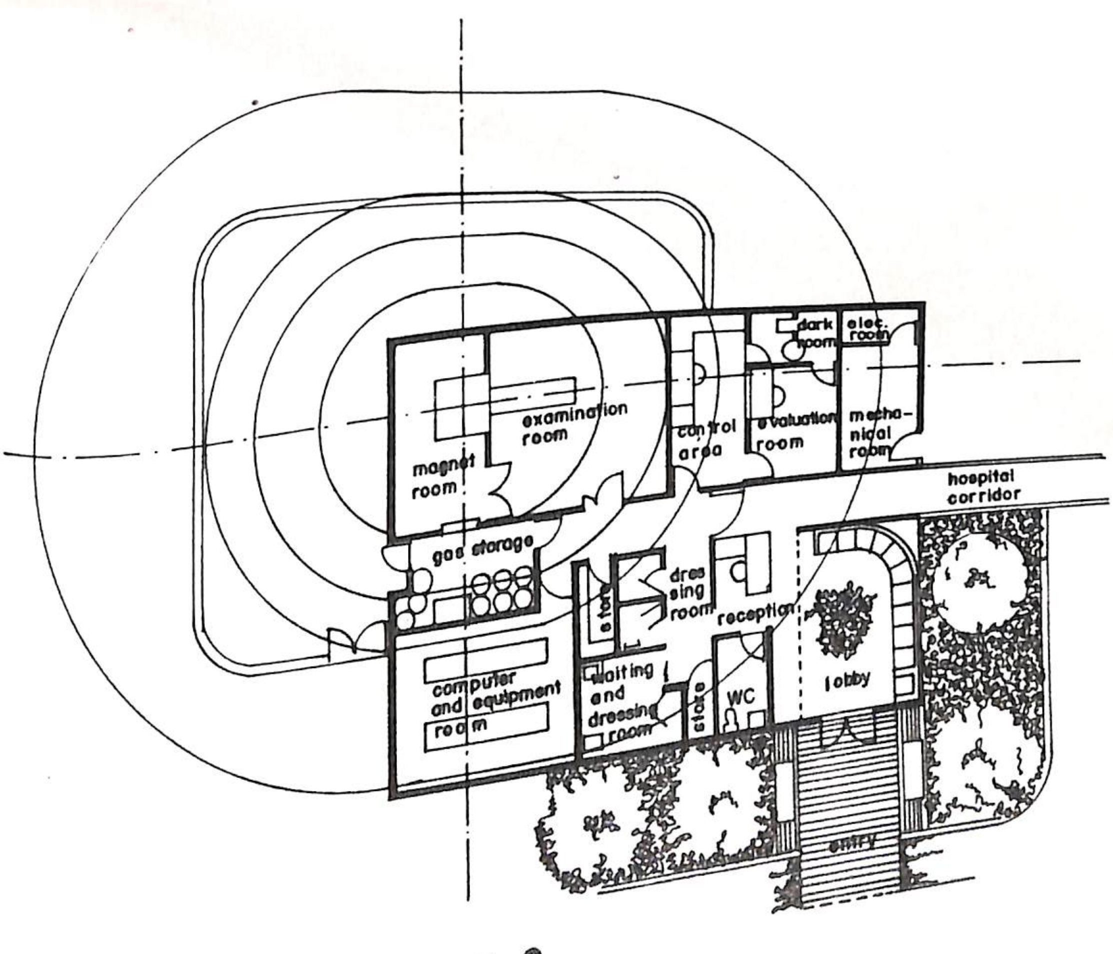


FIGURE 2.

FIG. 7.2

LIST OF ANNEXURE:

ANNEXURE 1.1

LIST OF DEPARTMENTS WITH VARIOUS LEVELS OF HOSPITAL.

LIST OF DEPARTMENTS
(FOR 50 BEDDED HOSPITAL)

S.NO.	NAME OF THE DEPARTMENT	OPTIONAL
Medical & Allied Disciplines		
1.	Anaesthesiology	Dentistry
2.	Community Medicine	
3.	Emergency Medicine	Pathology
4.	General Medicine	
5.	General Surgery	
6.	Obstetrics and Gynaecology	
7.	Paediatrics	
8.	Radio Diagnosis	
Health & Allied Services		
9.	Family Welfare	Clinical Psychology
10.	Health Education	Dental Hygiene
11.	Maternal and Child Health	Catering
12.	Nutrition	Laundry Technology
13.	School Health	Medical Social Work
14.	Drugs and Pharmacy	Operating Theatre
15.	ECG Technology	
16.	X-Ray Imaging	
17.	Ultrasound Imaging	
18.	Laboratory Technology	
19.	Medical Record Technology	
20.	Nursing Services	
21.	Opthalmic Technology	
22.	Sterlization and Disinfection Technology	
Engineering & Allied Services		
23.	Building Maintenance	Horticulture
24.	Electric Supply	LPG Supply
25.	Fire Protection	Solar Energy
26.	Mechanical Transport	Water Treatment
27.	Medical Gases Supply and Vacuum	
28.	Refrigerator	
29.	Solid Waste Disposal	
30.	Telephone and Communication	
Administrative & Ancilary Services		
31.	Audio-Visual Service	
32.	General Administration	
33.	House Keeping	
34.	Library	
35.	Materials Management	
36.	Security	

LIST OF DEPARTMENTS
(FOR 100 BEDDED HOSPITAL)

S.NO.	NAME OF THE DEPARTMENT	OPTIONAL
Medical & Allied Disciplines		
01.	Anaesthesiology	Critical Care Medicine
02.	Blood Transfusion	Dermatology & Venereology
03.	Blood Bank	Neonatology
04.	Community Medicine	Orthopaedics
05.	Emergency Medicine	ENT
06.	Dentistry	Physical Medicine
07.	General Medicine	Psychiatry
08.	General Surgery	Chest Disease
09.	Hospital Administration	
10.	Obstetrics and Gynaecology	
11.	Ophthamology	
12.	Paediatrics	
13.	Pathology	
14.	Radio Diagnosis	
Health & Allied Services		EEG Technology
15.	Family Welfare	Physiotherapy
16.	Health Education	
17.	Maternal and Child Health	
18.	Nutrition	
19.	School Health	
20.	Clinical Psychology	
21.	Dental Technology	
22.	Dietetics and Therapeutics	
23.	Drugs and Pharmacy	
24.	ECG Technology	
25.	X-Ray Imaging	
26.	Ultrasound Imaging	
27.	Laboratory Technology	
28.	Laundry Technology	
29.	Medical Record Technology	
30.	Medical Social Work	
31.	Nursing Services	
32.	Operating Theatre Technology	
33.	Opthalmic Technology	
	Sterlization and Disinfection	
Engineering & Allied Services		HVAC
34.	Building Maintenance	Hot Water Steam Supply
35.	Electric Supply	Solar Energy
36.	Fire Protection	
37.	Horticulture	
38.	Lifts and Vertical Transport	
39.	LPG Supply	
40.	Mechanical Transport	
41.	Medical Gases Supply and Vacuum	
42.	Refrigeration	
43	Solid Waste Disposal	
44.	Telephone and Communication	
45.	Workshop	
46.		

S.No.	NAME OF THE DEPARTMENT	OPTIONAL
Administrative & Ancillary Services		
47.	Audio-Visual Service	Education & Training
48.	General Administration	Financial Management
49.	House Keeping	Management Information
50.	Library	Personnel Management
51.	Materials Management	Public Relation
52.	Security	

LIST OF DEPARTMENTS
(FOR 250 BEDDED HOSPITAL)

S.NO.	NAME OF THE DEPARTMENT	OPTIONAL
Medical & Allied Disciplines		
01.	Anaesthesiology	Geriatrics
02.	Biochemistry	Paediatric Surgery
03.	Clinical Chemistry	Paediatric Cardiology
04.	Blood Transfusion	Plastic Surgery
05.	Blood Bank	
06.	Community Medicine	
07.	Critical Care Medicine	
08.	Emergency Medicine	
09.	Dentistry	
10.	Dermatology and Venerology	
11.	Gastro-Enterology	
12.	General Medicine	
13.	General Surgery	
14.	Clinical Haematology	
15.	Hospital Administration	
16.	Clinical Immunology	
17.	Microbiology	
18.	Neonatology	
19.	Obstetrics and Gynaecology	
20.	Ophthamology	
21.	Orthopaedics	
22.	Oto-Rhino-Laryngology	
23.	Paediatrics	
24.	Pathology	
25.	Physical Medicine	
26.	Psychiatry	
27.	Pulmonary Medicine	
28.	Radio Diagnosis	
29.	Traumatology	
Health & Allied Services		
	Bio-Statistics	Occupational Health
30.	Environmental Health	
31.	Epidemiology	
32.	Family Welfare	
33.	Health Education	
34.	Maternal and Child Health	
35.	Nutrition	
36.	School Health	
37.		

S.NO.	NAME OF THE DEPARTMENT	OPTIONAL
Nursing Administration		
38.	Clinical Psychology	CT Imaging
39.	Dental Technology	MR Imaging
40.	Dietetics and Therapeutics	Radio Therapy
41.	Drugs and Pharmacy	
42.	ECG Technology	
43.	EEG Technology	
44.	X-Ray Imaging	
45.	Ultrasound Imaging	
46.	Laboratory Technology	
47.	Laundry Technology	
48.	Medical Record Technology	
49.	Medical Social Work	
50.	Mental Health	
51.	Nursing Services	
52.	Operating Theatre Technology	
53.	Opthalmic Technology	
54.	Physiotherapy	
55.	Sterlization and Disinfection	
Engineering & Allied Services		
56.	Building Maintenance	HVAC
57.	Electric Supply	Hot Water &
58.	Fire Protection	Steam Supply
59.	Horticulture	Solar Energy
60.	Lifts and Vertical Transport	
61.	LPG Supply	
62.	Mechanical Transport	
63.	Medical Gases Supply and Vaccum	
64	Refrigeration	
65.	Solid Waste Disposal	
66.	Telephone and Communication	
67.	Workshop	
Administrative & Ancillary Services		
68.	Audio-Visual Service	
69.	Documentation	
70.	Education and Training	
71.	Estate Management	
72.	Financial Management	
73.	General Administration	
74.	House Keeping	
75.	Library	
76.	Management Information	
77.	Materials Management	
78.	Personnel Management	
79.	Public Relations	
80.	Security	

LIST OF DEPARTMENTS
(FOR 500 BEDDED HOSPITAL- TEACHING HOSPITALS)

S.NO.	NAME OF THE DEPARTMENT	OPTIONAL
Medical & Allied Disciplines		
01.	Anaesthesiology	
02.	Anatomy	
03.	Biochemistry	
04.	Clinical Chemistry	
05.	Biophysics	
06.	Blood Transfusion	
07.	Blood Bank	
08.	Cardiology	
09.	Cardio-Vascular and Thoracic Surgery	
10.	Community Medicine	
11.	Critical Care Medicine	
12.	Emergency Medicine	
13.	Dentistry	
14.	Dermatology and Venerology	
15	Endocrinology	
16.	Family Medicine	
17.	Forensic Medicine	
18.	Gastro-Enterology	
19.	General Medicine	
20.	General Surgery	
21.	Geriatrics	
22.	Haematology	
23.	Clinical Haematology	
24.	Hospital Administration	
25.	Immunology	
26.	Clinical Immunology	
27.	Medical Oncology	
28.	Microbiology	
29.	Neonatology	
30.	Naphrology	
31.	Neurology	
32.	Neurosurgery	
33.	Nuclear Medicine	
34.	Obstetrics and Gynaecology	
35.	Ophthamology	
36.	Orthopaedics	
37.	Oto-Rhino-Laryngology	
38.	Paediatrics	
39.	Paediatric Cardiology	
40.	Paediatric Surgery	
41.	Pathology	
42.	Immuno Pathology	
43.	Pharmacology	Surgical Oncology
44.	Clinical Pharmacology	Transplant Surgery
45.	Physical Medicine	
46.	Physiology	
47.	Plastic Surgery	
48.	Psychiatry	

S.NO.	NAME OF THE DEPARTMENT	OPTIONAL
49.	Pulmonary Medicine	
50.	Radio Diagnosis	
51.	Radiation Oncology	
52.	Toxicology	
53.	Traumatology	
54.	Urology	
Health & Allied Services		
55.	Bio-Statistics	
56.	Environmental Health	
57.	Epidemiology	
58.	Family Welfare	
59.	Health Education	
60.	Maternal and Child Health	
61.	Nutrition	
62.	Occupational Health	
63.	Population Science	
64.	School Health	
Nursing Services		
65.	Clinical Psychology	
66.	Dental Technology	
67.	Dietetics and Therapeutics	
68.	Drugs and Pharmacy	
69.	ECG Technology	
70.	EEG Technology	
71.	Imaging Technology	
72.	X-Ray Imaging	
73.	Ultrasound Imaging	
74.	CT Imaging	
75.	MR Imaging	
76.	Laboratory Technology	
77.	Laundry Technology	
78.	Medical Record Technology	
79.	Medical Social Work	
80.	Mental Health	
81.	Nursing Services	
82.	Operating Theatre Technology	
83.	Opthalmic Technology	
84.	Physiotherapy	
85.	Radio-Isotope Technology	
86.	Radiotherapy Technology	
87.	Sterlization and Disinfection	
88.	Speech and Hearing Technology	
Engineering & Allied Services		
89.	Bio-Medical Engineering	
90.	Building Maintenance	HVAC
91.	Electric Supply	Hot Waters &
92.	Fire Protection	Steam Supply
93.	Horticulture	Solar Energy
94.	Lifts and Vertical Transport	

S.NO.	NAME OF THE DEPARTMENT	OPTIONAL
95.	LPG Supply	
96.	Mechanical Transport	
97.	Medical Gases Supply and Vaccum	
98.	Refrigeration	
99.	Solid Waste Disposal	
100.	Telephone and Communication	
101.	Workshop	

Administrative & Ancillary Services

102.	Audio-Visual Service	
103.	Clinical Photography	
104..	Documentation	
105.	Education and Training	
106.	Estate Management	
107.	Financial Management	
108.	General Administration	
109.	House Keeping	
110.	Library	
111.	Management Information	
112.	Materials Management	
113.	Personnel Management	
114.	Public Relations	
115.	Security	

ANNEXURE 5.1

CLIMATIC ZONES OF INDIA

For purpose of design of buildings based on climatic and environmental considerations, India can broadly be divided into six zones. Essential characteristics of each of these zones, requirements for human comfort and design guidelines are outlined in this Building Digest.

This data is ;presented as simplified information on climatic conditions indifferent parts of the country. Factors relevant to the achievement of comfort conditions indoors are indicated.

The geographical confines of India are 8 degree to 36 degree N latitude and 68 degree to 97 degree longitude. The peninsular region is in the tropical zone and the rest in the temperate zone. The entire country may broadly be divided into six zones for environmental design. These are

1. West Coastal Tropical
2. East Coastal Tropical
3 Peninsular Plains
4. Gangetic Plains
5. Desert Areas
6. Eastern Hill Areas

Each of these has its own special environments physical characteristics and these should be considered in the planning of buildings. These are listed separately. However, since the information is applicable to large areas, the need for a critical examination of site condition should bot be overlooked.

The average daily maximum and minimum temperatures for the entire subcontinents lied around 28 degree and 18 degree Centigrade respectively with a swing of 10 degree Centigrade respectively and do not, therefore, indicate the extremes reached in summer or winter. To emphasise the possible extremes expectable during these periods, only these maxima and minima are shown in the following sections. Indian climate does not generally pose problems connected with extremes of heat coupled with extremes of humidity.

The main problems requiring solution in the designing for comfort are summer heart and monsoon humidity coupled with the failure of air movement when most required. there is need to avoid excessive heat gains in summer and heat losses in winter (wherever required) and for taking advantage of prevalent winds. Inclinations of apertures up to 30 degree with the expectable wind direction do not result in large changes in internal air motion. Therefore, in situations where there is a conflict between solar heat gain and air motion, the actual site requirement should be the deciding factor for orientation.

Design should take into account : (a) the worst or near worst conditions for heat gains or losses and (b) the optima for natural lighting, since these are well defined entitities depending only on solar position.

In warm climates 'Ventilation' has to serve two purposes : (a) for health and (b) for comfort. The former is taken care of by processes of infiltration, modes of living and our fenestration designs which do not make shutters for doors and windows airtight, while the latter only by a generous provision for air-movement by natural or artificial means. Air-movement outdoors, with its wellknown vagaries, does not lend itself as a dependable design parameter for comfort ventilation. Heat gains (and heat losses) by ventilation should also be taken into consideration.

The above mentioned facts have added significance in the planning of buildings for high density areas.

Hill stations at elevations of 1000 m or more above M.S.L need special design considerations. Here building should be designed to keep interiors warm at optimal comfort. To this end the buildings should be oriented NE-SW to get maximum solar radiation in the worst period of the year. Walls should be thick and insulative. Windows should be large (up to 30 per cent of floor area), double glazed and provided with air-tight shutters to prevent in filtration of cold outside air. Roofs should be thick and insulative and sloping. Outside colouring should be dark and absorptive. A court-yard to provide wind shelter and solar radiation trap would be an added advantage.

ZONE I

WEST COASTAL TROPICAL

This is a narrow strip of land varying in width from about 20 to 150 km. west of the Western Hills extending from Trivendrum in the south to the North of Daman, elevations can be from seal level to 150 m above M.S.L.

Temperature	Climate not excessively hot. Rather sultry. Annual summer mean maximum temp 30 - 33 Degree Centigrade. Annual winter mean minimum temp. 19 - 23 Degree Centigrade.
Humidity	Relative Humidity ranges between 65 to 88 per cent. November to February may be considered comfortable due to lower temperatures and low rainfall.
Rainfall	Principally during May to September due to S.W. Monsoon. Occasional rains not uncommon. Average rainfall 1800-2000 mm annually. Number of rainy days between 75 and 120 per year.
Wind	Principal wind direction during the year is W/NW. Wind speed of the order 5/10 km/hr. with possibility of gusts during rainy spells.
Daylight	Adequate for most purposes during 0800-1600 hrs. During rainy spells there may be need for supplemental artificial lighting.

Comfort	Sun exclusion between 0900 and 1700 hours. Generous provision for ventilation and air movement.
Requirement	Fans essential almost any time and necessarily during periods of calm between spells of rains.

Site	Good rainwater drainage essential.
Layout	Building to be on the E-W to NE-SW axis to reduce solar heat gains and improve wind movements.
Air-Movements	Good arrangements for cross ventilation. Fans essential.
Opening	15 per cent of floor area and up to a maximum of 20 per cent for ventilation, air movement and daylighting, low sill heights, windows horizontal.
Roofs	May be light weight but should be insulatives. False ceiling is helpful. Protection against heavy rainfall necessary.
External walls	Light weight, iff possible, short time lag for heat transfer. Light external colours, W. Wall rain protected.
Outdoor sleeping space	Not necessary, because of high precipitation.
Lightning Protection	Yes: in the southern areas of this zone. See Map.

ZONE - 3

PENINSULAR PLAINS

This region is roughly south of the line joining Surat and Calcutta. This area is topologically undulatory. Altitude ranging from 100 m to 900 m above M.S.L.

Temperature	Hot during summer and relatively warm during the year. Winter pleasant. Annual summer maximum temperature 34 - 41 Degree Centigrade Annual winter minimum temperature 14 - 19 Degree Centigrade
Humidity	The relative humidity ranges between 25 per cent to 80 during the monsoon season, generally between June to November. Number of rainy days in the year 40 to 75 days.
Rainfall	500 to 900 mm with few exceptions when it may go to 1300 mm. The period of rainfall is mostly June to Sept. in the western half and June-November in the easterly areas of the peninsula. Number of rainy days in the year 40 to 75 days.
Wind	The principal wind direction is W and NW and the wind speed between 3 to 10 km/hr.
Daylight	Adequate for most purposes during 0800-1600 hrs except when the rains are on.
Comfort requirements	Sun exclusion during 0900 to 1700 hrs. in summer. Reasonable provision for ventilation and air motion. Fans essential. Air conditioning desirable.
Site	Good rain water drainage essential.
Layout	Building on E-W axis to reduce solar heat gains in summer and most part of winter.
Air-movement	Single banked rooms for good cross ventilation.
Openings	Upto 15 per cent of floor area for ventilation, air motion, and daylighting. To be shielded during 0900 to 1700 hrs. during summer. Winter sunshine may bot be desirable either.
Roofs	Light weight insulative or medium heavy with a short time lags may be sufficient. Design for moderate rains. False ceiling and attic ventilation may be useful. Northern positions may need heavy roofs also.
External walls	Light Weight with short time lags will suffice. Local conditions may dictate heavy walls. Light colour on walls.
Outdoor sleeping space	Not essential, but may be required in some specified places. Depends on local climate and practise.
Lightning protection	Yes: in some parts of the southern end and N.E. end of the region. See map.

Roofs	Heavy with a eight hour time lag.* This will help keep interior at equitable temperature levels. Roofs should ;be designed for moderate rains. Should be white washed for additional comfort, just before onset of summer, to reduce heat gains.
Walls	Massive with 8 hour time lag.** If possible should be shielded with deciduous trees specially on the West and North West in summer. Careful consideration should be given to plan internal occupancy during hot summer months.
Outdoor sleeping area	Essential and most desirable. The possibility of re-radiation to the clear sky at night and consequent reduction of body temperature outdoor is great as compared to reradiation to the hot indoor ceiling and possible discomfort.
Special needs	Desert coolers in summer and room heaters in winter.
Lightning protection	Yes: in most parts of this zone. See map.

* Equivalent to a roof consisting of 10 cm RCC + 10 cm lime concrete+water proofing treatment.

** Equivalent to a wall consisting of 20 cm brickwork+1.25 cm lime plaster on either side.

ZONE -4

THE GANGETIC PLAINS

This is the large tract of land comprising the entire subcontinent north of an imaginary line joining Surat and Calcutta, with Bangladesh on the east, Himalayas on the north and the Rajasthan desert on the west. Elevation are generally between 100 and 600 m above MSL. Srinagar and Dehradun valleys, hill resorts at Simla, Manali, Almora, Nainital and Mussorrie are to be considered as areas requiring special consideration partly on account of rainfalls and partly because of temperatures and high winds prevailing at all higher altitudes.

Temperature	Hot during summer, cool to cold during winter and warm humid during monsoon season. Annual summer temp. Maximum 30 - 42 Degree Centigrade Annual winter temp. Minimum 7- 14 Degree Centigrade
Humidity	The relative humidity varies between 70 to 85 per cent during the rainy season and generally between 40 to 60 per cent in summer and goes as low as 25 per cent in winter. Summer nights outdoor are relatively cool except when atmospheric dustiness increases.
Rainfall	Rains are confined to the South West monsoon from mid July to mid September. Average rainfall is between 650 to 1400 mm and number of rainy days between 35 to 60 annually.
Wind	There is no specific wind direction but W. NW. and SW are most probable. Summer is characterised by hot dust raising winds with velocities going up to 15 km/hr. Atmosphere is dusty in May/June.
Daylight	Sufficient during 0800 to 1600 hrs. As one proceeds north the shorter duration of daylight hours in winter may require artificial supplemental lighting during the day.

Comfort requirements	Sun exclusion in summer during the day from 0800 to 1700 hrs. Sunlight penetration in winter desirable. Adequate provision for air change and comfort ventilation in monsoon period. Building requires cooling in summer by shading, roof treatments and/or air conditioning. Situation ideal to use desert coolers in summer. Winter heating required in most laces.

Site	Good rain water drainage very essential in view of the flat terrain and possibility of water stagnation
Layout	Building axis to be East - West to avoid heat gains in summer and receive the same in winter. Location of rooms to be judicially determined.
Air-movement	Open spacing desirable to take advantage of external air motion for cross ventilation just to fit. Excessive air changes in summer or winter brings in heat or cold respectively from outside.
Openings	Minimum 15 percent and up to 20 of floor area for ventilation and daylighting. Should be capable of being tightly closed during summer days and winter nights.

ZONE - 5

THE RAJASTHAN DESERT

This desert area includes parts of Rajasthan. Lying north of Gujrat, West of U.P. and South of Haryana. The elevations are between 200 to 400 m above MSL. Large tracts with little rainfall, absence of green vegetation and abundance of cacti and populations clustered around laks and water spots are main characteristics of this region. The ground water table is more than 50 metres below ground level.

Temperature	Hot to very hot during summer and cold to rather very cold in winter. Annual summer temp. maximum 41 to 44 Degree Centigrade Annual winter temp. minimum 8 to 10 Degree Centigrade
Humidity	Relative humidity upto 80 per cent while rains are on but only between 10 to 25 per cent on other days and nights. Summer nights cool with low relative humidity.
Rainfall	Annual rainfall ranges between 250 to 600 mm and confined to mostly July-August with number of rainy days between 20 to 35.
Wind	Principal directions W.NW. SW and in that order. Summer winds dust laden. Speeds range between 10-15 Km/Hr. Summer atmosphere dusty.
Daylight	Adequate during between 0800 to 1600 hrs. Slightly less during winter afternoons due to low solar position and shortness of day time when supplemental lighting may be needed.

Comfort requirements	Sun exclusion during summer between 0800 hrs. and 1700 hrs later. Sunlight entry in winter during day time preferred. Protection against hot, dusty, colds winds. Roof and walls need shading. Desert coolers are useful in summer. Fans at low speed provide relief during hot summer daytime indoor.

Site	Nothing specially required.
Layout	Building axis East-West to avoid solar ;heat gain in summer and received it in winter. Compact planning to avoid exposure to sun.
Air-movement	Not critical but desirable and hence compact planning.
Openings	Minimum 12 per cent of floor area but should be limited to 15 per cent in the N and S exposed walls. Should be provided with close fitting shutters to cut off hot ;and cold winds as well as dust.
Roofs	Heavy with a eight hour time lag.* This will help keep interior at equitable temperature levels. Should be white washed for additional comfort, just before onset of summer, to reduce heat gains.
Walls	Massive with 8 hours time lag.** If possible should be shielded with deciduous trees specially on the West and North West in summer. Careful consideration should be given ;to plan internal occupancy during hot summer months. Shielding is essential.

ZONE 6

THE EASTERN HILLS

This would include the hilly areas in the states of Assam, Arunachal Pradesh, Meghalaya and Nagaland. The terrain is undulatory and altitudes reach up to 1500 m above MSL and more. Characterised by dense tropical vegetation and high rainfall throughout the year. The world's wettest place Chirapunji lies in this region.

Temperature	Maximum summer temp. between 24-31 Degree Centigrade Minimum winter temp. between 4-10 Degree Centigrade
Humidity	Up to 95 per cent in the rainy season and 80 per cent generally. Days and nights oppressive due to high humidity.
Rainfall	Almost through out the year and more so from May to November. Total rainfall may extend from 2000 to 2800 mm annually. Number of annual rainy days about 130. Chirapunji records 10800 mm rain annually.
Wind	Principal direction S or SW. Possibility of driving rains.
Daylight	Adequate during 0800 to 1600 hrs. except when obstructed by tall vegetation or during short daytime hours in winter.

Comfort requirement	Adequate provision for ventilation in summer. Rain and fungus protection and control desirable.

Site	Adequate rain water drainage essential.
Layout	Orientation of longitudinal axis of building E-W desirable but not critical in hills.
Air-movement	Cross ventilation essential and controls to prevent penetration of wind borne rain indoors.
Openings	May be up to 25 per cent of floor area subject to adequate control of wind borne rain.
Walls	Light or heavy but should have sufficient insulation. Vapour barrier should be considered depending on location. Wind pressure on walls to be considered.
Roofs	Light or heavy but with sufficient insulation and designed for quick drainage. Vapour barrier should be considered based on location and possible wind pressures.
Outdoor sleeping space	Not necessary due to high precipitation.
Lightning protection	Yes: throughout this zone.

Outdoor sleeping spaces	Essential hence the recommended courtyard type compact planning.
Lightning protection	NIL

ANNEXURE 5.2

NUMBER OF DOCTORS IN GOVT. AGENCIES AND AVERAGE POPULATION SERVED IN DIFFERENT STATES/U.T.S - 1991

S.No.	States / U.Ts.	Doctor Engaged Under Govt.	Population served per Agency	Period to which Data Relates
1.	2.	3.	4.	5.
1.	Andhra Pradesh	1059	1:61471	31-1291
2.	Arunachal Pradesh'92	233	1:3536	31-12-90
3.	Assam'91	2660	1:8750	31-12-91
4.	Bihar'92	N.A	+	31-12-91
5.	Goa	540	1:2166	31-12-91
6.	Gujarat	3645	1:11404	31-12-91
7.	Haryana	N.A	1:11705	-
8.	Himachal Pradesh	N.A	1:5350	-
9.	Jammu & Kashmir'89	N.A	+	31-12-91
10.	Karnataka	3397	1:13536	31-12-91
11.	Kerala	4163	1:7213	31-12-91
12.	Madhya Pradesh	N.A	+	31-12-91
13.	Maharashtra	N.A	+	31-12-91
14.	Manipur	684	1:2675	31-12-91
15.	Meghalaya	322	1:5357	31-12-90
16.	Mizoram	146	1:5000	31-12-91
17.	Nagaland	202	1:5401	31-12-89
18.	Orissa	4965	1:64173	31-12-91
19.	Punjab	3462	1:5642	31-12-91
20.	Rajasthan	N.A	+	31-12-91
21.	Sikkim'92	101	1:4297	31-12-89
22.	Tamilnadu'90	3189	1:17879	31-12-91
23.	Tripura	673	1:3822	31-12-90
24.	Uttar Pradesh'86	8630	1:15438	31-12-91
25.	West Bengal	N.A	+	31-12-91
26.	A & N Islands	122	1:3448	31-12-91
27.	Chandigarh	864	1:913	31-12-91
28.	Dadra & Nagar Haveli	12	1:11000	31-12-90
29.	Daman & Diu'92	19	1:5346	31-12-91
30.	Delhi	N.A	1:6233	
31.	Lakshadweep	28	1:1714	31-12-91
32.	Pondicherry'92	350	1:2174	31-12-91
	TOTAL	39466		

NOTE :

+ = Not available, Ratio has been worked out with the Annual Estimates of Population of the year to which data relates. Govt. Agency includes Central/States Govt. Hospital, Public Sector Undertaking Hospital etc.

SOURCE: DIRECTORATE OF HEALTH SERVICES.

ANNEXURE 5.3

GENERAL QUESTIONNAIRE

I. GENERAL INFORMATION

* Catchment area of hospital.
* O.P.D. attendance per day.
* Admissions per day.
* Average length of stay.
* Hospital Infection Rate
* Hospital gross death rate (without 24 hours of admission)
* Hospital net death rate (after 24 hours of admission)
* Distribution of beds speciality-wise.
* Bed occupancy rate.

II. O.P.D. SERVICE (OUTPATIENT DEPARTMENT)

* Do you have a separate O.P.D. block ?
* Are there facilities for disabled ?
* Is there a separate office incharge of O.P.D. ?
* Number of new cases everyday.
* Number of repeat O.P.D. attendance.
* Do you have outreach Primary Health Care (PHC) Programme ?
* Do you have an injection room in O.P.D. ?
* Do you have a dressing room/plaster room in O.P.D. ?
* Have you have any Health Education Programme in O.P.D.?
* Have you Family Welfare Programme in O.P.D. ?
* Are the X-ray rooms and laboratory easily approachable from O.P.D.?
* Is there enough waiting space ?
* Is there facility for drinking water ?
* Are there enough toilets ?
* How many social guides are posted in O.P.D. ?
* Are suitable signs displayed for different guidance to different clinics?
* Are you satisfied with Sanitation of O.P.D. ?
* Linkage with Emergency Services.

III. CLINICAL SERVICES

GENERAL

* Number of general clinics.
* Number of special clinics.
* Does Hospital provide :

  P.H. Care

  Secondary Care

  Tertiary Care

  Super Tertiary Care

  Super Tertiary Care (Apical)
* Is Medical Audit Committee functioning ?
* System of continuing Medical Education Programme.
* The type of Research undertaken.
* Number of :

  Faculty Staff

  Resident Staff

  Other Medical Staff
* Number of intensive care beds/coronary care beds.

SPECIAL SERVICES

PAEDIATRIC SERVICES

* Number of Paediatric beds.
* Do you practice the concept of rooming in.
* Number of Nursery beds.
* Has the Nursery been divided into Normal, Premature and infected Nurseries.
* List the important equipments in the nursery.
* Do you practice barrier nursing in the nursery ?
* Have you got under five clinic and immunization programme ?
* Do you have any facilities for children play/recreation in the ward?
* Is separate space provided for mothers ?
* What is the identification system followed for new borns ?
* List safety measures for children.

OBSTETRIC SERVICES

* Number of deliveries/month.
* Number of Caesarian section/month.
* Number of abnormal deliveries.
* Is your hospital recognised for Medical Termination of Pregnancy (MTP) programme ?
* Have you got Post Partum Programme ?
* What is the length of hospital stay in normal deliveries ?
* Number of forceps deliveries/month.
* Mother Education Programme.
* Do you practice Rooming-in ?

O.T. SERVICES (OPERATION THEATRE)

* Are the operation theatre centrally located ?
* How many OTs you have ?
* Are all operation theatres centralised ?
* What is the system of Swab counts ?
* List the important O.T. equipment.
* Have you an O.T. committee ?
* Who is O.T. Chief ?
* What is the system of Air Conditioning ?
* Is O.T. on stand-by generator ?
* How long is an O.T. used daily ?
* Is there any regular monitoring to find out post operative infection rate ?
* System of identification of operated area and consent room.
* Is records of accidents in O.T. maintained.

EMERGENCY SERVICES

* Number of Ambulances Road worthy.
* Number of cases/day.
* Number of brought in dead per weak.
* Number of Medico Legal cases per day.
* Is emergency air conditioned ?

* *Is it on stand-by Generator ?*
* Have you, buffer stock system to avoid out of stock situations ?
* Number of nurses in one shift.
* Number of Doctors in one shift.
* Have you observation beds ?
* Number of emergency beds.
* List of important equipments.
* Are services of X-ray Department, Pharmacy Department, ECG, Bio-Chemistry, Blood Bank available round the clock ?
* Have you got disaster plan ?
* What is triage system ?
* *Are these facilities for relative waiting ?*

IV. NURSING SERVICES

* Is progressive patient care practised ?
* Is there a school of nursing ?
* Total number of nurse in hospital ?
* Total number of ward in hospital ?
* Do nurses find representation in various committees ?
* What is the rate of turnover among nurses ?
* Are all nurses provided accommodation in hospital premises ?
* System of continuing Nursing Education.
* System of Nursing in ward.
* Do nurses provide health education to the patient ?
* Nurses record in ward.
* Is there Nursing audit system ?

V. MEDICO ADMINISTRATIVE SERVICES

MEDICAL RECORD DEPARTMENT

* Is there a Medical record department in your hospital ?
* If yes, then Number of staff in Medical Record Department.

List of equipment in Medical Record Department.

Retention period of the record.

Is statistical information compiled every month ?

Do the medical record officer help in medical audit ?

What action is taken in case of incomplete record ?

To what extent is mechanisation used in filling/retrieval ?

Any plans to introduce computer ?

MEDICO-SOCIAL DEPARTMENT

* Is there a medico-social service department ?
* Number of medico-social workers.
* Number of part-time workers.
* Important functions of medico-social service department.

DIETARY SERVICES

* Have you a therapeutic kitchen ?
* Number of Dieticians including Chief ?
* Do you run Nutrition Clinic ?
* Is the department engaged in catering ?
* Is there system of staff health check ?
* Is inventory of fire accidents etc. maintained ?

VI SUPPORTIVE SERVICES

PHARMACY

* Have you a hospital pharmacopoeia ?
* How many drugs are in pharmacopoeia ?

Are they by generic names or otherwise ?

* Number of meetings of pharmacopoeia Committee in a year.
* Total number of Pharmacists including Chief.
* Have you prepackaging unit ?
* Have you got crystalloid manufacturing unit ?
* Do you issue Pharmacy News Letter ?
* Is there a system of monitoring drug errors ?
* Is there a department of Hospital Pharmacy ?

RADIOLOGY DEPARTMENT INCLUDING IMAGING

* Number of X-ray technicians.
* Have you automatic film processing unit ?
* Number of Doctors in Radiology Department ?
* Do you maintain buffer stock of X-ray films ?
* How do you store medico-legal X-rays ?
* Is the X-ray room air conditioned ?
* Is there any preventive maintenance system ?
* What is the frequency of breakdown of X-ray machines ?
* How many X-ray machines you have ?
* How long a patient has to wait for :

  Plan X-rays

  Contrast X-rays
* Are all X-rays reported by radiologist ?
* What are the rules for the case of Pregnant Mothers ?
* Have you ultrasound ?
* Have you cat scan ?
* Is there a system of monitoring of accidents ?
* Have you a Radiation Monitoring Badge service for staff ?
* Do you follow Radiation Protection standard as laid down by BARC ?

RADIOTHERAPY DEPARTMENT

* Do you have a Radiotherapy Department ?
* Is it separate from Radio Diagnostic Department ?
* Number of medical staff.
* Number of non-medical staff.
* Type of equipment.
* Do you follow radiation protection standard laid down by BARC?

LABORATORY

* Have you a separate collection counter in OPD ?
* How many OPD samples are collected everyday ?
* List divisions of laboratory services.
* What system of quality control you have in laboratory ?

* Number of technical staff other than doctors in Laboratory ?
* Describe briefly the system of dispatch of laboratory reports.
* Have you a laboratory committee ?
* Does your laboratory help in hospital infection control surveillance?
* What procedure is following for dealing with chemical and bacteriological hazards ?
* Is service available round the clock ?
* What is the system of patient sample identification ?

C.S.S.D.

* Do you have a C.S.S.D. ?
* List of equipment in C.S.S.D. ?
* Describe briefly the system of sterility control.
* Number of autoclaves and their sizes.
* List of equipments other than autoclave.
* Have you a door delivery system ?
* Have you a separate counter for receipt and supply ?
* What is the percentage of disposable being used in your hospital ?
* How do you ensure that a given tray contain appropriate instruments?

BLOOD BANK

* Have you a Blood Bank ?
* Have you a Blood Bank Van ?
* What are the types of donors you get ?
* Does your blood bank perform Rh. and V. Hepatitis virus VDRL and AIDS test on all donors ?
* What is blood reaction rate ?
* Number of technical staff in blood bank.
* Is blood bank airconditioned ?
* Is blood storage refrigerator on standby generators ?
* What is the system of quality control in cross matching ?

MECHANICAL AND ENGINEERING SERVICES

HOSPITAL LAUNDRY

* Have you a Hospital Laundry ?
* Is it manual or mechanical ?
* Number of staff working in Laundry.
* What is the system of supply of linen ?
* Have you a Tailor in Laundry ?
* What is the system of maintenance of machines ?
* How do you ensure linen is sanitised ?
* Have you separate clean and dirty area in laundry ?
* How do you ensure staff safety ?

HOSPITAL WORKSHOP

* Have you a workshop ?
* Does the workshop undertake maintenance of all the patient, equipment ?
* What is the staff position in Workshop ?
* Enumerate the equipment in workshop ?
* How do you ensure staff safety ?

TRANSPORT SERVICES

* Total number of vehicles/road worthy.
* Do you have a black van ?
* Who controls Transport and Ambulance services ?
* What is the system of maintenance ?
* Is separate transport available for disabled ?

ENGINEERING SERVICES

* Have you the following :

  Civil Engineering Section

  Electrical Engineering Section

  Air Conditioning Section

  Horticulture Section
* Chief of Engineering Section report to the Medical Suprintendent.

* Is there good co-ordination between Chief of Engineering Department and Medical Suprintendent ?
* System of Checks to ensure uninterrupted water and electricity supply
* Do they carry out regular inspection of buildings and grounds ?
* Has the Department a disaster plan ?

HOUSE KEEPING SERVICES

* Number of house keeping staff.
* Number of supervisory staff.
* Degree of Automation.
* Training Programme, if any.
* Is there good team spirit among house keeping staff ?
* Are checks on effectiveness of disinfectant carried out ?
* Is there any incinerator available ?

UTILITY SERVICES

* The amount of water supply per day to hospital.
* Number of electricity units supplied per day.
* The amount of water supply bill paid by your hospital.
* Amount of electricity bill paid.
* System of garbage and infected material disposal.

COMMUNICATION SERVICES

* Telephones.
* Inter-com connections.
* Public Address system.
* Paging System.
* Any others.
* Role in disaster plan of Hospital.

MORTUARY SERVICES

* Have you mortuary service in the hospital ?
* Do you perform post-martens (PM) ?

* Number of medico-legal PM performed.
* Number of non-medico legal PM performed.

MEDICAL STORES

* Have you a separate Medical Store for your hospital ?
* Is its location satisfactory ?
* Are the orders initiated in time and supplies received in time
* Is there proper inventory control ?
* Are you well informed about stock outs ?

HOSPITAL LIBRARY

* Have you a hospital library ?
* Number of medical books ?
* Number of other books.

HOSPITAL CANTEEN

* Have you a hospital canteen ?
* To whom canteen serves ?
* Who manages the canteen ?

HOSPITAL ADMINISTRATION

* Do you have a hospital administration department ?
* Do you have a full time Medical Suprintendent ?
* Number of staff in Hospital Administration.
* Are staff of 2 and 3 professionally qualified in Hospital Management/Health Administration ?
* Total amount of hospital budget :
  Plan Budget.
  Non-Plan Budget.
  Capital/Revenue Budget.
* System of Financial Management and Audit.
* System of Material Management.
* System of Personnel Management.

* Are there personnel policies ?
* Security and Fire Fighting arrangements
* Does your department conduct Operation Research Project ?
* Have you a Committee spectrum of management ?
* List important committees functioning in your hospital
* Do you conduct patients satisfactions studios ?
* What system do you follow for management of complaints ?
* Do you provide teaching and training facilities to other than medical students ?

MISCELLANEOUS

* Does your hospital have some common room with Radio, TV etc.?
* Does your hospital get daily newspaper, magazines etc. ?
* Does your hospital accepts gifts and donations ?
* Does your hospital organize some social functions ?
* What activities are being done for Rehabilitation of patients if required?
* Have you got a Dharmashala attached to your hospital ?

ACTIVITIES	AREA IN SQ MT MINIMUM ONE SIDE DIMENTION	INTERNAL FINISHES								REMARKS
		WALLS	FLOORING	CEILING	DOORS	WINDOWS	MONGARY	INTERAL GLAZING	HATCH WINDOW	

DEPARTMENT –

S1

AIR CONDITIONING								AIR PRESSURE RELATIVE TO ADJOINING SPACE	HEATING	EVOPARATIVE COOLING	SERVICES					WASTE				REMARKS
AIR TEMPERATURE WINTER	AIR TEMPERATURE SUMMER	AIR CHANGES		RATE OF AIR CHANGES	AIR HUMIDITY WINTER	AIR HUMIDITY SUMMER	AIR FILTRATION				SINK	HOT WATER	COLD WATER	DISTILLED WATER	GAS	SOLID	LIQUID	GASEOUS	RADIO ACTIVE	
		NATURAL	MECH																	

DEPARTMENT –

F1

ACTIVITIES	NO OF USERS	EQUIPMENT	FURNITURE	STAFFING PATTERN	CASE LOAD BEING REFERRED FROM OTHER DEPARTMENT	REMARKS

ROOM REQUIREMENTS

DEPTT :

ROOM

CODE

4

FURNISHINGS

FURNITURE

EQUIPMENTS

ENGINEERING

H V A C

P L U M B I N G

E L E C T R I C A L

COMMUNICATION

ARCHITECTURE

F L O O R

C E I L I N G

W A L L S

DOORS/WINDOWS

A C O U S T I C S

RELATIONSHIPS

P R I M A R Y

S E C O N D A R Y

C O M M E N T S

OCCUPANCY

DIMENSIONS

N' REQUIRED

EXISTING AREA

OTHER

R E M A R K S

ANNEXURE 5.5

BUILDING EVALUATION - 1

Constr., Fire Safety, Htg & Cooling, Elec (Note Treat each building and additional

Hospital ______________________ Number ______________________

separately.)

Building (Name or Identification Code) ______________________

Date Built ____________ Ground Coverage (Sq Ft) ____________ No of Floors ____________ Total Area (Sqft) ____________

1. Form 6a evaluates each building separately
2. Fill out one of these forms for each building
3. Priority - Column P - as architects determine

Building Elements to be Evaluated	% Satisfactory					Description	Improvement Costs with Priority			
	0	25	50	75	100		Quant	@	Rs. Est. Costs	P
CONSTRUCTION										
Foundation										
Structural frame										
Exterior walls										
Floors										
Roof										
Fire Resistance										
FIRE SAFETY										
Exits, Stair										
Towers, etc.										
Enclosure										
Location										
Number										
Fire Walls										
Vertical Shafts										
Doors, Transoms										
Interior Finishes										
Other Hazards										
HEATING & COOLING										
Boilers-Controls										
Boiler Feed System										
Heating System										
Cent. Cool, Plant										
Incinerators										
ELECTRICAL										
Comply NEC										
Transformers										
Main Switchboard										
Main Feeders & Panels										
Fire Alarm Detection										
Emergency Power										

Cost Sub-totals

Form 6a

Hospital ______________ Location ______________

Total Existing Beds ______________ Future ______________

NURSING

Nursing Bldg ______________

Floor(s) ______________

PRESENT FACILITY

Total Existing Floor Area (Sq.Ft.) ______________

Total Recommended Floor Area (Sq.Ft.) ______________

Existing Floor Area per bed (Sq.Ft.) ______________

Recommended Floor Area per bed (Sq.Ft.) ______________

Dept. Elements to be evaluated	% Satisfactory				REMARKS	Improvement Costs, with priorities							
	25	50	75	100		Quant.	@	New Rs. Space	P	Rs. Alter.	P	Rs. Mod	P
DEPARTMENTAL													
Space													
Arrangement													
Location													
Finishes													
Plumb.-htg. fix.													
Electric fix.													
Air Cond. Exist.													
Air Cond. New													
Total Costs													

Elements	% Satisfactory				Est. Costs to Improve			
					REMARKS	Quant.	@	Total
Patient Rooms No.	25	50	75	100				
Single								
Double								
3-4 Beds								
Over 4								
w/o lav.								
w/toilet								
Nurse Sta.								
Nurse Rest								
Doctor's Dict. Conf.								
Visitors-Day Room								
Treatment								
Clean Utility								
Soiled Utility								
Cent. Toilet Bath								
Floor Pantry								
Linen								
Janitor								
Storage								

GROSS AREA ALLOCATION SUMMARY

Hospital: ______________________ Number ______________

Department	Measured Gross Area, Sq Ft 1	Evaluating A: Adjusting Building Floor Area to Fit Existing Bed Complement				Bed Capacity for Existing Area 6
		Desired Area				
		Area Bed (____ Beds) 2A	Per Bed 3A	Gr. Area 4A	+ or - in Gr. Area 5A	
1. Nursing Services						
a. Bed Units (Incl. Nursery)						
b. Operating Suite						
c. Delivery Suite						
d. Emergency						
2. Adjunct Facilities						
a. Labs. & Morgue						
b. Radiology						
c. Phys. & Occ. Therapy						
d. Pharmacy						
3. Service Departments						
a. Dietary						
b. Housekeeping						
c. Laundary						
d. Central Sterile Supply						
e. Central General Stores						
f. Employee Facilities						
g. Shops & Mech. Equipmnt						
h. Power Plant						
4. Adminstration						
a. Offices						
b. Medical Records						
c. Public Space						
d. Volunteers' Space						
5. Other Spaces						
a.						
b.						
c.						

DEPARTMENTAL GROSS AREA TABULATION BY FLOORS

(In Square Feet)

Hospital ______________________ Number ______________ Date Constructed ______________

Building ______________________

1. Fill out a sheet like this for each separate building or section of different age Summarize of Form 3.
2. Gross areas include exterior walls, columns, shefts, and portions of corridors, stairs, elevators, etc.

DEPARTMENT	Sub-basement	Ground	1st	2nd	3rd	4th	5th	6th	Total
1. NURSING SERVICES									
a. Bed units (incl nursery)									
b. Operating suite									
c. Delivery suite									
d. Emergency									
2. ADJUNCT FACILITIES									
a. Labs. & Morgue									
b. Radiology									
c. Phys. & Occup. Therapy									
d. Pharmacy									
3. SERVICE DEPARTMENTS									
a. Dietary									
b. Housekeeping									
c. Laundary									
d. Central Sterile Supply									
e. Central General Stores									
f. Employee Facilities									
g. Shops & Mech. Equip. Area									
h. Power Plant									
4. ADMINISTRATION									
a. Offices									
b. Medical Records									
c. Public Space									
d. Volunteers' Space									
5. OTHER SPACES									
a.									
b.									
c.									
d.									
e.									

Hospital ______________________ Number ______________________

Year Built or Year of Major Renovation*	(For planning agency use. Do not fill in this column.)	Building or Section of Building	Total Sq.Ft. That Date from the Year Shown	(For planning agency use: Do not fill in this column.)

* What is wanted is the effective age of the various sections of the hospital. In most cases the facilities will date from the time of construction, but in cases where a major renovation has completely updated a section of the facilities, that more recent date would be more appropriate. For projects now under contract, the estimated date of completion of the contract should be used.

TOTAL SQ. FT.
(same as on Form 2)

Form 2b

SPACE CRITERIA FOR HOSPITAL EVALUATION
(In Gross Square Feet per Bed)

Departments	100 Beds	200 Beds	300 Beds	400 Beds
1. Nursing Services	362-439	356-432	351-427	355-441
a. Bed Units(Incl. Nurses)	290-350	290-350	290-350	300-370
b. Operating Suite	44-54	41-51	39-49	36-46
c. Delivery Suite	18-20	16-18	14-16	12-14
d. Emergency	10-15	9-13	8-12	7-11
2. Adjunct Facilities	60-81	57-74	52-72	48-67
a. Labs & Morgue	22-28	21-27	20-26	20-26
b. Radiology	24-32	24-30	22-28	21-27
c. Phys. & Occup. Therapy	8-12	7-10	8-12	7-11
d. Pharmacy	6-9	6-8	5-8	4-7
3. Service Departments	164-199	151-183	140-168	130-157
a. Dietary	45-50	42-47	39-44	36-41
b. Housekeeping	4-7	4-5	3-4	2-3
c. Laundary	15-17	12-14	12-14	11-13
d. Central Sterile Stores	10-13	9-12	8-11	7-10
e. Central Gen Stores	25-35	25-35	24-32	23-30
f. Employee Facilities	13-17	12-15	10-12	9-11
g. Shops & Mech. Equip.	52-60	47-55	44-51	42-49
4. Administration	60-70	55-65	52-63	48-59
a. Offices	34-39	31-36	30-36	29-35
b. Medical Records	10-11	10-11	9-10	8-9
c. Public Space	8-10	7-9	7-9	6-8
d. Volunteers' Space	8-10	7-9	6-8	5-7
TOTAL HOSPITAL	646-789	620-755	598-732	585-728
5. Out Patient Department	0-40	0-45	0-50	0-60

Explanatory Notes :

Figures given represent square foot gross floor area per bed, including partitions and exterior walls, plus all general and circulation area in each department. High and low figures shall not be construed as fixed limits but may be exceeded if local judgement so indicates.

Educational andi residential areas are not listed. Where program of individual hospital includes teaching and living quarters for staff, space for these functions must be added to conform to specific requirements.

Form 4

ANNEXURE 5.6

ACTIVITY DATA METHOD

One of the most difficult tasks in the building process is to provide the designer with a clear and comprehensive statement of the user's requirements. At present the most common form for recording requirements is a schedule of rooms with details of the furniture and fittings for each room. But the designer needs to know a great deal more before he can design a building. He will need information on the activities to be carried on in the various rooms and on the way in which these activities are interrelated--to name only two of the many points he will be expected to take into consideration. Normally he collects this information in a haphazard way as the design stage proceeds, committing it to memory or scribbling it on scraps of paper. In these circumstances even the most conscientious and confident designer may overlook a number of details which will give cause for complaint when the building is finally occupied.

The purpose of **Activity Data Method** (A.D.M.) is to provide the designer with as complete a statements as possible of his client's requirements before the design state is reached. Instead of assuming a schedule of rooms which may presuppose a design solution. A.D.M aims to be more fundamental and to record the activities which are to take place in the building. It does this by means of standard diagrams and data sheets. which form a compact document for use by all members of the design team.. The document can be revised easily and further information added where necessary.

...ry of Public Building & Works.

...ment, London.

THE ACTIVITY AS A BASIS FOR DESIGN

The basic units used to record information in A.D.M. are the activities which are to take place in the building. It is left to the designer to accommodate these activities in the building, and to decide what arrangement of rooms or space will provide the best solution within the sum the client is prepared to pay. This means that the designer does not manipulate rooms, such as a kitchen or larder instead he manipulates activities, such as the preparation of meal, the washing up of dishes or the storing of food.

How much can an activity embrace if it is to form a useful basis for design? At present it is difficult to give a perfect definition in theoretical terms. It is easier to take a practical example and to move from extremes towards the mean. Living is an activity. So is beating an egg. But the knowledge that both these activities are to be performed in a kitchen will not assist anyone to design it. One is too general, the other too particular. Clearly some mean between these two extremes is required. In this particular instance perhaps "preparation of meals" would be the most useful activity for design purpose.

These categories may change as development proceeds. But at present they seem to offer a good working basis for the method. Although they may be difficult to define in theory they are prooving simple to identify in practice. A primary activity may, like an elephant, be hard to describe, but so far clients and designers have founded it easy to recognise one when they see it.

Listing activities.

The first step in the use of A.D.M. is to compile a complete list of the activities to be accommodated in the building. The briefs so far prepared using A.D.M. have been for buildings to house organisations already in existence. These organisations have a formalised structure which is the result of much management experience and has been set down in chart form. In such cases, once the purpose of the organisation and its method of working are understood, it is relatively easy to draw up from the organisation chart a list of activities.

When there is no formal organisation to be accommodated, an alternative method of listing activities must be found. One method might be to examine the main processes to be accommodated. For example, in listing the activities for a swimming pool, the following processes come to mind immediately: paying the entrance fee, changing into a swimming costume, storing normal clothes, taking a shower before swimming, and then swimming. The processes after swimming would be similar but in reverse. This method would give the main activities which take place, but it would be easy to add others which the client thought necessary - for example, the viewing of swimming by spectators, the sale of light refreshments and the clerical work required in running the swimming pool. Whatever the method used, the result must be a list of activities. (also Ref. Table in Chapter V 5.17.2)

WHEN AN ACTIVITY IS NOT AN ACTIVITY

As has been explained above, it is desirable, if not essential, in the present development of A.D.M. to differentiate between **primary** and **secondary** activities. There are, however, a number of other factors which might seem at first sight to be **activities** in their own right but which it would be unwise to regard as such. These are factors such as movement or building maintenance which are entirely, or almost entirely, determined by the design solution. For example, although one can record the unloading of goods from a lorry and the storage of these goods, it would be unwise to record the carrying of these goods from the place where they are unloaded to the place where they are stored, because this activity depends on how the building is to be planned. If in the final design the place of unloading and the place of storage are close together, it may be possible for the men handling the goods to carry them straight to their place of storage. But if it is necessary to carry the goods some distance, it may be necessary to use mechanical handling equipment or to introduce a chute or a lift to handle the goods. In each case the nature of the activity is different and therefore to record any one of the alternatives would be to presuppose a particular design solution. Again, although the client will obviously expect his building to be capable of easy maintenance, the assessment of the need for maintenance, the way in which it is to be carried out and the space required to store maintenance equipment will all depend entirely on the design solution produced to cater adequately for the client's primary and secondary activities.

WHAT TO RECORD ABOUT ACTIVITIES

Once the scope of the activity has been settled, it is necessary to decide exactly what to record about it for the purpose of design. Much time can be wasted discussing topics which have no direct effect on the design of a building. For instance, in the case of an activity such as administration the responsibilities undertaken by the administrator, or the day-to-day decisions he makes, can be recorded in great detail, but this information does not help the designer to design an environment in which the administrator can work. He really needs to know that the administrator works at a desk, interviews his staff or visitors and stores documents in a filing cabinet. He can then provide sufficient space for the activity, an appropriate layout of furniture and satisfactory conditions.

The information the designer needs about an activity is provided by A.D.M. in two forms. First, information about the activity itself is recorded on an **Activity Data Sheet**. This describes what happens, when it happens and what people and things are involved. It describes the characteristics of the activity-for example whether fumes or noise are produced. It specifies the conditions that are required, such as warmth, silence or light, and the services that are needed, such as electric power an a supply of hot water.

Secondly, information about the relationship between activities is shown on a Link Analysis diagram. This information is intended to guide the planning of the building.

ACTIVITY DATA SHEETS (Ref. Annexure 5.4 & 5.6)

The Activity Data Sheets comprise the greater part of an A.D.M. statement of requirements and take most time to prepare. These sheets are divided into two sections. The left-hand side of the sheet describes the activity and enumerates the people and things concerned and illustrates the various amounts of space they require. The right hand side describes the quality of the space required for the activity.

Before an activity is recorded on a Data Sheet, it must declare exactly what is done, when it is done, who does it and how it is done. If the activity is already performed in a satisfactory way it is a simple matter to record by observation. But more often some expert, such as a manager or a man with experience of the activity, will be needed to describe exactly how the activity should be performed. When appropriate, a work study man can be asked to investigate the activity and propose the best way of doing it.

Normally it is best for the designer to fill in the Activity Data Sheets. Once draft copies are available the users are asked for their comments. The users who have so far had experience on them have found them easy to understand, and their comments will ensure that the information is correct. It has been found that after some experience of A.D.M. users can themselves complete most of the Data Sheets. This means that when a brief is being prepared for a large project or when there is a large building programmed, a team from the user organisation can work with the designer in recording user requirements.

LINK ANALYSIS

The Link Analysis is a diagram in which activities are shown by circles and the relationships between the activities by lines linking the circles. A sample diagram is shown in Fig. 5.10 The relationships recorded in the example are based on the potential movements of people and things. If a person or an object is involved in first one activity and then another a link is drawn between the two activities concerned. If the two are then planned apart, the person or object involved in both will have to move from one to the other. If necessary, arrows can be drawn on the links showing the direction of this movement.

Each link should be given a value or loading . The simplest method of expressing this is in terms of importance. The example shows only two degrees of importance (vital and important links), but in other cases more could be introduced. If the link is a vital one then the two activities should be planned next to each other; if the link is rated as important then the activities should be near to each other if not next to each other. Another way of giving a value to a link is to express it in quantitative terms such as the frequency of movement multiplied by the cost of movement. But so far this measurement has not been used as the measurement of frequency and cost of movement requires more time than has been available to the research team.

To draw a Link Analysis it is best to begin with the most important activities. For a storage depot, drawing began with the storage activities, and for a workshop, with the main repair activities. Some care is necessary to avoid recording too many links. It is not difficult to imagine links between any activity and nearly all the others, but too many links will slow up the design process.

It is essential that Link Analysis is prepared jointly by the designer and the representatives of the user. The team which prepared the first two briefs using A.D.M was made up of an architect and two work study men belonging to the user organisation. The architect drew the links, and the work study men made an assessment of their importance.

It is possible that a Link Analysis may not prove to be the best means of expressing relationships between activities. So far it has been preferred to other methods, such as an association chart, on the grounds that it makes a bigger visual impact and can therefore be understood more easily. Its main practical disadvantage- the difficulty of laying it out-has the corresponding virtue that it forces the compiler to omit all but the most important links and thus to present a more striking, if less comprehensive, picture that an association chart. Nevertheless efforts will be made as development proceeds to provide an improved method of presentation.

THE COMPLETE DOCUMENT

In addition to the List of activities, the Activity Data Sheets and the Link Analysis, a general description of the organisation is compiled, giving its purpose and the way in which it operates and setting out other relevant data about the organisation, such as the number of staff employed and their hours of work. The complete Statement of Requirements then consists of :

General Description of the Organisation

List of activities

Activity Data Sheets

Link Analysis

ANNEXURE 5.6 (CONT.)

	activity space data sheet	OPD 27
ORIGIN D.H.S.S.	ISSUE NO: 3	DATE JAN. 1977

DEPARTMENT: OUT PATIENTS

ACTIVITY SPACE NAME: AUDIOLOGY ROOM

ACTIVITY UNIT SELECTION	Qty	Description	Code
	1	AUDIOLOGY sound proofed test room	A32N90
	1	CLINICAL MEASUREMENT, Audiology Equipment	A32N135
	1	PREPARATION STORAGE, cupboard 800x1200x500mm, lockable with worktop	BO5CF
	1	ADMINISTRATION, desk single pedestal, chair, telephone and socket outlet	B14AY
	1	HOOK, hat and coat, two	CO3CB
	1	CHAIR, stacking	CO4CA
	1	SHELF, 1200x500mm	C33ED
	4	SHELF, 2100x300mm	C33HB
	3	UPRIGHTS	C33JB
	3	UPRIGHTS	C33JF

FUNCTIONAL DESIGN REQUIREMENTS

FACILITIES needed for the following activities

(i) Patient who may be ambulant or in a wheelchair to be interviewed in lobby prior to being taken into the Audiology Chamber for examination.

(ii) The Technician to conduct the tests standing at the worktop located in front of an observation window in the wall of the Audiology Chamber with low ambient noise levels.

(iii) Patient to wait comfortably within the Audiology Chamber for:

- a) Pure tone audiometry
- b) Speech audiometry
- c) Acoustic impedance test

(iv) Secure storage for test equipment etc.

(v) Administrative work.

(vi) Coat hanging.

PERSONNEL

1 patient, 1 or 2 others

ADDITIONAL EQUIPMENT OR ENGINEERING TERMINALS not associated with a specific activity unit

Microphone/loudspeaker system with engineering terminals. See Design Guide

Spur BESA box, 150mm insulated cover, with 25mm PVC conduit to Audiology sound proofed test room for extra signals cables

"In use indicator"

Fire alarm indicator buzzer and/or visual signal

2 No. Silenced transfer ducts in wall to corridor

PLANNING RELATIONSHIP

Within outpatient area

TECHNICAL DESIGN DATA OPD 27

SPACE REQUIREMENTS			SPACE LOCATION GENERAL	SPACE LOCATION INTERNAL	NOTES
	Air temperature	Winter		18°C	Reverberation time 0.2 to 0.25 secs.
	Air changes	Natural or mechanical		MECH	
	Air changes	Natural or mechanical		10/HR	C
☆	Air temperature	Summer		25°C	
	Air humidity	Summer		-	
	Air humidity	Winter		-	
	Air filtration			-	
	Air pressure	(relative to adjoining space)		POSITIVE	
LIGHTING	Lighting intensity	General		200 lux	
	Lighting intensity	Night		-	
	Lighting intensity	Local		-	
	Lighting intensity	Emergency		GRADE B	H
☆	Glare index			-	
	Colour rendering			TUNGSTEN	
SAFETY	Maximum accessible hot surface temperature		-		
	Maximum domestic hot water supply temperature		-		
NOISE	Acceptable level of noise from outside		LOW		
	Total acceptable sound level within space	Not to exceed	50 dB(A) (Vent Operating)		Acceptable frequency spectrum attached
☆	Description of noise which cannot be tolerated within space		no predominant frequencies		
	% of time acceptable sound levels can be exceeded				

NOTE ☆ Absolute control of these conditions cannot be attained except by the use of costly and complex engineering systems. Values should only be put against these conditions where they are essential to room function as defined in and in accordance with Departmental Guidance.

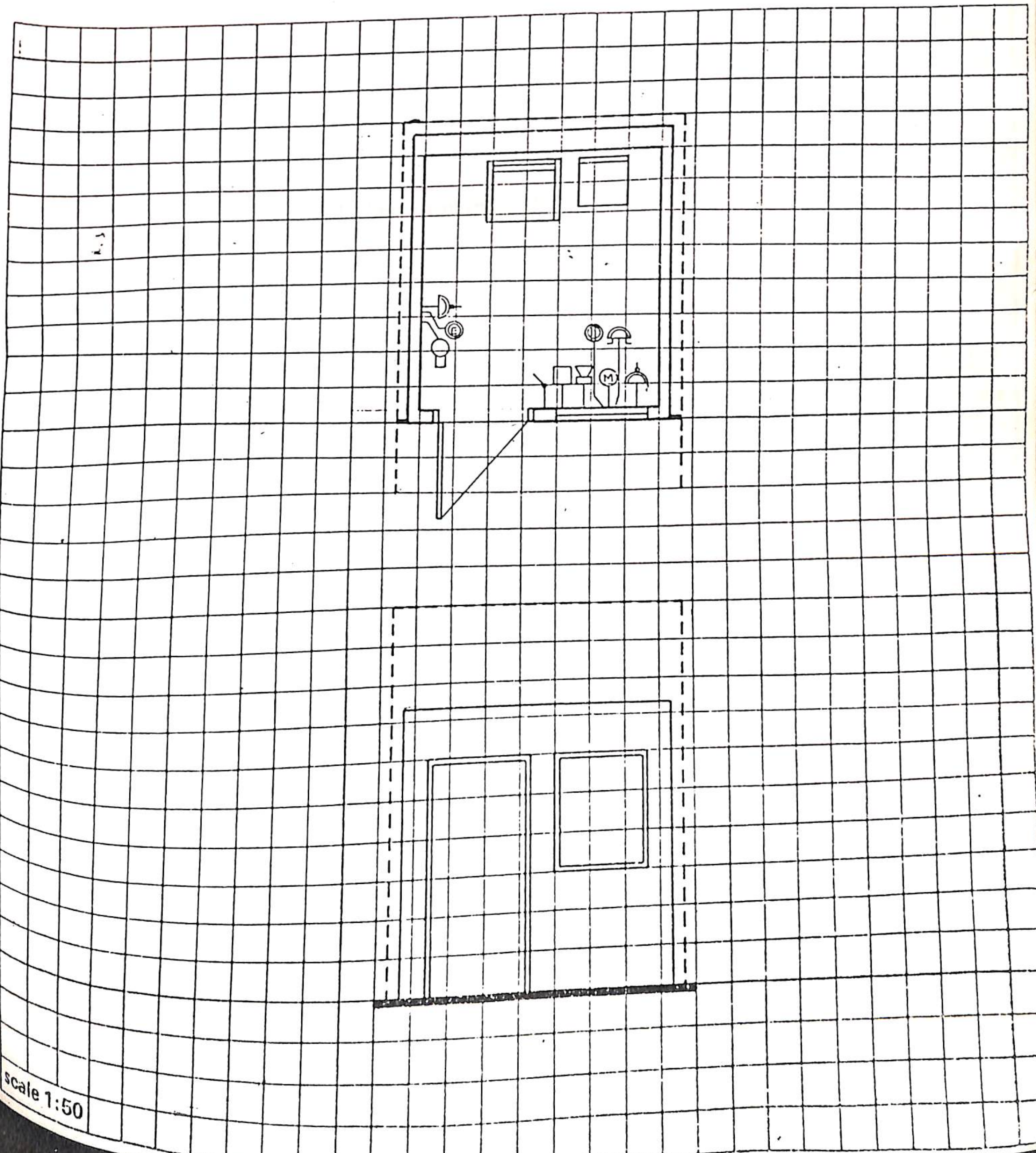
DESIGN CHARACTER

INTERNAL FINISHES	WALLS	FLOOR	CEILING
GRADE	F (Acoustic Treatment)	F (Carpet required)	C (Acoustic Treatment)
SURFACE REFLECTIVITY			

DOORS	900mm leaf, single swing, sealed for sound attenuation, ½ HFR
IRONMONGERY	Butts, mortice latch lock, lever handles, single action closer, buffer plates, kick plates With suitable safety escape mechanism to lock mechanism
WINDOWS	N/A
INTERNAL GLAZING AND METHOD OF OBSCURING	Clear glass from Audiology Chamber, double glazed
HATCH	N/A

nucleus	activity unit data sheet	
ACTIVITY UNIT TITLE	AUDIOLOGY sound proofed test room	A32N90

Activities: Diagnosis of deafness and the assessment of the degree of hearing loss in patients of all ages. The patient will be either ambulant, with or without walking aid or in a wheelchair.

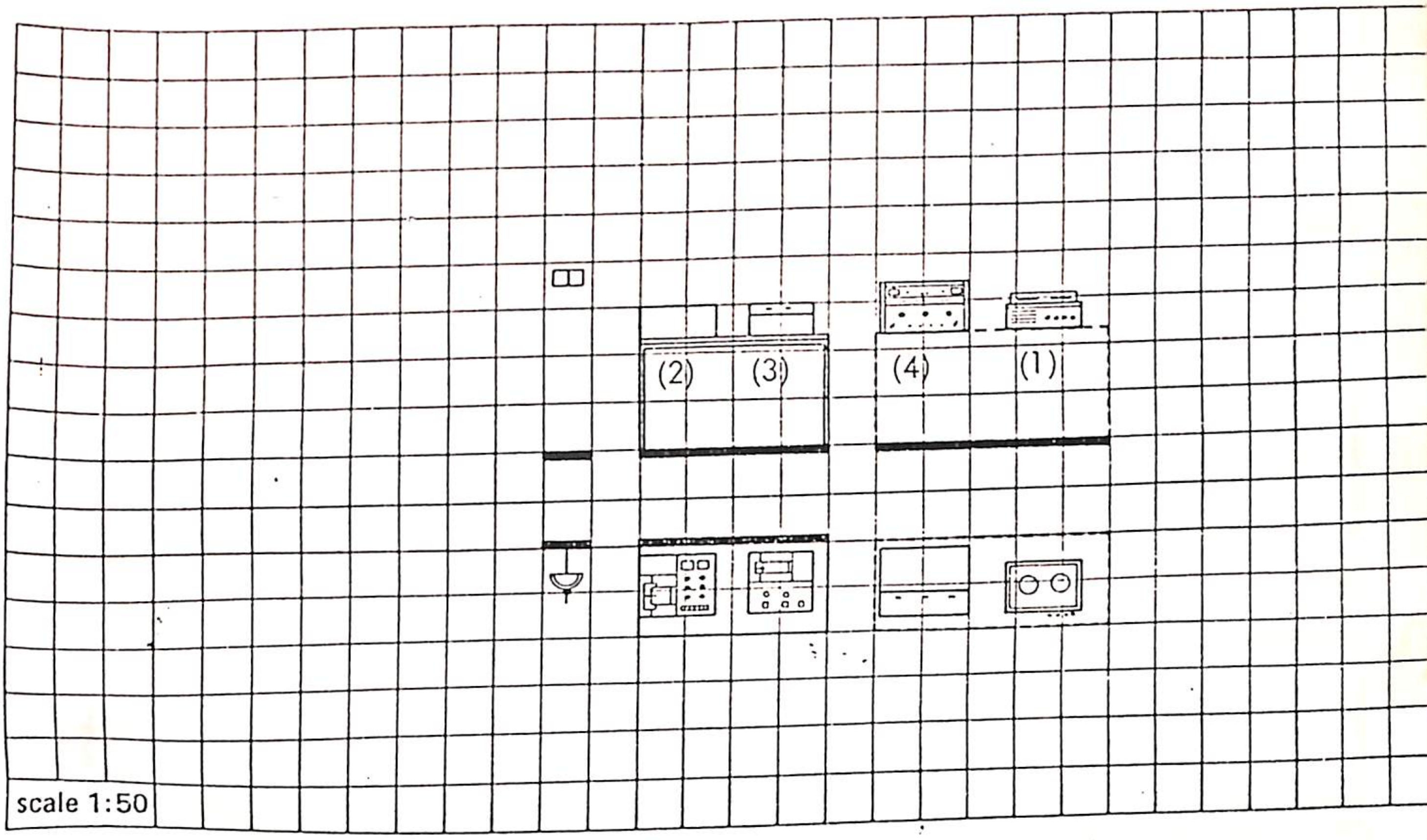


scale 1:50

Group	Item	Qty	Size mm	Notes
1	Specialist sound proofed Audiology test room (The noise level within the test room during use with ventilation system operating must not exceed 30dB'A' and that of the adjacent lobby 50dB'A'. Supply air is to be provided from the main hospital plant to give 10 Air changes per hour. Extract will take place naturally via purpose made panel in the end wall of the modular test room, and then to the adjacent corridor via a silenced transfer duct fitted in the outer wall. Supply and transfer duct silences to be provided by specialist test room manufacturer. Winter temperature to be 18°C. Lighting level to be 200 Lux NOTE: This test room is for use within a larger room constructed as a monolithic brick box having a concrete roof slab, no services passing through it, and acoustic doors etc. Surrounding areas are to be carpeted. Services entering the space must be sealed.	1	2100x2400x 2100	Audiology test room floor level to be the same as Audiology lobby, to allow easy access by wheel-chairs There must be a 100mm space between test room and surrounding lobby, and the space must be sealed from the lobby by the test room manufacturer
	Socket outlet: 13A, switched double	2		
	Fire alarm bell	1		
	Fire alarm, visual signal labelled 'Fire Alarm'	1		
	Spur Box BESA 150mm, insulated cover with 25mm PVC conduit	1		
	Microphone/Loud speaker system to Audiology lobby	1		
3	Light switch	1		
	Chair stacking	1		
	Chair semi easy high back	1		

nucleus	activity unit data sheet	
ACTIVITY UNIT TITLE	CLINICAL MEASUREMENT Audiology equipment	A32N135

Activities: Testing and recording the middle ear function. Diagnostic Audiometry by Bekesy procedure. Testing and recording air, bone and speech measurements with narrow band, white noise and Synchronous Masking.



Group	Item	Qty	Size	Notes
			mm	
1	Socket outlet, 13A, switched double	1		
3	Table 710x1200x600mm	1		
	Recorder tape	1		1
	Meter Impedance	1	406x508x190	2
	Bekesy Accessory	1	406x406x190 tapering to 115mm	3
	Audiometer	1	585x450x320	4

ANNEXURE 6.1

Outpatient accommodation requirements

(E.N.T DEPARTMENT)

GENERAL

17. The E.N.T. out-patient unit at district general hospitals should consist of the following functional elements:

E.N.T. clinic

audiology suite

hearing aid centre

office and other supporting accommodation.

A suggested functional relationship is shown in Figure 1. This is a department where wheelchairs may be used extensively and, where appropriate, doors should be sized accordingly.

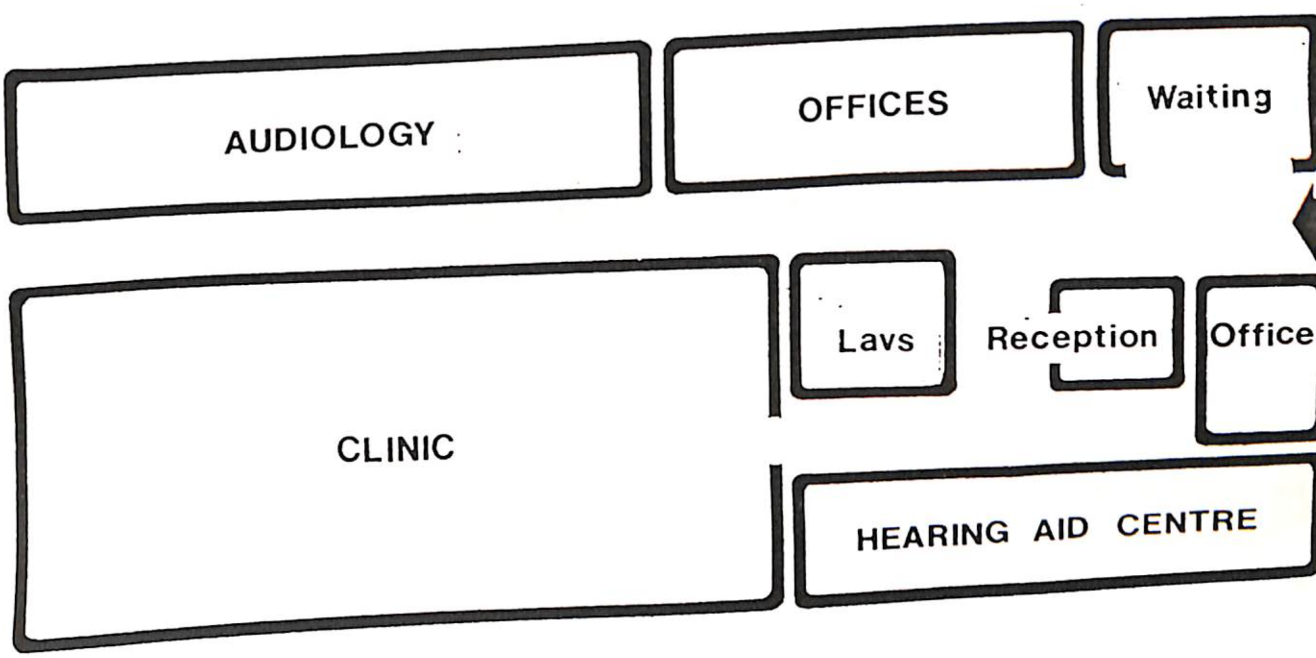


Figure I

Entrance and reception

18. The entrance to the unit should be adjacent to or should be shared with that of the main out-patient department. It should lead directly to the unit reception area serving patients who will be attending clinics in any of the functional elements indicated in the previous paragraph. Some of the patients will have to communicate name, address, age and family particulars in writing and the design of the reception desk or counter

waiting space, consulting/examination rooms and the treatment area. Figure 2 illustrates a suitable layout and if possible the whole department should be planned to ensure that this suite will not be used as a short cut to other elements in the department.

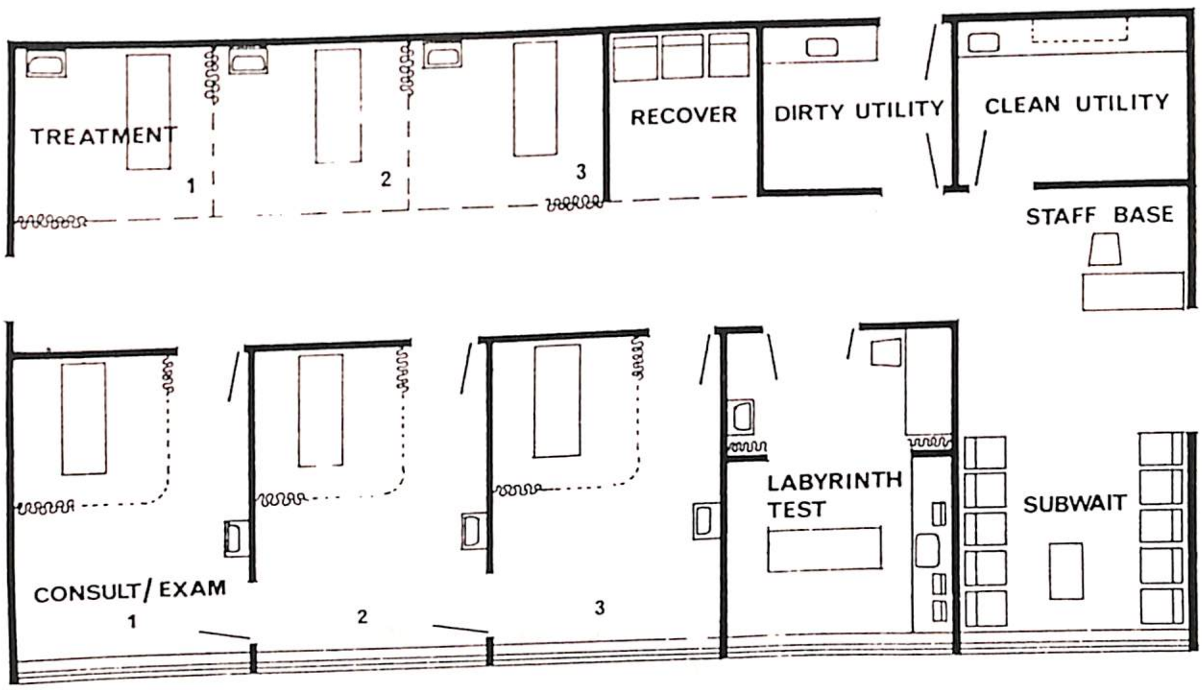


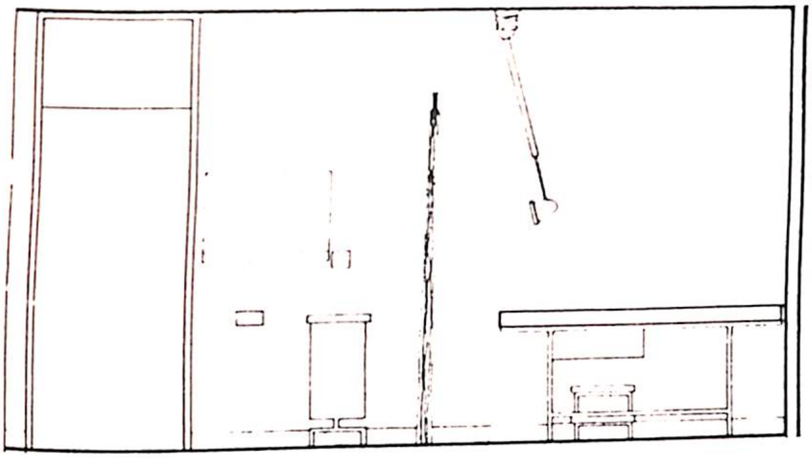
Figure 2

Sub-waiting space

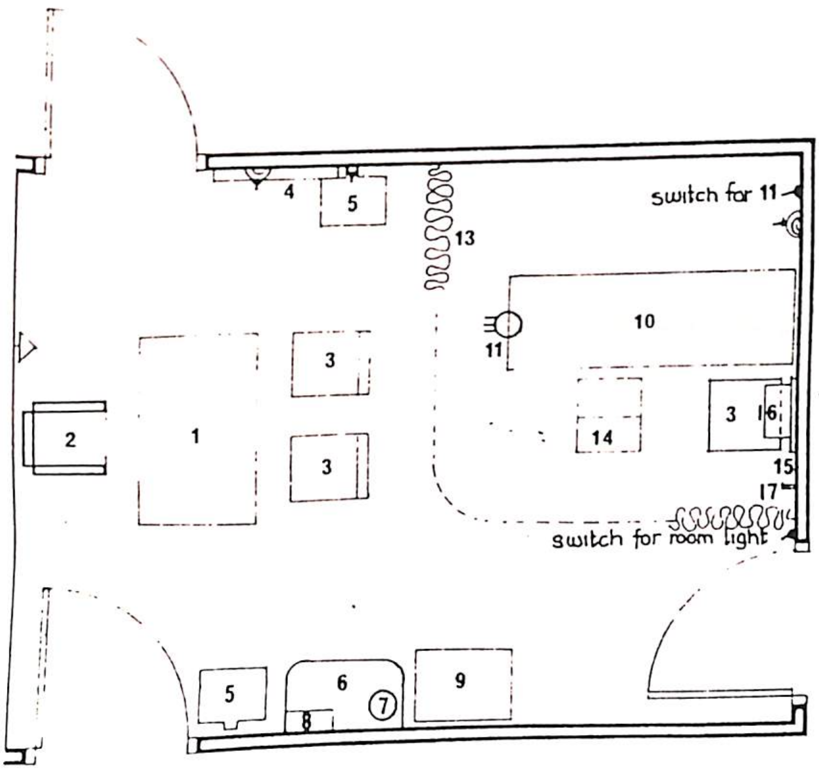
23. A sub-waiting space adjacent to the consulting/examination rooms is needed to facilitate clinic management. This area will serve not only patients waiting to see the doctor but also those already seen and awaiting further attention, those returning from, say, audiometry or X-ray and occasionally those returning for routine treatment who do not need to be seen by the doctor.

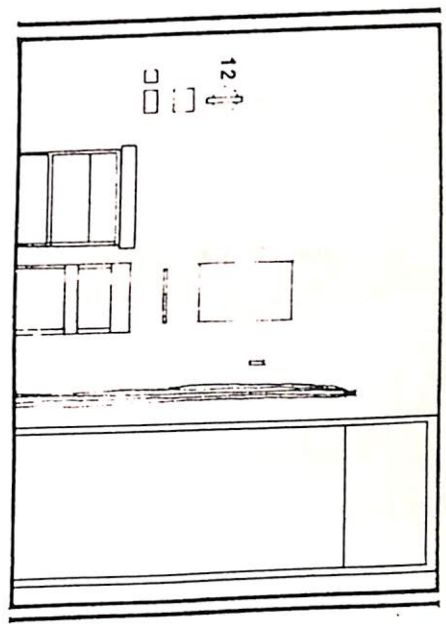
Consulting/examination rooms

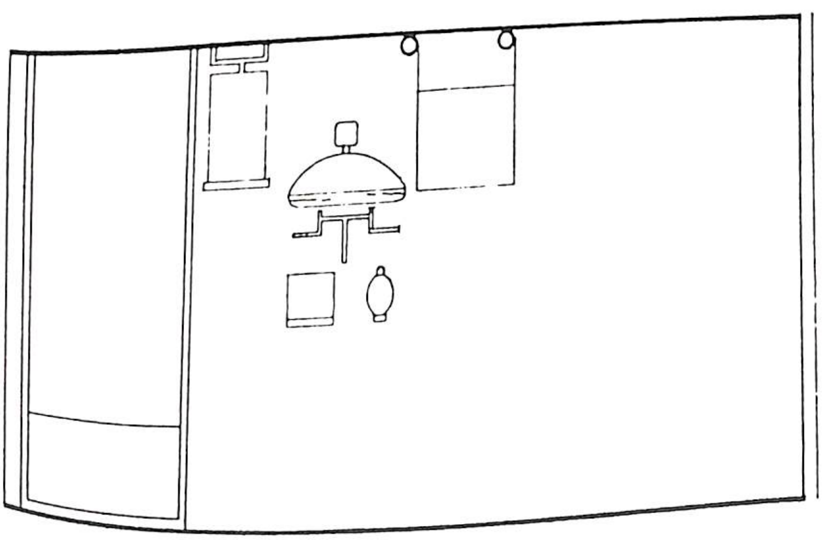
24. Although there will be only an occasional need for an E.N.T. patient to undress or be examined lying down, the rooms should be designed identical to those of the main out-patient department with a couch within a curtained area. Appendix 2 shows a suitable arrangement. This will enable them to b used at appropriate times for any other speciality. They should be planned on an external wall with natural light and ventilation but should be capabl of being blacked out. About 6 doctor-sessions or 12 room-sessions per 100,000 of the population per week are likely to be required to handle the



1 Consultants desk
2 Consultants chair
3 Upright chair
4 Double X ray viewer
5 Paper sack holder
6 Clinical hand washing basin
7 Soap dispenser
8 Paper towel dispenser
9 Treatment trolley



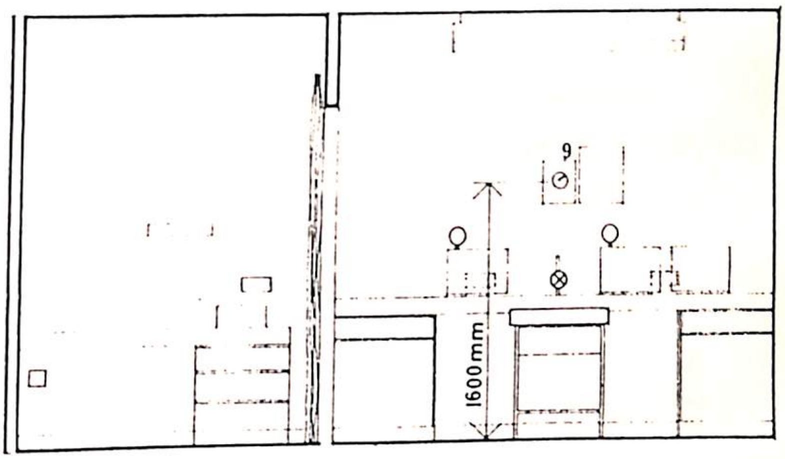


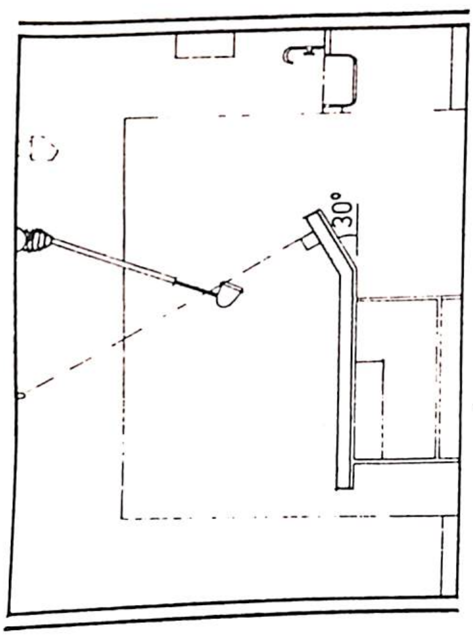


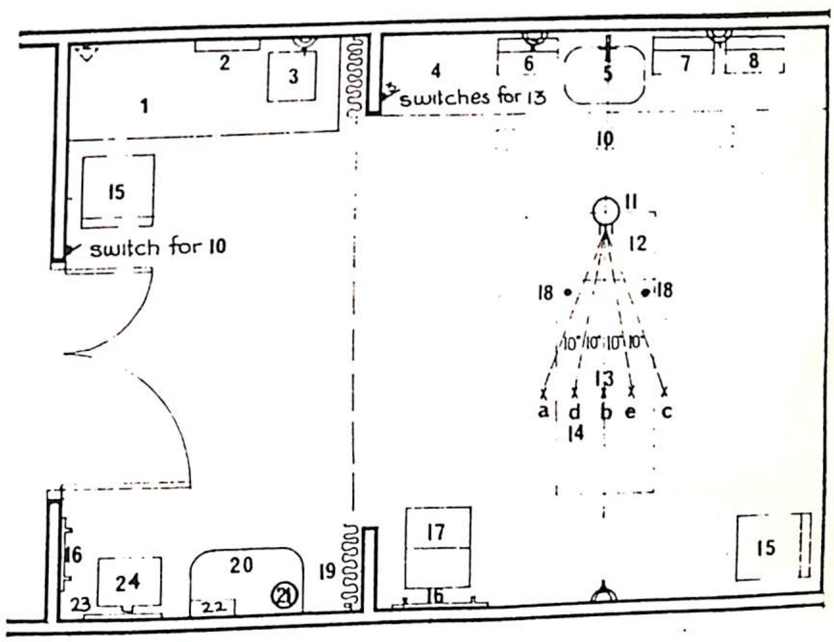
10 Examination-couch with couch cover dispenser
11 Ceiling mounted exam light
12 Sphygmamonometer wall-mounted
13 Cubicle curtain track & 2 curtains
14 Couch steps
15 Mirror
16 Shelf below 15
17 Coat hook

Consulting / examination room

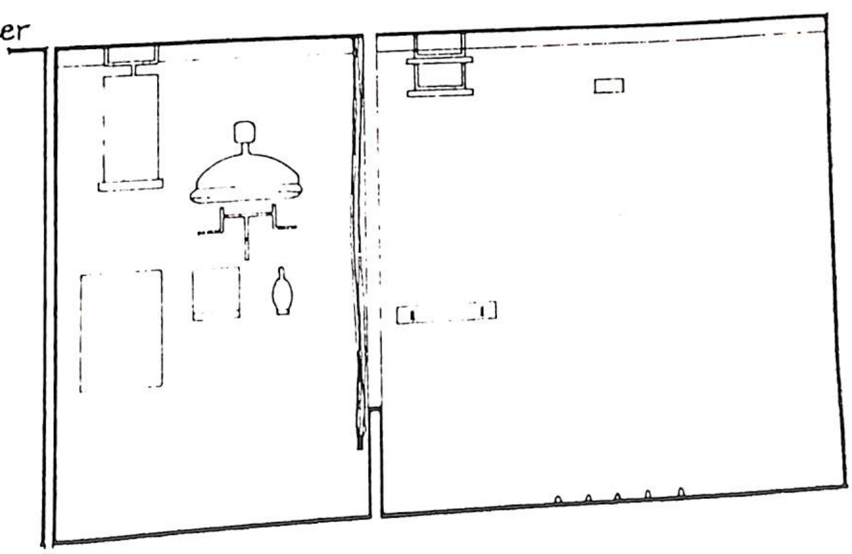
1 Desk with drawers
2 Wall light with integral switch
3 Electronystagmograph
4 Worktop with 2 underbench drawer/ cupboard units
5 Stainless steel sink with single laboratory-type cold tap
6 44°C caloric tank
7 30°C caloric tank
8 Mains water temp. caloric tank
9 Timer and associated controls
10 'Wall-washer' fluorescent light
11 Ceiling-mounted examination light with integral switch







12 Examination couch with adjustable head end and couch cover dispenser
13 Fixation lights (a, b, c,)
14 Calibration lights (d, e,)
15 Upright chair
16 Coat hooks
17 Couch steps
18 Foot controls for 9
19 light-tight curtains
20 Clinical handwashing basin
21 Soap dispenser
22 Paper towel dispenser
23 Mirror
24 Sack holder pedal-operated



Labyrinth test room

SCHEDULE OF ACCOMMODATION

	Population served: 150,000 m^2	200,000 m^2	250,000 m^2
A. BASIC ACCOMMODATION			
<u>General</u>			
Reception	8	8	8
Main waiting	15	17.5	20
Lavatories	17	17	17
<u>ENT clinic</u>			
Consulting/examination rooms (each $17m^2$)	34	51	68
Sub-waiting	7.5	10	12.5
Treatment cubicles (each $9m^2$)	18	27	36
Recovery	4.5	6.5	8.5
Clean utility	9	9.5	10
Dirty utility	7	7.5	8
Labyrinth test room	17	17	17
<u>Audiology suite</u>			
Sub-waiting	10	10	10
Young children's audiology	30	30	30
Observation lobby	21	21	21
Adults' audiology	16	16	16
<u>Hearing aid centre</u>			
General office	15	15	15
Interview/fitting room (each $11m^2$)	22	22	22
Ear mould workroom	11	11	11
Workshop/store	18	18	18
<u>Supporting accommodation</u>			
Speech therapy	17	17	17
Offices (each $11m^2$)	44	44	44
Seminar	20	20	20
Cleaners' room	5.5	5.5	5.5
Store	5	5.5	6
Switch cupboard	1.5	1.5	1.5
B. CIRCULATION (40%)			
C. ADDITIONAL ACCOMMODATION			
Lip-reading	17	17	17
D. COMMUNICATIONS			
Ventilation plant room	15	15	15

NOISE LEVEL LIMITS FOR AUDIOLOGY ROOMS

$\frac{1}{3}$ octave centre frequency Hz	dB SPL re 2×10^{-5} N/m^2
50	50
63	46
80	42
100	39
125	36
160	33
200	30
250	28
315	26
400	25
500	23
630	22
800	21
1000	20
1250	20
1600	19
2000	19
2500	19
3150	19
4000	19
5000 and above	20

ANNEXURE 6.2

ASSESSMENT OF C/E ROOM REQUIREMENTS

Given - some data on previous attendances at Out Patient Departments

Aim - establish no of C/E rooms required

What is a C/E room?	individual pattern of working pattern of team work no of rooms per doctor
What is a session?	any length of time at one stretch that a doctor sees patients e.g. 3 hours
How many patients/doctor/ session?	specialty proportion of new to return patients pace of individual doctors pressure of work consultation time/speciality for new return patients
How many doctor sessions/ specialty/week	identified need/demand previous demand for services any identified increased requirement
Retrospective data - national district	extrapolate to district population calculate work load/week
What data - total attendances + no of new patients	calculate no of return attendances and proportion of new to return
Scottish method	no of patients/clinic session for each specialty + proportion of new to return patients set out
Proposed English method	proportion of new to return patients must be calculated and times for each type of consultation selected
Model timetable	indicates on way in which workload can be accommodated other timetables/commitments eg operating theatre session timetable

BIBLIOGRAPHY

1 Green, J. and Moss R.
Hospital research and Briefing Problems
King Edward's Hospital Fund for London
London, 1971

2 James, W.P. and Tatton-Brown W.
Hospital Design and Development
Architectural Press, London, 1986.

3 James, W.P. and Noakes A.
Hospital Architecture
Longmans Building Studies
London, 1994.

4 Noble A.
Designing for Out-patient Services
MARU, PNL, London, 1981.

5 Cox, A. and Groves P.
Hospitals and Health Care Facilities: Design and development guides
Butterworth Architecture, 1990.

6 NHS Estate
The Design of Community Hospitals
HMSO Publication
London, 1991.

7 Kleczewski, B.M. and Nilson N.O.
Health Care facility Projects in Developing Areas: Planning, Implementation and Operation
WHO, Geneva, 1984

8 Kleczewski, B.M. and Pibouleau R.
Approaches to Planning and Design of Health care Facilities in Developing Areas. (Vols. 1,2,3,4,5)
WHO, Geneva, 1984.

9 Mein, P. and Jorgensen T.
Design for medical Buildings : a manual for the Planning and Building of Health Care facilities Under Conditions of Limited Resources.
Housing Research and Development Unit
University of Nairobi, 1975.

10 World hearth Organisation
Hospitals and Health for All: Report of a WHO Expert Committee on the Role of Hospitals at the First Referral Level
Technical Report Series 744
WHO, Geneva, 1987

11 Marberry, S. E.
Innovations in Healthcare Design
Van Nostrand Reinhold
New York, 1995.

12 Isadore Rosenfield
Hospital Architecture and Beyond,
Van Nostrand Reinhold Co.
New York 1969

13 MARU
Functional Suitability and Space Utilisation
Assessment Methods
1986.

14 MARU
Space Utilisation in Hospitals-concepts, methodology and preliminary results,
1977.

15 Activity Data Base
Computerised design and briefing tool
NHS Estates, Leeds
1995.

16 Audit Commission
A Short Cut to Better Services: Day Surgery in England and Wales
HMSO 1990.

17 Audit Commission
Measuring Quality: the Patients View of Day Surgery
NHS Occasional Papers number 3
HMSO 1991.

18 Health Services Journal
Day Surgery
HSJ Special Report 16 Feb 1995.

19 Vishwanathan R.
Report on General Hospital by committee on plan project
(Building Projects Team) Ministry of Health.
New Delhi 1964

20 Bajaj I.D.Dr.
Reports of the Hospital Equipment, Standardisation Committee
1980.
Ministry of Defence

21 Scale of Accommodation for Armed Forces Hospital
Govt. of India, New Delhi 1982.

22 Standards India
New Delhi
April 1989, August 1990, February 1991, March 1991.

23 Central Bureau of Health Intelligence, D.G.H.S.
Health Information of India
New Delhi, 1993.

24 Kleczkowski B.M. and Pibouleau R.
Approaches to Planning and Design of Health Care Facilities in developing
areas, Volume 2
W.H.O. Geneva, 1977.

25 Llewelyn Davies R. & H.M.C. Macaulay
Hospital Planning & Administration
W.H.O.
Geneva, 1966.

26 World Health Organisation
Health Care in South East Asia
WHO Regional Publication
South East Asia Series no. 14.
WHO Regional Office for South East Asia
New Delhi, India, 1985.

27 Government of Bangladesh
Statistical Year Book of Bangladesh
Bangladesh Bureau of Statistics
Ministry of Planning
Dhaka, Bangladesh, 1986,1990.

28 Hossain, R. Dr.
The Planning and Design of District Hospitals in Bangladesh
PhD thesis, Catholic University
Leuven, Belgium, 1988.

29 United Nations Children Fund
The State of the World's Childrens
Oxford University Press
UK, 1990.

30 Loomis S.A M.P.H. Syncris
The Dynamics of Health Care, XVII, Bangladesh
U.S. Department of Health, Education and Welfare
Public Health Service Division of Programme Analysis
USA, March 1976.

31 Preliminary Feasibility Study Report for Specialised-cum-General Hospital in Dhaka
Dhaka, Bangladesh, March 1981.

32 Geogerry Broad Bent
Design in Architecture
John Willey & Sons
London 1973

33 Francis D.K. Ching
Architecture, Form Space & Order
Van Nostrand Reinhold Co.
New York 1979

34 Ivan Flores
Data Base Architecture
Van Nostrand Reinhold Co.
New York 1981

35 Clovis Heimsath AIA
Behavioural Architecture Towards an Accountable Design
McGraw Hill Book Co.
New York 1977

36 Joseph De
Manual of Housing/Planning & Design Criteria
Chiara & Lee Koppelman- Prentice hall in. Engle Wood
N.J. 1975

37 Consultant Editor Elder A
A Handbook of Building Enclosure
Riba Architectural Press
London

38 Martin Evans
Housing Climate and Comfort
Architectural Press London
1980

39 Jain Malkin
The Design of Medical and dental Facilities
Van Nostrand Reinhold Co.
New York 1982

40 Manual Marti Jr. P.D.A.
Space Operational Analysis
Publisher Corp.
U.S.A. 1981

41 Etodd Wheeler
Hospital Modernization and Expansion
McGraw Hill Book Co.
New York 1971

42 Primary Health Briefing and Design Guide for Architects and their Clients
Architectural Press,
London 1981

43 Carol Ann.
Study at Planned organisational change in the structure and functioning of
Indian Hospital
HUSJ 1980

44 John Wiley
Hospital Planning Handbook
Allen Rex Whiteker & Kasolvi Ilona Van.
New York 1976

45 Laszlo Aranyi & Larry L. Goldman
Design of Long Term Care Facilities
Van Nostrand Reinhold Co.
New York 1978

46 James W Paul & Talton Brown W.
Hospitals Design & Development London
Architectural Press
London 1986

47 B.M & Nilsson
Health Care Facility Projects developing area
World Health Organisation
N.O. 1984

48 Health for all by 2000 A.D.
Ministry of Health
India 1981

49 Ministry of Health
Report of the Working group for Administrative and Engg.
India 1981

50 Health Centres, Reception, Waiting and Patient Cell
Welsh Office Deptt. of Health & Social Security Britain
London 1973

51 Health Equipment Note: Diagnostic X-ray Deptt. No. 6,
Welsh Office department of Health and Social Security,
Britain 1975
- do - 6 Radiodiagnostics Deptt. Britain (1982)
- do - 29 Pharmaceutical Depot. - do - (1975)

52 Bureau of Indian Standard
Basic Requirements for Hospital Planning Part - 1
Delhi 1988

53 World Health Organisation
Principal of Health Planning in the U.S.S.R.
Geneva 1971

54 Health : United States
U.S. Department of Health & Human Services
1981

55 The Planner's Response
Mcgraw Hill Publications
New York

56 Accreditation Manual for Hospital A.M.H. 83
Joint Commission on Accreditation of Hospital
1982

57 Depot. of Health & Welsh Office
Health Building Note
HMSO Publication
London 1990

58 David Baker
Health Design Guide MRI Suites
U.K. April 93 , May 93 , May 94 ,Nov 96

ABBREVIATION

OPD	:	Out Patient Department
IPD	:	In Patient Department
C/E	:	Consultation / Examination
POP	:	Population
DDU	:	Deen Dayal Upadhayay
RML	:	Ram Manohar Lohia
AIIMS	:	All India Institute of Medical Sciences
CSSD	:	Central Sterile Stores Department
ENT	:	Ear Nose Throat
OT	:	Operation Theatre
LAB	:	Laboratory
EQUP	:	Equipment
DIAGNO	:	Diagnostic
EXAM	:	Examination
RM	:	Room
STRUCT	:	Structural
DR	:	Doctor
FURN	:	Furniture
ENG	:	Engineering
FIN	:	Finishes