

# Planning and Designing of a 100 Bed Capacity Hospital

Ms. Hawabi Shaikh<sup>1</sup> Ms. Sampata Patil<sup>2</sup> Mr. Rutwik Sawant<sup>3</sup> Ms. Sharvani Chirekar<sup>4</sup>

Ms. Pradnya Gawade<sup>5</sup>

<sup>1</sup>Assistant Professor

<sup>1,2,3,4,5</sup>Department of Civil Engineering

<sup>1,2,3,4,5</sup>Yashwantrao Bhonsale Polytechnic, India

**Abstract**— Hospitals are the most complex of building types. Each hospital is comprised of a wide range of services and functional units. These include diagnostic and treatment functions, such as clinical laboratories, imaging, emergency rooms, and surgery; hospitality functions, such as food service and housekeeping; and the fundamental patient care or bed-related function. This diversity is reflected in the breadth and specificity of regulations, codes, and oversight that govern hospital construction and operations. Each of the wide-ranging and constantly evolving functions of a hospital, including highly complicated mechanical, electrical, and telecommunications systems, requires specialized knowledge and expertise. No one person can reasonably have complete knowledge. The functional units within the hospital can have competing needs and priorities. Idealized scenarios and strongly-held individual preferences must be balanced against mandatory requirements and actual functional needs (internal traffic and relationship to other departments).

**Keywords:** 100 Bed Capacity Hospital

## I. INTRODUCTION

The art and science of designing a hospital anywhere is a complex affair. Beyond technical requirements that modern medicine demands and rigid functional relationships between different medical departments, the designer has to cope with a host of more subjective issues like the anxiety of the patient, the stressful work environment of the staff and the need to build a sustainable and healing building; Hippocrates' injunction to the medical community being, "First, do no harm." This paper will address pre-design planning and concept design, which in India are a much neglected but essential part of the process of designing a good hospital.

In addition to the wide range of services that must be accommodated, hospitals must serve and support many different users and stakeholders. Ideally, the design process incorporates direct input from the owner and from key hospital staff early on in the process. The designer also has to be an advocate for the patients, visitors, support staff, volunteers, and suppliers who do not generally have direct input into the design. Good hospital design integrates functional requirements with the human needs of its varied users. A functional design can promote skill, economy, conveniences, and comforts; a non-functional design can impede activities of all types, detract from quality of care, and raise costs to intolerable levels

The basic form of a hospital is, ideally, based on its functions:

- 1) Bed-related inpatient functions
- 2) Outpatient-related functions
- 3) Diagnostic and treatment functions
- 4) Administrative functions
- 5) Service functions (food, supply)
- 6) Research and teaching functions

Healthcare in India is in a developing stage and it needs a radical policy shift at government level to usher in the changes to face the challenges of the future. Under the umbrella of health care providers are outpatient set-ups, nursing homes, hospitals, medical colleges, health spas, diagnostic centers, ayurvedic and naturopathy centers, hospices, old age homes and more. Most of these institutions will have varied needs, which will differ vastly in terms of their planning needs. Health care provision in India is different in rural and semi urban settings where it is more unorganized to today's super specialty centers where it more institutionalized. The mechanisms for funding are fast changing to the private sector involvement thereby pushing up the cost of both setting up hospitals as well as availing health care in these hospitals. The lowering of interest rates over the years has no doubt helped the cause of the private sector wherein more entrepreneurs are coming forward to set up hospitals as it has become affordable to take loans and repay them. The rapid growth of the insurance sector is equally helping the community to face the problem of spiralling health care costs.

There are innumerable stakeholders in the health care delivery domain including the government, philanthropic trusts, educational institutions, corporate sector, insurance companies, bio-medical vendors, architects, construction companies, patients, relatives, the pharmaceutical industry, professionals like doctors and other para-medical staff, and the funding agencies. Given the wide spectrum of stakeholders, the industry growth will benefit many in the population.

The hospital ownership pattern can be basically three types:

- 1) Government owned - central / state / district / autonomous like army, railways etc
- 2) Not For Profit – Managed by Trusts / Societies
- 3) For Profit – Corporate Sector

## II. AIM OF THE WORK

It is envisaged that no single standard can meet the requirements of different regions in our country representing plains, islands and hilly terrains with diverse geo-climatic variations. However, attempt has been made in this paper to cover basic needs of 100 bedded hospital which could be suitably adjusted to meet specific needs and priorities of a particular region or a community. Suitable reduction and increase needs to be carried out for hospitals with varied bed combinations than 100 beds.

The aim of this research paper is to explore how a civil engineer can apply the concept of healthy hospital design. The goal is to show designs for people's health, for a healthy environment and for a healthy approach to development. This design guide will address pre-design programming and concept design, which in India are a much

neglected but essential part of the process of designing a good hospital.

We will cover following aspects in designing a healthy hospital with 100bed capacity:

- 1) Project conceptualization
- 2) Types of surveys required
- 3) Data analysis for financial feasibility
- 4) Factors for Site Selection
- 5) Departmental Planning and Design
- 6) Area requirements for the proposed 100 bed hospital
- 7) Staff requirements for the proposed 100 bed hospital

### III. METHODOLOGY

#### A. Project Conceptualization

The first step in hospital planning is to finalize the project concept in terms of:

- 1) Identification of the market needs
- 2) Finalization of the facility mix
- 3) Deriving the appropriate size of the project
- 4) Determining the possibility of getting skilled manpower

All the above factors have a bearing on the project cost and its viability in future. This process helps understand the need of the community that will be served by the hospital in the given location.

#### B. Types of surveys required

Data is collected from various sources like the internet, libraries, media publications, newspaper archives, ministry of health and district health departments records etc. Unfortunately, India does not have a reliable mechanism for capturing health related data especially in the private sector. There are three types of surveys required:

- 1) House Hold Survey: This is essentially done to understand the health care seeking behaviour pattern of the community as a whole.
- 2) Doctor's Survey: Medical professionals are normally the best judge of the deficiency in the health care market and need to be interviewed carefully to identify the project concept that would succeed in the geographic service area.
- 3) Institutional Survey: Getting basic feedback on the competitors in the primary service area would be important to assess the strengths and weakness of existing institutions.

#### C. Data Analysis for Financial Feasibility

The data collected through secondary and primary sources is then analysed to arrive at a facility mix for the proposed project. It will also determine the scale of the project in terms of its bed size. In case it identifies some atypical need like cancer treatment, it would perhaps need more research to understand the profitability of such capital-intensive specialty.

After finalizing the project concept in terms of its facilities and size, the next important step is to analyse its financial viability. This will also help the promoter in planning the means of financing the project based on its profitability and capability of servicing the debt proportion. The first step of the feasibility process is to identify the cost

of the project in a realistic manner. This is done by way of producing a detailed project report (DPR).

#### D. Factors for Site Selection

Among the above four factors, location, size, shape and orientation, for a proposed healthcare facility the most important is location. Whether it is in an urban area or not, the location of the facility will be an important determinant in its financial success. Proximity to transportation hubs, good access roads, visibility, the location of competitor's hospitals with regard to the proposed facility all contribute to the suitability of the site.

A rational, step-by-step process of site selection occurs only in ideal circumstances. In some cases, the availability of a site outweighs other rational reasons for its selection, and planners and architects are confronted with the job of assessing whether a parcel of land is suitable for siting a hospital. In the case of either site selection or evaluation of adaptability, the following items must be considered: size, topography, drainage, soil conditions, utilities available, natural features and limitations

#### E. Departmental Planning and Design

This section deals only with general principles of planning and design. The different departments of the hospital can be grouped according to zone, as follows:

- 1) Outermost zone, which is the most community orientated:
  - a) primary health care support areas
  - b) out-patient department
  - c) emergency department
  - d) administration
  - e) admitting office, reception
- 2) Second zone, which receives workload from:
  - a) diagnostic x-ray
  - b) laboratories
  - c) pharmacy
- 3) Middle zone between outer and inner zones
  - a) operating department
  - b) intensive care unit
  - c) delivery
  - d) nursery
- 4) Inner zone, in the interior but with direct access for the public:
  - a) wards and nursing units
- 5) Service zone, disposed around a service yard:
  - a) dietary services
  - b) laundry and housekeeping
  - c) storage
  - d) maintenance and engineering
  - e) mortuary
  - f) motor pool

The functional program and the space program are to be prepared for the short-term project or for phases of a longer-term project for which planning has already been done. It serves as a common policy document which outlines the parameters and vision of the project for all the members of the planning and design team. It should also contain all the necessary information for the architectural design team to commence conceptual and schematic design. The components of the functional and space program for each

department of the proposed healthcare facility could read as follows:

Listing of planning assumptions:

- 1) An assessment of the situation on the ground (as existing)
- 2) The planning objectives and a vision for the future
- 3) Existing and proposed workloads
- 4) Proposed time of operation
- 5) Existing and proposed staffing
- 6) Operational and support systems assumptions
- 7) Equipment list for the proposed department
- 8) Functional adjacencies and access requirements of the various departments

The space program consists of a list of the various spaces in the department in square feet or square meters.

**F. Area requirements for the proposed 100 bed hospital**

Area requirement for hospital is to be derived from carpet area of various services and functions as outlined in functional programme by applying conversion factor for circulation space. The circulation space will include corridors, stairs, fire escapes, walls, ramps and lifts, etc. Area calculation is done for following departments of the hospital:

- 1) Public Areas
- 2) Casualty Department
- 3) Out-Patient Department
- 4) Physiotherapy & Rehabilitation
- 5) Radiology / Imaging & Diagnostics
- 6) Dialysis Unit
- 7) Operation Theatre Complex & Day Care Unit
- 8) Interventional Cardiology (Cath. Lab.)
- 9) Maternity Centre
- 10) Nursery & NICU
- 11) Intensive Care Unit
- 12) In-Patient Wing
- 13) Central Sterilization & Processing Department
- 14) Clinical Laboratory & Blood Bank
- 15) Kitchen & Dining
- 16) Administration
- 17) Materials Management, Housekeeping, Laundry & Staff Lockers
- 18) Electrical, HVAC, Maintenance & Bio-Medical Engineering

**G. Staff requirements for the proposed 100 bed hospital:**

In the beginning when the hospital starts working, it is recommended that the total strength should be based on 1.5 persons per bed but should increase to 2 persons per bed when the hospital is working to its full load capacity. Given below is the list of various departments for which staffing is calculated.

- 1) Administration
- 2) Accounts Staff
- 3) OPD
- 4) IPD
- 5) Quality Control
- 6) HRD
- 7) Medical Records
- 8) IT Dept.
- 9) Engineering & Plant Services
- 10) Pharmacy
- 11) Purchase & Materials

- 12) Marketing & Business Development
- 13) General
- 14) Medical / Clinical & Nursing
- 15) Other staff – outsourced

**IV. RESULTS AND CONCLUSIONS**

**A. Total Built-up Area of the Hospital**

Sr No	Description	Area In Sq. Ft.
1	Public Areas	7044
2	Casualty Department	2632.5
3	Out-Patient Department	5980
4	Physiotherapy & Rehabilitation	603
5	Radiology / Imaging & Diagnostics	4700
6	Dialysis Unit	1586
7	Operation Theatre Complex & Day Care Unit	6682
8	Interventional Cardiology (Cath. Lab.)	0
9	Maternity Centre	2964
10	Nursery & NICU	1443
11	Intensive Care Unit	13663
12	In-Patient Wing	23673
13	Central Sterilization & Processing Department	1332
14	Clinical Laboratory & Blood Bank	1884
15	Kitchen & Dining	3132
16	Administration	5124
17	Materials Management, Housekeeping, Laundry & Staff Lockers	5850
18	Electrical, HVAC, Maintenance & Bio-Medical Engineering	7044
Sub-Total		95336.5
Add: Vertical Circulation, Fire Escapes, AHU's & BUA Factor @ 25%		23834.12 5
Total		119170.6 25

**B. Total Staff Requirements for 100 Bed Hospital**

Category	No. of Staff
Administration	
Medical Director	1
Gen. Manager- Administration	1
Secretary to M.D.	1
Secretary to G.M.	1
Administration Clerk	2
Helper	2
Accounts Staff	
Finance Manager	1
Accounts Assts.	4
Support & Ancillary Services	
OPD	
Manager	1
Asst.Executive	1
Billing & Cashier	2
IPD	
Manager	1

(IPD -ADT) Asst.Executive (incl. floor staff)	2
Billing & Cashier	3
Quality Control	
Manager	1
Asst.Executive	1
HRD	
Manager	1
Asst. Executive	2
Medical Records	
Manager	1
Asst. Executive	1
Helper	1
IT Dept.	
Manager	1
I.T. Engineer	2
Engineering & Plant Services	
Manager	1
Maintenance Engineers	4
Biomedical Engineer (Sr.)	1
Biomedical Engineer (Asst.)	2
Pharmacy	
Sr. Pharmacist	1
Asst. Pharmacist	1
Clerks	2
Pharmacy Dispensing Assistants	2
Assistants (Helpers in OTs)	2
Purchase & Materials	
Manager	1
Asst. Executive (Stores)	0
Clerk	1
Helpers	1
Marketing & Business Development	
Manager	1
Marketing / PR Executive	1
General	
Medical Social Worker	1
Patient Counsellor	0
Librarian	1
Library Helper	0
Receptionists	4
Tel. Operator	3
Medical / Clinical & Nursing	
Radiologist / Imaging	1
Asst. Radiologist	2
Gen Surgeon (surgical resident)	0
Anaesthetists (Intermediate)	1
Anaesthesia Technicians	2
Gen. Medicine (Physician)	0
Intensivist-Critical Care	2
Physiotherapist	1
Asst. Physiotherapists	4
Chief Pathologist	1
Asst. Pathologist	1
Lab Technician- Senior	4
Lab Technician- Intermediate	6
Histopathologist	1
Blood Bank in Charge	1

Blood Bank Technician (Senior)	2
Blood Bank Technician (Interned.)	2
Sr. Residents	14
Jr. Residents	25
Radiology & Imaging Technician (Senior)	5
Radiology & Imaging Technician (Interned.)	1
CSSD in Charge	1
CSSD Technicians (Sr.)	2
CSSD Technicians (Jr.)	2
Helpers	2
Dietician (Sr.)	1
Nursing	
Nursing Supdt	1
Matron (OT in-charge)	1
Senior Staff Nurse for IPD	58
Intern. Staff Nurse For IPD	87
Nursing Aide	145
Jr. Staff Nurse for OPD & Diag. Services	5
Other staff - outsourced	
Helpers (Gen.)	15
Ayahs	31
Attendants	
Sweeper	53
Laundry & Kitchen	11
Tailor	2
Security	30
Liftmen	12
Drivers	4
Total	603

REFERENCES

- [1] Cox, Anthony and Groves, Philip, Hospitals and Health-Care Facilities: A Design and Development Guide: London: Butterworth Architecture, 1990.
- [2] Cynthia Hayward, SpaceMed Guide: A Space Planning Guide for Healthcare Facilities: HA Ventures and Hayward & Associates, LLC, Ann Arbor, Michigan.
- [3] E. Maxwell and Dale R. Brown, Programming Processes for Military Health Care Facilities, Clarence United States Army, Washington, D.C.
- [4] John P. Petronis, Strategic Asset Management: An Expanded Role for Facility Programmers, Architectural Research Consultants, Albuquerque, New Mexico.
- [5] Miller, Richard L. and Swensson, Earl S., New Directions in Hospital and Healthcare Facility Design. New York: McGraw-Hill, Inc., 1995.
- [6] Preiser, Wolfgang F.E., Professional Practice in Facility Programming, New York: Van Nostrand Reinhold, 1993.
- [7] Richard L. Kobus, Ronald L. Skaggs, Michael Bobrow and Julia Thomas, Thomas M. Payette and ShoPing Chin, Stephen A. Kliment-Series Editor, Building Type Basics for Healthcare Facilities: John Wiley and Sons, Inc, Hoboken, New Jersey.
- [8] Wilbur H. Tusler, SMP, San Francisco, California, with Frank Zilm James T. Hannon, and Mary Ann Newman, Programming: The Third Dimension.

- [9] Government of India Ministry of Housing & Urban Affairs, Central Public Works Department- Compendium of Norms for Designing of Hospitals & Medical Institutions.
- [10] WHO Regional Publications. Western Pacific Series No.4 District Hospitals: Guidelines for Development Second Edition

