SPACE PLANNING & CRITICAL DESIGN FEATURES IN HEALTHCARE PROJECTS

By
V. Sukumar Hebbar
Larsen & Toubro Ltd.
3rd February 2011
HEALTH CARE INDUSTRY

PRESENT SCENARIO

India’s Health care industry Revenue is Rs. 2,50,000 Crore (5% G.D.P)

GROWTH:
- 16% Y-O-Y
- 4 MILLION PEOPLE EMPLOYED
- ONE OF THE LARGEST SERVICE SECTOR IN INDIA

HEALTH CARE EXPENDITURE
- INDIA – 0.9% G.D.P
- LESS DEVELOPED COUNTRIES – 2.8% G.D.P
- DEVELOPED COUNTRIES – 5-6% G.D.P

TOTAL EXPENDITURE ON HEALTH
- PUBLIC EXPENDITURE – 20%
- PRIVATE EXPENDITURE – 80%
CONTRIBUTION:
• STATE GOVERNMENT – 15.2%
• CENTRAL GOVERNMENT – 5.2%
• THIRD PARTY INSURANCE & EMPLOYERS – 5.2%
• MUNICIPAL GOVERNMENT – 1.3%

INVESTMENT:
• PRIMARY HEALTH CARE – 58.7%
• SECONDARY & TERTIARY HEALTH CARE – 38.8%
• NON-SERVICE COSTS – 3.88%

MEDICAL INSURANCE SCHEME:
• India – 3 to 5% of Total Population
• 12% penetration in top 20 cities
• Developed Countries – 75% of Total Population
HEALTH CARE INFRASTRUCTURE

- Inadequate for serving the needs of growing population
- Efforts are made up to create Infrastructure and to provide Manpower
- Build up Appropriate linkages between the various centers

INDIA’S THREE TIER PUBLIC HEALTH SYSTEM

1. PRIMARY HEALTH CENTERS
2. DISTRICT HOSPITALS
3. TERTIARY CARE HOSPITALS

- SUB CENTERS – 137271 Nos.
- DISPENSARIES – 27400 Nos.
- PRIMARY HEALTH CENTERS – 22971 Nos.
- COMMUNITY HEALTH CENTERS – 2935 Nos.
- HOSPITALS – 15097 Nos.
HEALTH CARE INFRASTRUCTURE

HOSPITALS

Government Hospitals – 4475 Nos. 375987 Beds
Charitable Trusts Hospitals – 335 Nos. 19677 Beds
Private/ Corporate Hospitals – 10289 Nos. 228155 Beds

TOTAL 15099 Nos. 623819 Beds

DISTRIBUTION OF HOSPITALS

• Varies according to Socio-Economic conditions

FOR EG.

U.P (HIGHEST POPULATION)
– 139 Million – 735 Hospitals

KERALA
– 29 Million – 2053 Hospitals
**HEALTH CARE SCENARIO**

- Government Health Service focusing on Primary Health Care
- Attainment of Development Indicators is significant
  - a. Reduction in Birth rate & Death rate
  - b. Reduction in Infant Mortality rate
  - c. Increase in Life Expectancy

**STATISTICAL DATA**

**HOSPITAL BEDS TO POPULATION**

<table>
<thead>
<tr>
<th>Country</th>
<th>Beds to Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>0.9:1000</td>
</tr>
<tr>
<td>Developed Countries</td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>14:1000</td>
</tr>
<tr>
<td>U.S.A</td>
<td>5:1000</td>
</tr>
<tr>
<td>U.K</td>
<td>5.5:1000</td>
</tr>
<tr>
<td>German</td>
<td>10:1000</td>
</tr>
<tr>
<td>France</td>
<td>9:1000</td>
</tr>
<tr>
<td>Italy</td>
<td>7:1000</td>
</tr>
<tr>
<td>Canada</td>
<td>6:1000</td>
</tr>
<tr>
<td>Sweden</td>
<td>6.5:1000</td>
</tr>
<tr>
<td>South Korea</td>
<td>5:1000</td>
</tr>
</tbody>
</table>
## STATISTICAL DATA

### DOCTOR’S TO PATIENTS RATIO

<table>
<thead>
<tr>
<th>Country</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>1:1600</td>
</tr>
<tr>
<td><strong>No. of Physician</strong></td>
<td>7,57,377 Nos.</td>
</tr>
</tbody>
</table>

### Developed Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>1:550</td>
</tr>
<tr>
<td>U.S.A</td>
<td>1:375</td>
</tr>
<tr>
<td>U.K</td>
<td>1:625</td>
</tr>
<tr>
<td>Germany</td>
<td>1:295</td>
</tr>
<tr>
<td>France</td>
<td>1:340</td>
</tr>
<tr>
<td>Italy</td>
<td>1:180</td>
</tr>
<tr>
<td>Canada</td>
<td>1:475</td>
</tr>
<tr>
<td>Sweden</td>
<td>1:325</td>
</tr>
<tr>
<td>South Korea</td>
<td>1:900</td>
</tr>
</tbody>
</table>

### NURSES TO PATIENTS RATIO

<table>
<thead>
<tr>
<th>Country</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>1:1100</td>
</tr>
</tbody>
</table>

### Developed Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>1:135</td>
</tr>
<tr>
<td>U.S.A</td>
<td>1:120</td>
</tr>
<tr>
<td>U.K</td>
<td>1:225</td>
</tr>
<tr>
<td>Germany</td>
<td>1:110</td>
</tr>
<tr>
<td>France</td>
<td>1:170</td>
</tr>
<tr>
<td>Italy</td>
<td>1:180</td>
</tr>
<tr>
<td>Canada</td>
<td>1:110</td>
</tr>
<tr>
<td>Sweden</td>
<td>1:100</td>
</tr>
<tr>
<td>South Korea</td>
<td>1:385</td>
</tr>
</tbody>
</table>
## STATISTICAL DATA

### No. OF HOSPITAL BEDS

<table>
<thead>
<tr>
<th>Country</th>
<th>Beds</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>6,23,819</td>
</tr>
<tr>
<td>Japan</td>
<td>16,60,784</td>
</tr>
<tr>
<td>U.S.A</td>
<td>10,97,700</td>
</tr>
<tr>
<td>U.K</td>
<td>2,64,520</td>
</tr>
<tr>
<td>Germany</td>
<td>7,83,631</td>
</tr>
<tr>
<td>France</td>
<td>5,08,075</td>
</tr>
<tr>
<td>Italy</td>
<td>3,44,840</td>
</tr>
<tr>
<td>Canada</td>
<td>1,54,000</td>
</tr>
<tr>
<td>Sweden</td>
<td>49,468</td>
</tr>
<tr>
<td>South Korea</td>
<td>2,09,303</td>
</tr>
</tbody>
</table>

India needs to add 80000 hospital beds each year for next five years.
HEALTH CARE SCENARIO IN INDIA

MOST FAVOURED DESTINATION

STRONG ECONOMY

• Trillion dollar economy
• 12th largest economy in the world
• 53% of GDP from service sector
• 29% of GDP from industry sector
• Average growth of 7% even during recession

STRONG ENABLERS

• Economy expected to grow at 8% + annually
• Young employable human resources
• A market of more than a billion population

OVERVIEW

• Indian healthcare market expected to touch USD 77 billion or INR 330,000 crores by 2012
• Annual growth rate of 15% for the next 15 years
OVERVIEW

- Employment for 9 million by 2015
- With rise in income levels & increase in adoption of health insurance, demand for tertiary care hospital is expected to grow
- Share of tertiary care in total healthcare market is around 15%
- Market for tertiary care hospital to grow at a faster rate due to rise in complex ailments
- Use of technologically advanced diagnostic equipment & excellent infrastructure making India a medical travel hub

SHIFT TOWARDS LIFESTYLE RELATED DISEASES

- Occurrence of communicable diseases decreasing & non communicable diseases increasing
RAPID ADVANCES IN MEDICAL TECHNOLOGY

• Lifecycle of high end medical equipment is becoming shorter due major innovation
• Telemedicine in ophthal, cardiac to meet the demand of rural populace
• Tele-radiology to leverage the time difference advantage with developed countries
• Indian diagnostic industry is expected to grow at CAGR of 30 -40%

CURRENT TRENDS IN MEDICAL TECHNOLOGY

• Robotics in OT, Pathology, Research
• Laser technology in surgery
• Increased usage of advanced instruments
• Biotechnology, genomics, molecular biology and stem cell research

HEALTH CARE SCENARIO

Women & Children hospital, JIPMER

Medical college & Research centre, JIPMER

Nursing College, JIPMER
HOSPITALS

TYPES OF HOSPITALS:
1. TEACHING / RESEARCH HOSPITALS
2. GENERAL HOSPITALS
3. TERTIARY CARE SPECIALTY HOSPITALS

FEATURES
- Orientation
- Planning of traffic & Circulation
  (Patients, Staffs, visitors, Service deliveries, Garbage & Waste removal)
- Easy traffic movement & promote efficiency of operation

ZONING - - - - - - - factors
- Secondary level of infection
- Separation of dissimilar activities
- Separation movement of clean / dirty material
PLANNING ASPECTS

LOCATION

- Quiet environment & Good accessibility
- Away from noise & polluted area
- Dedicated Emergency entrance
- Separate service road
- Zoning – hospital / institutional / residential service
- Separate parking for visitors / staff
- Separate entry for staff / patients / visitors / material
- Separation of OPD & IPD with negative space between with courtyard / atrium
HOSPITALS - ZONING

Inpatient wards

Diagnostic services
(Radiology & Imaging)
Clinical laboratories
Therapeutic services
Pharmacy

Surgery

Labour delivery suite

Nursery

Emergency department

Out patient department

Out patients

Emergency patients

Maternity patients

Administration

Services
Dietary kitchen,
Laundry, store,
House keeping,
CSSD, Maintenance

Access

© RFHHA. All rights reserved
HOSPITALS - ZONING

OUTER ZONE
- Reception, Registration
- Admission, Administration
- OPD / Emergency

INTERMEDIATE ZONE
- Diagnostic/Pathology
- Therapeutical & Pharmacy

NUCLEUS
- Surgery suite
- ICU
- Labour & Delivery suite

INNER ZONE
- IPD
### HOSPITALS – SPACE PLANNING

#### 3 MAIN AREAS

**OPD**
- Emergency/ casualty
- Consultancy services
- Diagnostic facilities
- Physiotherapy
- Pharmacy

**IPD**
- Surgical suites
- ICU/ CCU/ HDU
- Cath lab
- Day care
- Pathology
- Wards

**SERVICES**
- CSSD
- Laundry & Linen
- Stores
- Diet Kitchen
- Bio-medical

---

**CT SCAN**

**MODULAR OPERATION THEATRE**

**Central Sterile Supply Dept.**
## Out-Patient Department - Emergency / Casualty

<table>
<thead>
<tr>
<th>Functional Area</th>
<th>No</th>
<th>Area Requirement in Sq.MT.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>NHS</td>
</tr>
<tr>
<td>Minor Operation Theatre</td>
<td>1 Room</td>
<td>36</td>
</tr>
<tr>
<td>Resuscitation Beds</td>
<td>3 Beds</td>
<td>14</td>
</tr>
<tr>
<td>Examination / Treatment</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Observation Beds</td>
<td>5 Beds.</td>
<td>11.5</td>
</tr>
<tr>
<td>Triage</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Police / Counselling</td>
<td>1 Each</td>
<td></td>
</tr>
<tr>
<td>Dirty / Clean Utility</td>
<td>1 Each</td>
<td>3.6</td>
</tr>
</tbody>
</table>

A typical observation Bay

Emergency Entrance for Ambulance

A typical Resuscitation Bay
## OUT-PATIENT DEPARTMENT

### CONSULTANCY SERVICES

<table>
<thead>
<tr>
<th>FUNCTIONAL AREA</th>
<th>NO</th>
<th>AREA REQUIREMENT IN SQ.MT.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>NHS</td>
</tr>
<tr>
<td>CONSULTATION ROOM</td>
<td>1 Room</td>
<td>16.5</td>
</tr>
<tr>
<td>TREATMENT ROOM</td>
<td>1 per 3 C.R.</td>
<td>12 - 16</td>
</tr>
<tr>
<td>WAITING LOBBY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIRTY / CLEAN UTILITY</td>
<td>1 per Dept.</td>
<td>3.6</td>
</tr>
</tbody>
</table>

- **Opd Consultancy rooms**
- **Paediatric OPD Waiting area**
- **Main entrance lobby of OPD in JIPMER, Puducherry**
DIAGNOSTIC FACILITIES

Proximity to O.P.D, Emergency & I.P.D

X-ray
Fluoroscopy
Mammography
Ultra sound
CT scan
MRI
Gamma camera
Gamma knife
Colour Doppler

-(Space planning to suite the equipment
Manufacturer’s specification & AERB guidelines)
**SURGICAL SUITE**

<table>
<thead>
<tr>
<th>FUNCTIONAL AREA</th>
<th>NO</th>
<th>AREA REQUIREMENT IN SQ.MT.</th>
<th>NHS</th>
<th>AIA</th>
<th>L&amp;T INDICES</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAJOR OT – (1OT / 40-50 BEDS)</td>
<td>1</td>
<td>40</td>
<td>33.45 – 44.39</td>
<td>48 - 54</td>
<td></td>
</tr>
<tr>
<td>MINOR OT</td>
<td>1</td>
<td>30</td>
<td></td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>SEPTIC / EMERGENCY OT</td>
<td>1</td>
<td>30</td>
<td></td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>PRE OPERATIVE BEDS / OT</td>
<td>2</td>
<td>12</td>
<td>7.43 with 1.2 clear</td>
<td>10-11</td>
<td></td>
</tr>
<tr>
<td>POST OPERATIVE BEDS / OT</td>
<td>4</td>
<td>14 - 16</td>
<td>7.43 with 1.2 clear</td>
<td>12- 13.5</td>
<td></td>
</tr>
</tbody>
</table>

- Operation Theatre for teaching hospital shall be as per MCI requirement
- For CTVS OT around 54 sq.mt required
- Above is clear area inside the OT and all supporting facilities are additional
- For modular OT, area to be included to get the clear space as above
## IN-PATIENT DEPARTMENT – ICU / CCU

<table>
<thead>
<tr>
<th>FUNCTIONAL AREA</th>
<th>NO</th>
<th>AREA REQUIREMENT IN SQ.MT.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>NHS</td>
</tr>
<tr>
<td>ICU / CCU (8 Beds / OT or 10% of the total no. of beds)</td>
<td>1BED</td>
<td>24.5</td>
</tr>
<tr>
<td>NEONATAL ICU</td>
<td>1 BASSINET</td>
<td>11.22</td>
</tr>
<tr>
<td>ISOLATION ROOM</td>
<td>1</td>
<td>24.5</td>
</tr>
</tbody>
</table>

Level 1 Nursery in CMC Vellore

A view of typical NICU

A typical view of ICU complex with nurse station

© RFHHA. All rights reserved
### IN PATIENT DEPARTMENT

**WARDS**

<table>
<thead>
<tr>
<th>FUNCTIONAL AREA</th>
<th>NO</th>
<th>AREA REQUIREMENT IN SQ.MT.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>NHS</td>
</tr>
<tr>
<td>Deluxe Room</td>
<td>1 BED</td>
<td>16</td>
</tr>
<tr>
<td>Private Room</td>
<td>1 BED</td>
<td>16</td>
</tr>
<tr>
<td>Semi Private Ward</td>
<td>2 BEDS</td>
<td></td>
</tr>
<tr>
<td>General Ward</td>
<td>8 BEDS / ROOM</td>
<td>10-12 / BED</td>
</tr>
</tbody>
</table>

*© RFHHA. All rights reserved*
HOSPITALS – SPACE PLANNING

SERVICES
Hospital administration
Laboratories
Medical records department
Library & conference room
Auditorium
Central sterile supply department
Dietary kitchen
Laundry
Housekeeping
Engineering services
Medical gas manifold
Change & lockers
Mortuary

CSSD
LABORATORY
Diet Kitchen in SSSIHM, Puutaparthy
PLANNING ASPECTS

- Isolated from traffic & noisy area
- Away from contamination & cross infection
- At close proximity to Emergency / cath lab
- Dedicated lift & dumb waiter to CSSD
- 100% Air change desirable,
- ACH – 20-22 changes/hour (AIA)
- Laminar flow of conditioned air 19 – 21 deg. with 0.3 micron HEPA filter
- Seamless finish flooring / false ceiling / walls
- Pre operative / post operative & ICU at close proximity apart from change rooms
- Clear ht of 3.0m & 5.4mt total ht incl. service floor
PLANNING ASPECTS......

CONSIDERATIONS

- Segregation of clean & dirty traffic
- Sub-zone to ensure sterility
- Triple corridor system
  - Dirty / Clean/ Sterile
- Circulation pattern
- Separation of movements
  - doctors/staff / patients / materials
- Unidirectional air flow (clean to unclean)
- Selection of good materials
- Sharing of sub sterile / scrub / sluice with other OT with hatch opening

Operation Theatre

Laminar Flow
PLANNING ASPECTS

LOCATION
• Quiet environment
• Away from traffic
• Away from contamination & cross infection
• Close proximity to Emergency, OT, Recovery rooms, Nursing units
• Closer to vertical transportation

CONSIDERATIONS
• Isolation rooms for air borne diseases
• Step down ICU or HDU
• Double corridor system
  - Outer corridor & Sterile corridor
• Centralized nursing station
CONSIDERATIONS

NICU
- Controlled access from Labour & Delivery areas
- Viewing windows at appropriate areas
- Noise control & sound insulation
- Central control nursing station
- Dedicated space for lactation support/consultation
- Temp. 22-25deg.c. & ACH-6 changes/hour

ISOLATION ROOMS.....
- Double door system with ante room
- No recirculation of air
- Negative air pressure to be maintained
- Exclusive hand wash station & toilet
- 6-12 Air changes/hour
INTERIORS

SELECTION OF MATERIALS IN OT COMPLEX

OPERATION THEATRES  -  WALLS

- Seamless 1mm thk. Stainless steel sheet cladding (SS316G)
- Polyurethane/ anti-microbial paints finished on plaster
- High Pressure laminates (HPL) 4mm thk. with sealants
- Dupont make Corean synthetic resin wall cladding with seamless finish

FLOORING

- Seamless flooring to avoid microbial growth
  3mm thk. Self levelling epoxy or cold welded anti static vinyl flooring

DOORS & JOINERIES

- Stainless steel door with access controlled sliding type
- Double action & Two-leaf type
- Hermetically sealed aluminium glazing with air gap, extruded aluminium frames to ensure sound & thermal insulation
- Sensor operated Hatch Box to Sterile store & Dirty Sluice
- Sensor operated Stainless Steel Scrub
PATIENT TOILET

SIZE
- A clear width of not less than 1550mm for wheel chair movement
- 2400mm x 1550 clear size for bath, WC & Wash basin
- Door shutter width shall not be less than 800mm & shall always open out

ADDITIONAL FEATURES
- Ideal to provide wall hung EWC to avoid junctions
- Grab bars at every sanitary fixtures

FINISHES
- Ceramic tile dado upto false ceiling level
- False Ceiling GI Coil coated
- Wooden flush door
DEFINED CIRCULATION CORRIDORS
Identified corridors for
- staffs/ doctors / patients & materials

STAFFS/ DOCTORS
  a. Shoe change area
  b. Slippers & Dress change room
  c. Air showers

PATIENTS
  a. Separate transfer area (Change over of stretchers)
  b. Transfer zone links Pre-operative areas

MATERIALS
  a. Exclusive transportation route
  b. Handling Clean/ Dirty materials
  c. Connectivity of functions
WASTE MANAGEMENT SYSTEM

CLASSIFICATION OF WASTE

GENERAL WASTE
- Domestic waste
- Waste water from laundry / CSSD

PATHOLOGICAL & INFECTIOUS WASTE
- Tissues, organs, body parts
- Human fetuses, Blood & body fluids
- Infectious agents from laboratories
- Autopsy on patients with infectious diseases
- Waste from Surgery & infected patients
- Dialysis waste from infected patients

CHEMICAL & RADIOACTIVE WASTE
- Discarded solid, liquid & gaseous chemicals
- Solid, liquid contaminated with radio-nuclides

SHARPS - Needles, syringes, scalpels, saws, blades
DISPOSAL OF WASTES/ WASTE DISINFECTOR

- Incineration
- Recycling or refuse
- Public disposal system
- Chemical disposal system

WASTES FROM DIFFERENT AREAS

O.P.D Consultation rooms
- Waste water: Public disposal system

Treatment rooms
- Waste water: Public disposal system
- Sharps: Incinerator
- Pharmaceutical: Incinerator

DIAGNOSTIC SERVICES
- Chemical: Incinerator
WASTE MANAGEMENT SYSTEM

CLINICAL LABORATORIES
- Chemical Incinerator
- Pharmaceutical Incinerator
- Infectious Incinerator

SURGICAL SUITES/ ICU’s
- Soiled linen CSSD / Laundry
- Instruments CSSD
- Pathological Incinerator
- Waste water Public disposal system
- Sharps Shredder
- Pharmaceutical Incinerator

I.P.D
- Waste water Public disposal system/ STP
- Pharmaceutical Incinerator

SERVICES
- CSSD Public disposal system
- Laundry Public disposal system
WASTE MANAGEMENT

- **SEGREGATION** of different classes of wastes at source
- **COLLECTION** from point of generation & transportation
- **TRANSFER** of wastes into different disposable system

COLOUR CODE

<table>
<thead>
<tr>
<th>Colour</th>
<th>Type of wastes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow</td>
<td>Clinical wastes (incineration)</td>
</tr>
<tr>
<td>Light blue</td>
<td>Autoclaving before disposal</td>
</tr>
<tr>
<td>White</td>
<td>Soiled linen</td>
</tr>
<tr>
<td>White with red band</td>
<td>Foul or Infected linen</td>
</tr>
<tr>
<td>Red</td>
<td>Human tissue wastes</td>
</tr>
</tbody>
</table>
FACT

• In India, nearly 60% of the patients get secondary level of infection in the hospital and the recovery process becomes critical.
• Developed countries – 6-10%

CONCLUSION

• With better ‘SPACE PLANNING, INFECTION CONTROL & GOOD DESIGN FEATURES’, the designers and medical planners can address the issue very effectively and contribute substantially to mitigate the problem

MERITS & TANGIBLE BENEFITS

- Avoid cross-contamination
- Get accreditation from world renowned bodies
- Achieve international standards
- Optimize patients recovery cycle
- Increase productivity of staff / doctors
- Boost to Health care tourism
BUDDHA SAID ONCE THAT AMONGST ALL OF THE GAINS........

"GAINS OF HEALTH ARE HIGHEST & BEST"