

UNIT 1

FUNDAMENTALS OF BUILDINGS

Syllabus: Buildings: classification of buildings based on nature of occupancy & built environment and neutrality, classification of residential building : Detached, semi detached, Row houses or chawals, duplex type house, blocks of flats or terrace houses.

CLASSIFICATION OF BUILDINGS BASED ON NATURE OF OCCUPANCY:

Following are the classification of buildings based on nature of occupancy:

- 1) Residential buildings
- 2) Educational buildings
- 3) Institutional buildings
- 4) Assembly buildings
- 5) Business Buildings
- 6) Mercantile buildings
- 7) Industrial buildings
- 8) Storage buildings
- 9) Hazardous buildings

1. Residential buildings: They have sleeping accommodation with or without dining facilities. They include:

- i) Single or multi-family houses
- ii) Apartments, where three or more families live together with independent accommodation.
- iii) Hotels, including lodgings where accommodation is provided for different people no way related to each other.
- iv) Dormitories where accommodation is provided for a group of no way related people.
- v) Hostels where students, employees or workmen are accommodated.

2. Educational buildings: they are schools or collages imparting education to students. They function only for a part of the day where accommodation only for sitting or working is needed.

3. Institutional buildings: They harbor:

- i) Physical or mental patients undergoing treatment as in hospitals.
- ii) Orphanages .

- iii)** Insane or emotional people Convicted for their crimes undergoing their term of punishment or reformation – such as in jails, prisons.
 - iv)** Oldage homes, where dining and sleeping accommodation is provided and where care and caution are of primary importance.
4. **Assembly buildings:** These are relatively larger buildings accommodating more number of people for a stay of relatively short time for, “Social, Cultural, religious or political meetings and recreation, or travel purposes” as assembly halls, community halls, auditoriums , museums.
 5. **Business buildings:** They are the buildings meant for public transactions as offices, banks, consultancy offices, and research laboratories.
 6. **Mercantile buildings:** These buildings involve money transactions towards purchases, shopping complexes.
 7. **Industrial buildings:** They are specially constructed structures to manufacture products after processing, assembling and fabricating. Laboratories, cleaning plants.
 8. **Storage buildings:** These buildings constructed mainly for the storage and preservation of goods. They include ware houses, cold storage godowns.

Cool and dry place with less ventilation and illumination is required for effective storage.

9. **Hazardous buildings:** These buildings store, manufacture or process hazardous products which are explosive, highly inflammable poisonous, irritating corrosive.

These buildings need be isolated from the rest of the buildings so that in case of any accident or leakage the damage occurred should be a bare minimum and confined to a limited area.

CLASSIFICATION OF BUILDINGS BASED ON BUILT IN ENVIRONMENT AND NATURALITY:

- 1.Natural Building
- 2.Green Building
- 3.Intelligent Building

1. **NATURAL BUILDING:** Natural building is the construction of building using minimally processed, local and low tech materials with a major emphasis on local ecology. A natural building invokes a variety of design elements, localization of materials, site and size of

appropriate, non toxic materials, recyclable salvaged materials, site and size appropriate and high functioning systems and regenerative in India.

2. **GREEN BUILDING OR SUSTAINABLE BUILDING:** A green building also known as sustainable building is a structure that is designed, built, renovated, operated or reused in an ecological and resource-efficient manner. A green building is one which uses less water, optimise energy efficiency, conserves natural resources, generates less waste and provides healthier spaces for occupants as compared to a conventional building.

The major distance between these two buildings is that green building frequently in cooperates highly processed materials and high tech installation methods to gain energy efficient performance from buildings where as national buildings maximized the use of minimally processed and natural materials from the start .

Most of green building cost a premium of less than 2%, but gives yield 10% times as much over the entire life of building.

- 3.**INTELLIGENT BUILDING:** An intelligent building is one which provides a productive and cost – Effective environment to optimization of its four basic elements structures, systems, services and management and the inter relationship between them.

It integrates information technology and communications system to create the physical environments safer, more comfortable, interactive, secure, productive for its occupants and more operationally efficient for its owners.

Typical features of an intelligent building.

- i)restricted access to the building. one would need a password to enter building or permission from the owner to enter the premises.
- ii)energy saving devices and techniques are used to save electricity bills upto40%
- iii) green landscapes to conserve environment.
- iv)integrated home automation systems
- v)measures to be adopted to reduce operation/maintenance coasts.
- vi)building management systems to manage heating, close circuit televisions, alarm systems etc.

Different Types of Residential Buildings

Definition: A building used for dwelling purposes is known as residential buildings. Residential building is one which people reside permanently or for a sometime.

Residential buildings need to be planned according to

- Needs of the occupants
- Available funds for construction.
- Materials for construction
- Metrological conditions for the area.

Residential buildings include one or more family dwellings, apartment houses, lodging houses, restaurants, hostels, dormitories and residential hotels.

The residential buildings can be divided into following five groups:

1. Detached Houses
2. Semi-detached Houses
3. Row Houses or Chawls
4. Block of Flats or Terrace houses
5. Duplex type houses

DETACHED HOUSE

It is an independent house of one or two storeyed to accommodate one family. No structural member is shared by the neighboring building. Detached house shall be having one or two or sometimes three bed rooms with attached toilets, drawing room, kitchen and verandah enclosed by a compound. Detached houses offer independence, good ventilation, illumination and maximum privacy and space.

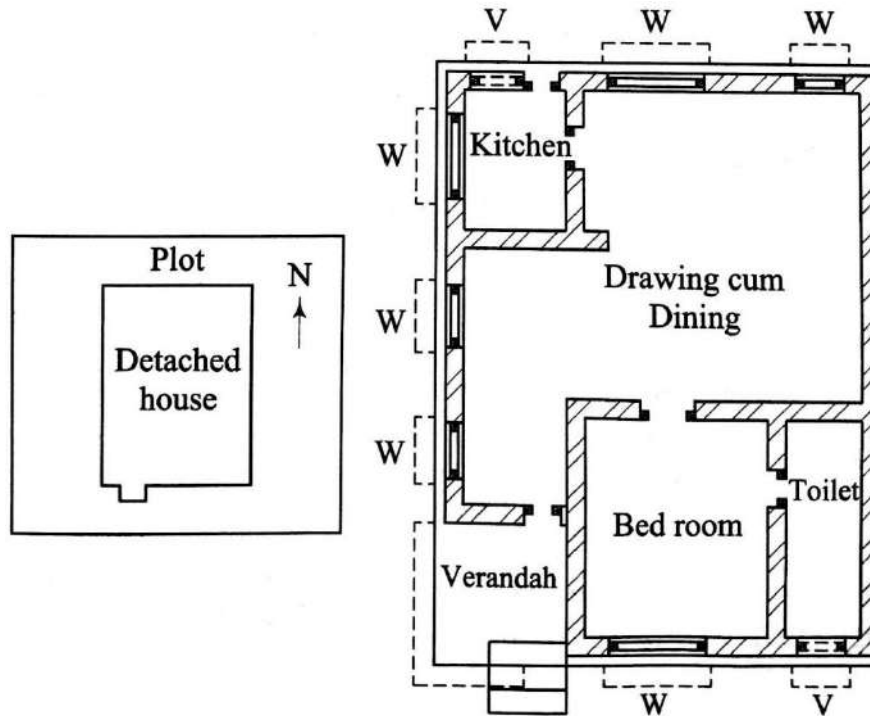
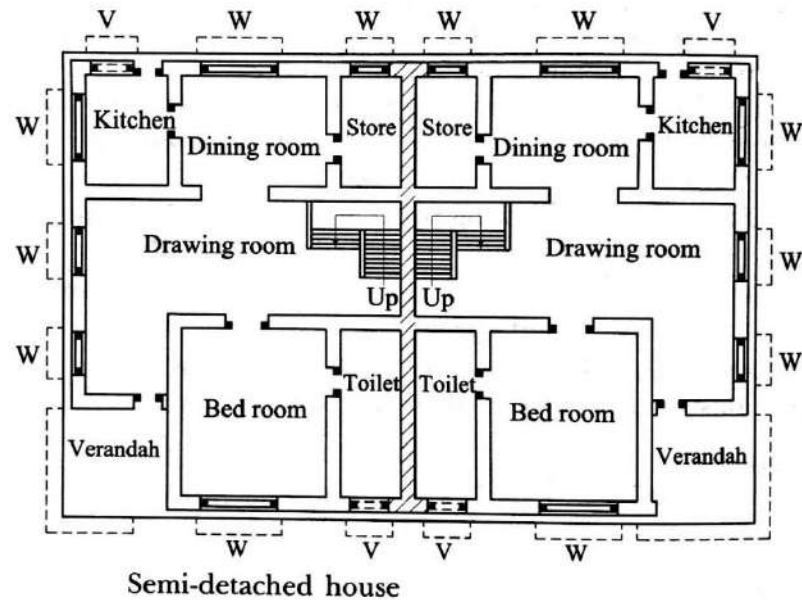
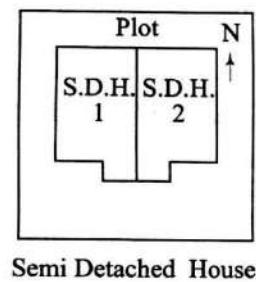


Fig: Detached House

SEMI-DETACHED HOUSE

Semi detached house is nothing but two detached houses arranged side by side with a wall separating them and one portion is on one side of it being the mirror image of other. It had all the advantages of detached house with less privacy. Extensive renovations of one particular portion house may not be possible.

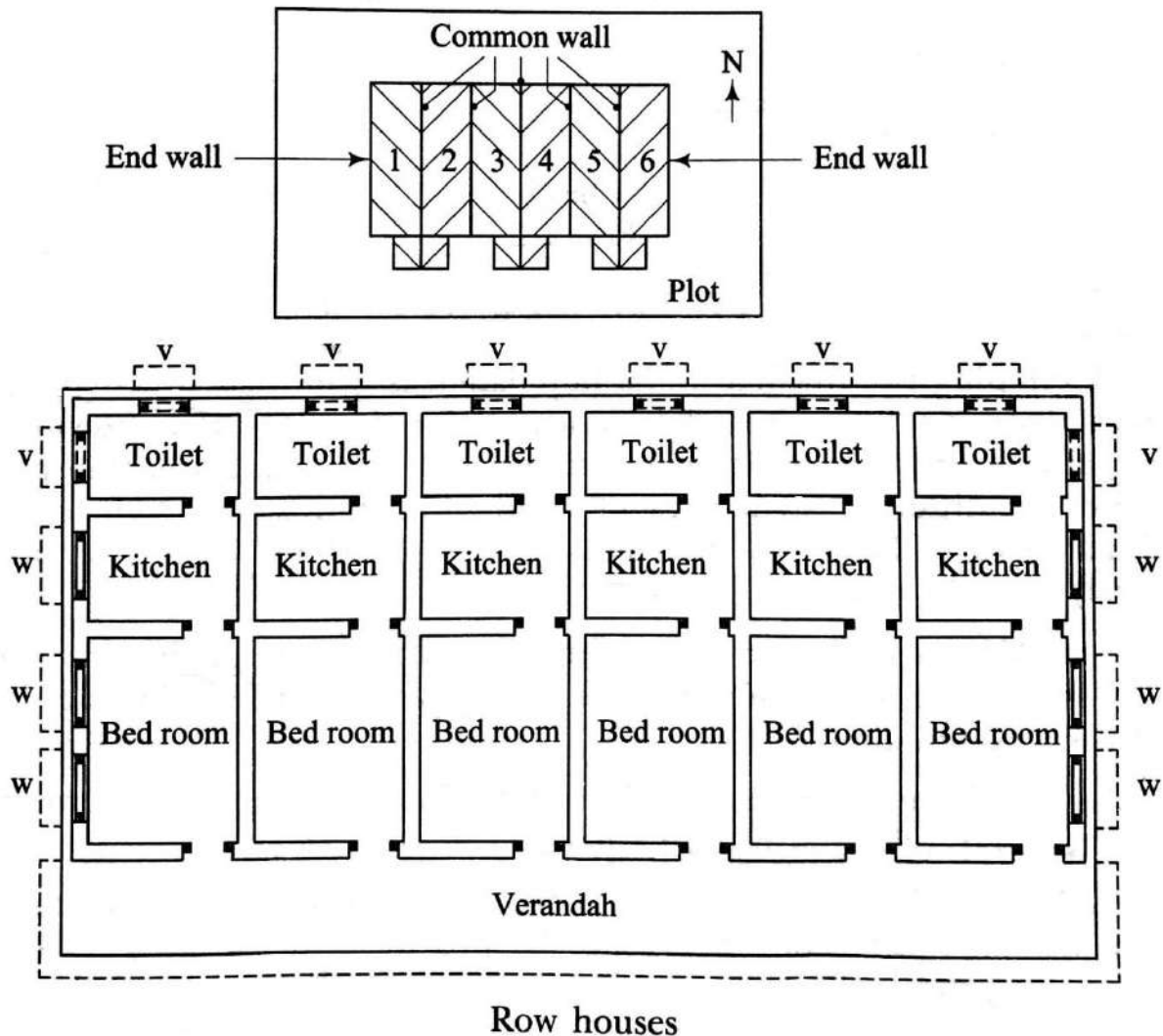
Semi detached house provide neighborhood, security and amity. It is cheaper to build and provides good accommodation for an average family. Because of being surrounded on three sides by space, it almost gives impact of being a detached house.



ROW HOUSE OR CHAWLS

These are single storeyed houses in a straight line with common long walls. All the houses are of same plan and occupy the least area, compared to detached and semi detached houses. These types of houses are very common in India. Railway staff quarters are mostly of this type because accommodation is to be provided for many in proximity of railway station.

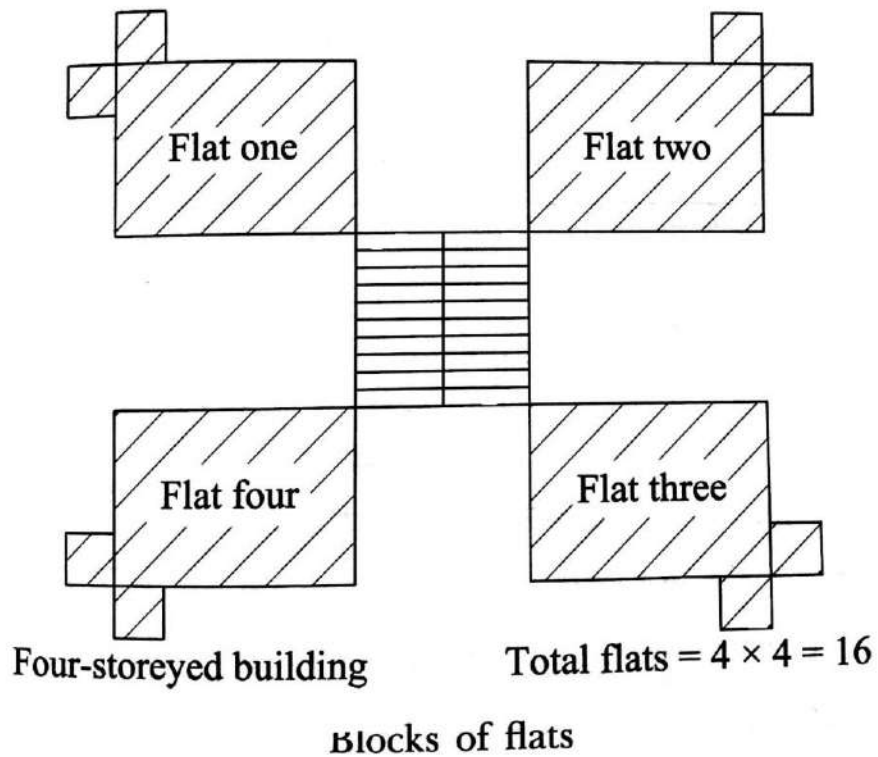
Each house may have two rooms one kitchen cum dining and another living cum bed room. A front verandah and back yard may be separately provided for every house. One water closet and bath may be provided for two or more families. Maximum security exists in this type of houses but less privacy because of common walls between houses. Hotels and dormitories are examples of row type housing.



BLOCK OF FLATS OR TERRACE HOUSES

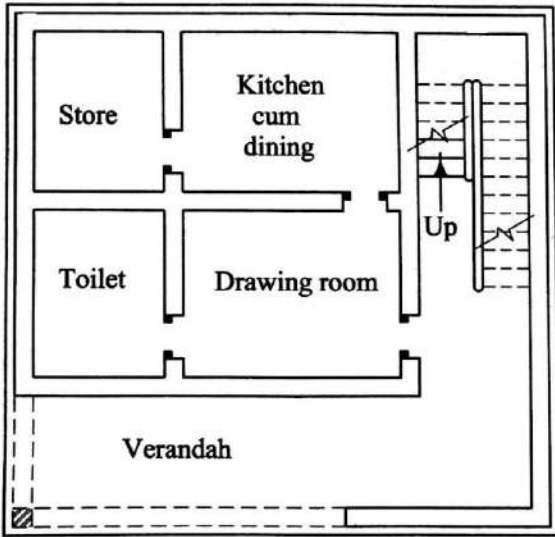
In a developing country like India population is growing t a fast rate. Land is limited to be used for agriculture, transportation, parks and for different structures of residential, industrial, commercial and recreational nature. Hence it is necessary to spread vertically over the horizontal area.

Flats or apartments are the clusters of detached or semi detached houses grouped and assembled at different levels of a single building. Any flat is a framed structure of three or more floors. In general its ground floor shall be free from walls and used for parking of vehicles. Flats can accommodate tens of families in a similar area. Any type of detached or semi detached house plan can be adopted for flats.

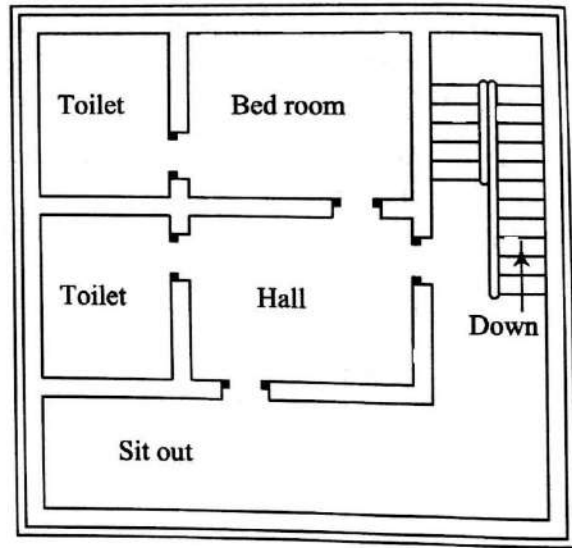


DUPLEX TYPE HOUSES

Duplex type houses are detached or semi detached type houses in which accommodation for a family is spread over two floors. These houses are constructed where the cost of land is high to accommodate all the rooms at the same level. Verandah, drawing, kitchen and dining are provided at floor level. Sit out, bed rooms and toilets may be provided at the first floor over the same roof area of ground floor.



(a) Ground floor



(b) First floor

Duplex house

UNIT – II: Climate and its influence on building planning

Introduction, elements of climate, temperature of air, wind, humidity, precipitation, topography, climatic zones in India, climate and comfort & landscaping.

Principles of planning of buildings: Principles of Aspect, prospect, privacy, roominess, grouping, circulation, sanitation, lighting, ventilation, flexibility, elegance, economy, practical considerations

Climate and its influence on building planning

Elements of climate:

- a) Solar radiation
- b) Temperature of air
- c) Wind
- d) Humidity
- e) Precipitation
- f) Topography of the place.

a) Solar radiation: (Fig 1 reference)

While **conduction** and **convection** require a medium for the slow transfer of heat, radiation is a fast mode of heat transfer that needs no medium.

Short wave solar radiation from the sun is only the source of heat reaching the earth on a bright day i.e., without clouds. As a part of it is reflected back due to reflecting surfaces, another part is absorbed by the dust and water vapour and only a fraction of it reaches the surface of the earth. **Albedo** is the reflective capacity of a surface to the solar radiation. Pure ice crystals may exhibit 90% Albedo, a white washed smooth surface of wall 75%, an irregular dirty surface 10% and a black surface 0% Albedo. The best orientation of any building is the building as whole should receive the maximum solar radiation in winter and minimum radiation in summer.

b) Temperature of Air:

The temperature of a large area is determined by the amount of solar radiation which falls upon that area during each season. Lowest temperature of the day may be recorded at the day break and highest temperature is around 2 p.m.

Concrete roof slabs, cement plastered walls and heat absorbing dark colours readily conduct heat and at times make the enclosed room hotter than surroundings.

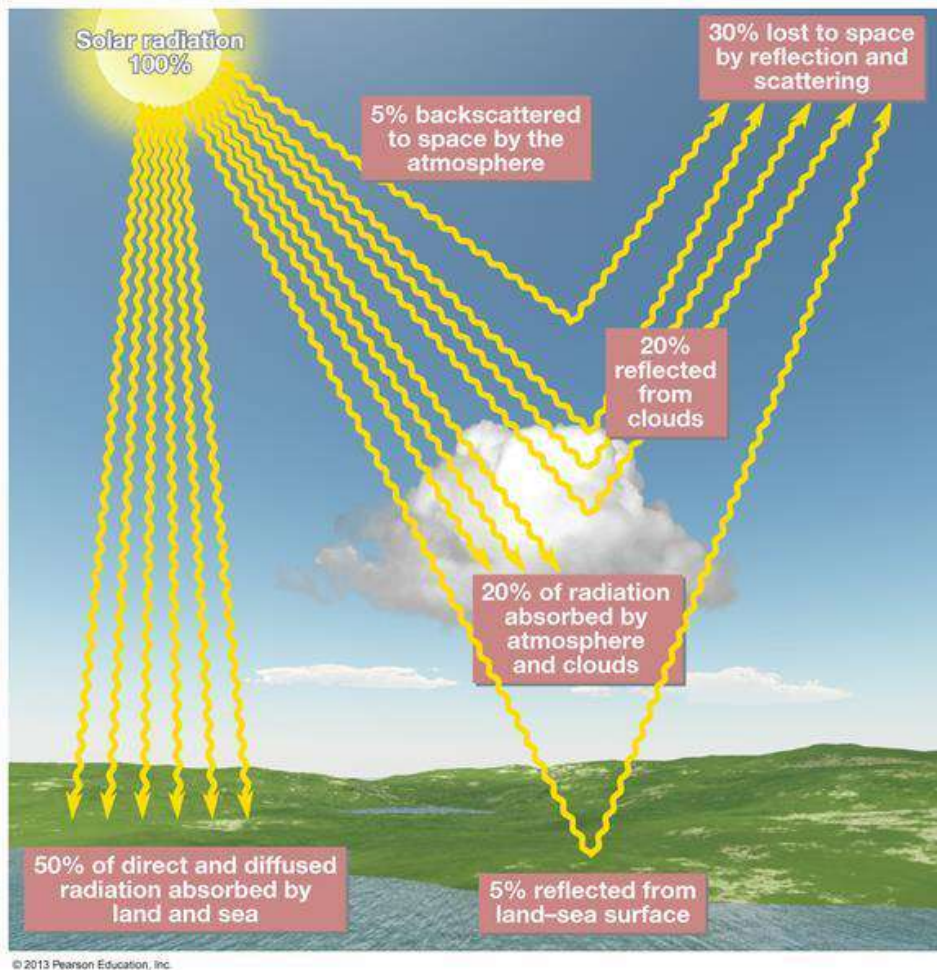


Fig 1: Solar radiation

c) Wind:

Wind is air in motion. It is designated by the direction of its origin i.e. west to east. It is in the practice to record the velocity of wind at a height of 10m above the Ground level

Its direction and velocity are very important in

- 1) Controlling cooling
- 2) Dust carrying and sedimentation
- 3) Raining

Based on the velocity of flow, moving air can be named or branded as following:

1. Breeze
2. Wind
3. Gale
4. Tempest
5. Hurricane.

Relative humidity varies from 10% to 100% depending up on temperature. The climate is said to be dry when relative humidity is less than 40% and humid when it is more than 40%.

e) Precipitation:

It is the amount of rainfall and snowfall at a place. Growth of vegetation depends on it. Pitched roofs are to be provided where rain fall is heavy.

f) Topography:

It is the physical appearance of the land

1. Plains: flat site making an angle of less than 4° with horizontal i.e. slope of 7% or less.
2. Hilly regions: in this angle more than 20° with horizontal i.e., slope greater than 36%.

The topography or land form of a site and surroundings could either flat, sloping and undulating. If the land is flat similar conditions would prevail over the entire site.

CLIMATIC ZONES OF INDIA:

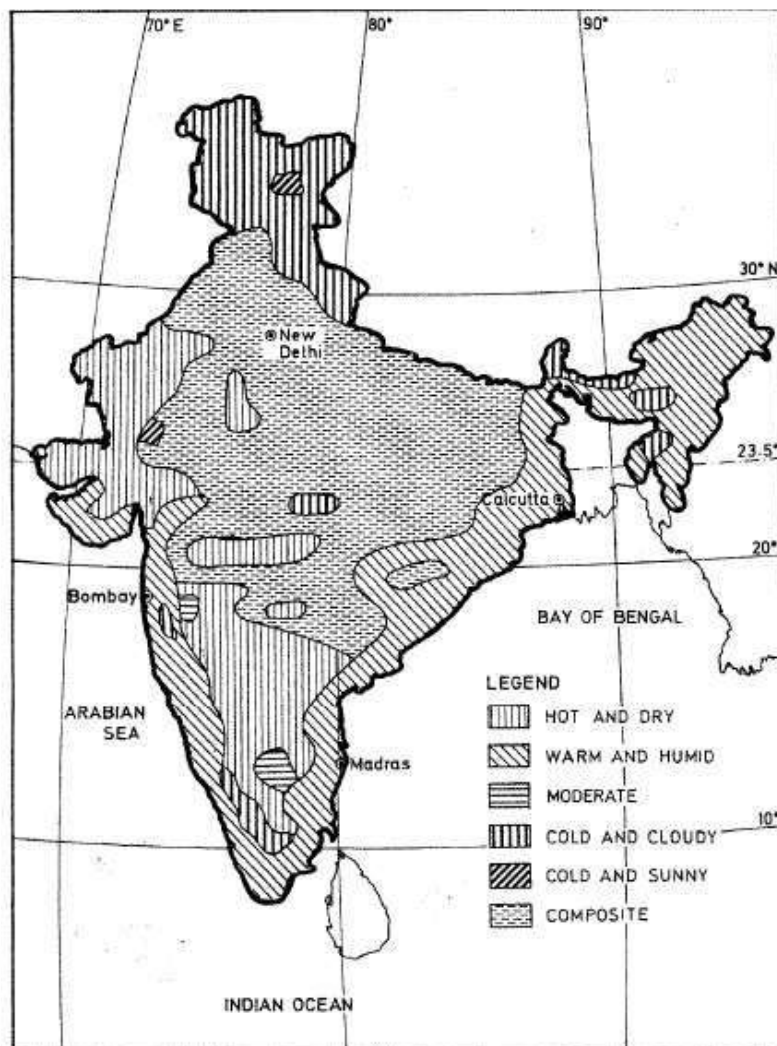


Fig 2: Climatic zones in India

1. Hot dry zone (northern India and Central India)
2. Warm humid zone
3. Composite zone.
4. Cold zone.
5. Moderate.

Table 2

S.No	Climate zone	Mean monthly temperature °C	Relative humidity %	Mean precipitation (mm)	Number of clear days in an year
1	Hot & dry	>30	>55	<5	>20
2	Warm& humid	>30	>55	>5	<20
3	Cloud & cloudy	<25	>55	>5	<20
4	composite	This applies when 6 months or more do not fall within any of the above categories			

1. Hot dry zone:

In India this type of climate can be experienced in **Jaisalmer (Rajasthan), Jodhpur (Rajasthan) and Sholapur (Maharashtra).**

Temperature

- In summer, 40-45°C during day & 20-30°C at night.
- In winter, 5-25°C during day & 0-10°C at night.

Humidity

- Humidity is very low ranging from 25-40%

Precipitation

- Due to very less rainfall the annual precipitation is less than 500 mm.

Sky conditions

- Sky is normally clear and blue.
- Sometimes dust storms fill complete sky and create unbearable glare.

Solar radiations

- solar radiation is direct and strong during day and often
- Escapes into clear skies during nights.

Wind

- High speed dusty winds (20 to 30 km/hr) are very common for this type of climate.
- Wind often changes directions locally.

Soil and vegetation

- Soil is very loose and sandy with very poor vegetation.
- Only thick leaves and thorny plants can easily survive here.

Building characteristics

1. North-south orientation as it protects from morning and evening solar radiations.
2. Bedrooms should be oriented to receive cool night air.
3. Courtyard along with some trees and small water body creates cooling effects.
4. Thicker external walls with minimum windows to avoid heat and solar radiations.
5. Window sill should be higher to provide dust protection.
6. Deep sun shades are required to shade windows effectively.

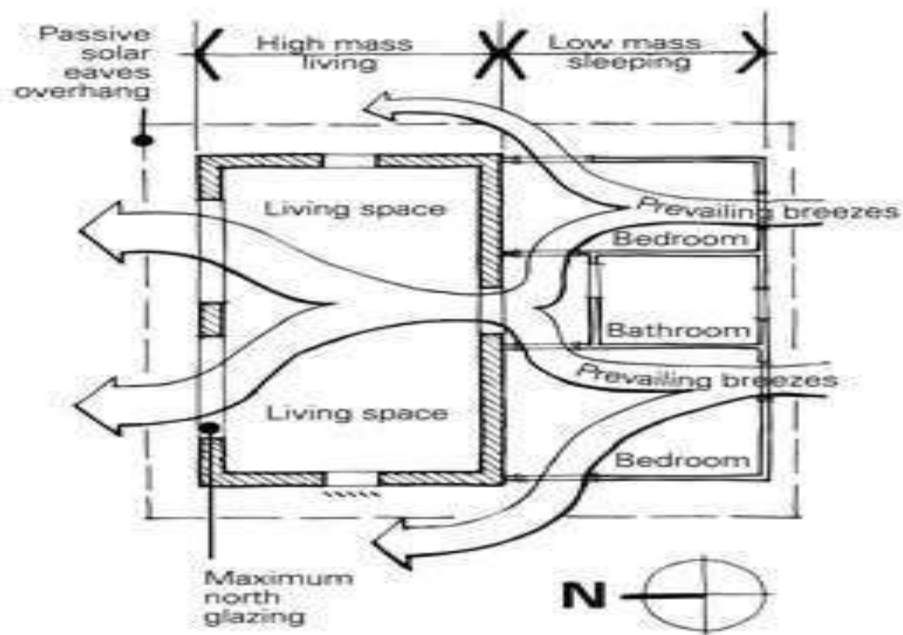


Fig 3: **Hot dry zone**

2. Warm humid zone:

In India this type of climate can be experienced in **Mumbai, Kolkata, Chennai, Goa.**

Characteristics of warm and humid climate

Temperature

- In summer, 30-35°C during day & 25-30°C at night.

- ☐ In winter, 25-30°C during day & 20-25°C at night.

Humidity

- ☐ humidity is very high ranging from 70-90%

Precipitation

- ☐ Precipitation is very high about 1200 mm/yr.

Sky conditions

- ☐ Sky is fairly cloudy.
- ☐ Cloud covers 60-90%.

Solar radiation

- ☐ the intensity of solar radiation is high during summers
- ☐ And moderate during winters.

Wind

- ☐ Wind velocity is low, calm and periodic. But may be strong
- ☐ During rain squalls.

Vegetation

- ☐ Grows quickly due to frequent rains.
- ☐ Difficult to control.
- ☐ high humidity accelerates mould and algae growth,
- ☐ Rusting and rotting.

Building characteristics:

1. Buildings should be spread out with large open spaces in between for unrestricted air movement.
2. Cross ventilation is very important. Large openings to unobstructed air path and to ensure proper ventilation.
3. The openings should be shaded by external overhangs. Outlets at higher levels to vent hot air.
4. Ceiling fans are effective in reducing the level of discomfort.
5. Proper water proofing and quick drainage of water is essential due to heavy rainfall

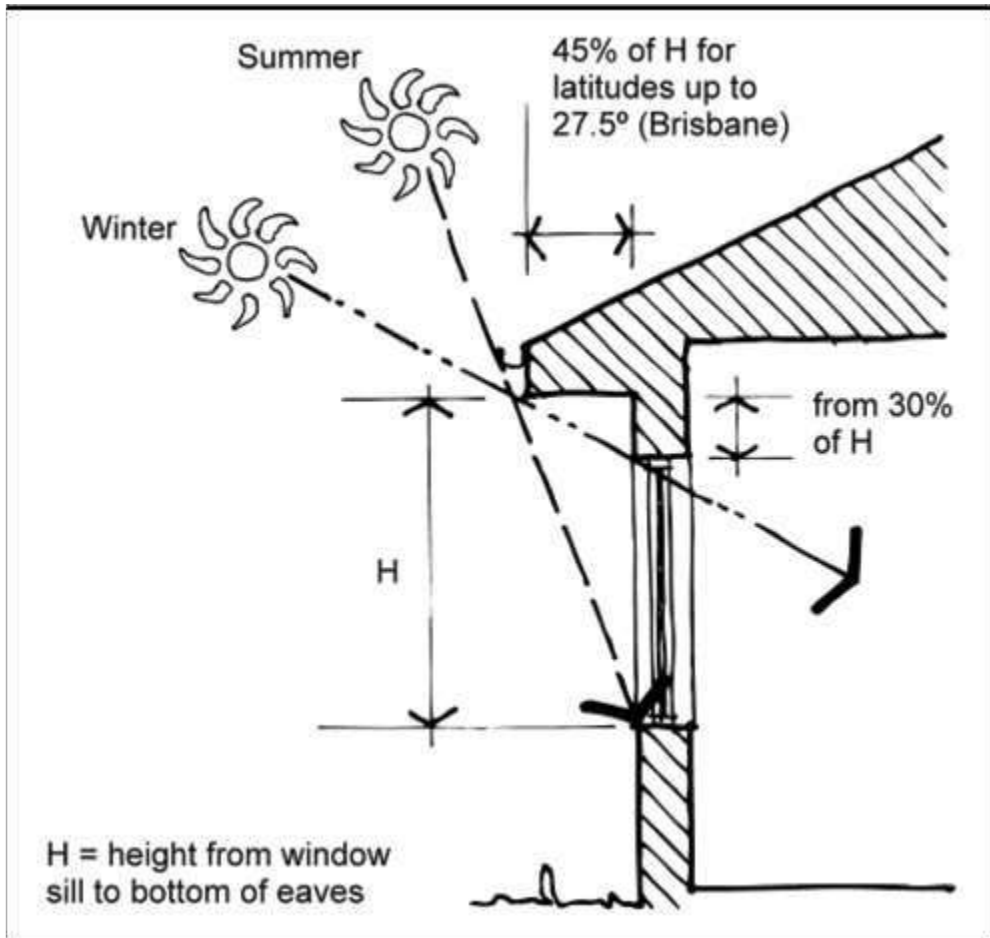


Fig 4: **Warm humid zone**

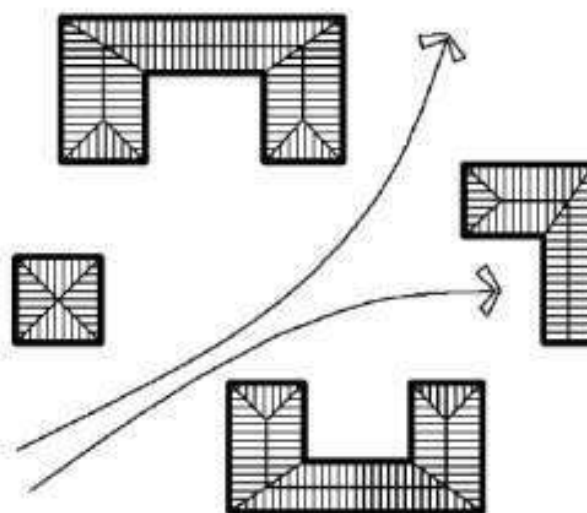


Fig 4: **Warm humid zone**

3. Composite zone:

In India this type of climate can be experienced in **New Delhi, Kanpur,**

Allahabad etc.

Temperature

- In summer, 32-43°C during day & 27-32°C at night.
- In winter, 10-25°C during day & 4-10°C at night.

Humidity

- The relative humidity is about 20 – 25 % in dry periods and 55 – 95 % in wet periods

Precipitation

- Precipitation varies between 500-1300 mm per year.

Sky conditions

Sky is overcast & dull in the monsoon, clear in winter & frequently hazy (మబ్బులు) in summer.

Solar radiation

The intensity of solar radiation is very high in summer with diffuse radiation. In monsoons, the intensity is low with Predominantly diffuse radiation.

Wind

Winds are strong during monsoons from the south-east and dry cold winds from the north-east. In summer, the winds are hot and dusty.

Vegetation

A variable landscape and seasonal vegetation characterize this zone.

BUILDING CHARACTERISTICS

1. Appropriate orientation and shape of building.
2. Use of trees as wind barriers & ponds for evaporative cooling.
3. Roof & wall insulation, thicker walls, air locks & balconies.
4. Walls, glass surfaces protected by overhangs, fins, & trees.
5. Exhausts, courtyards, wind towers, & arrangement of openings.

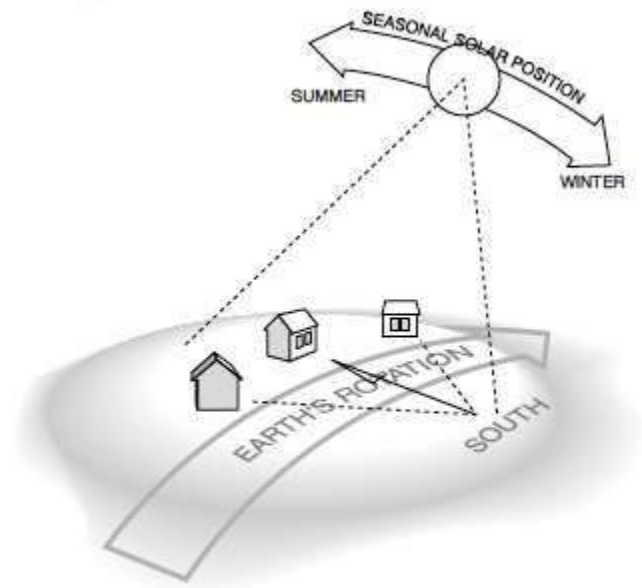


Fig 5: orientation of building in composite zone



Fig 6: window shades

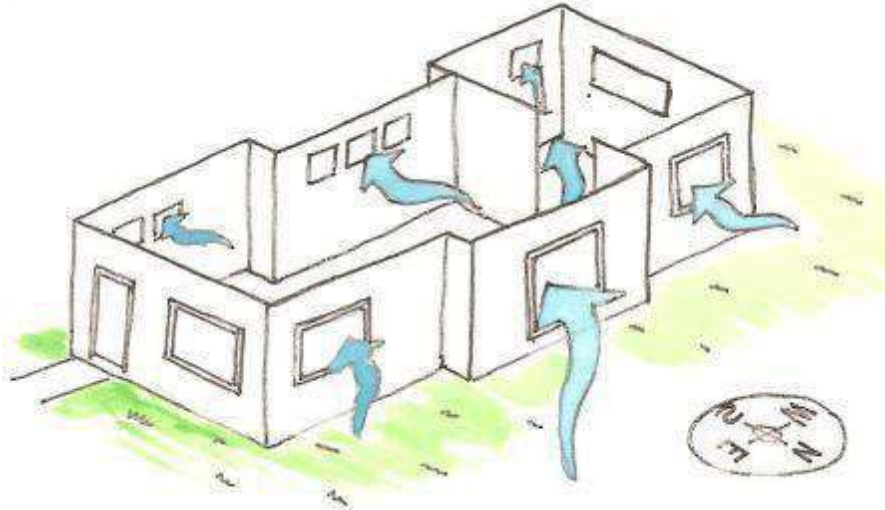


Fig 7: Openings

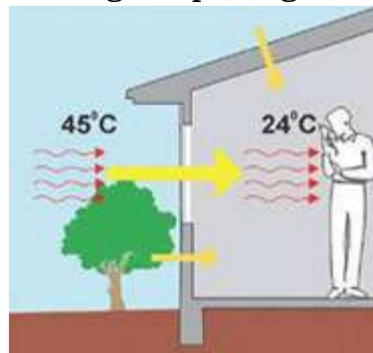


Fig 8: Vegetation

4. Cold zone.

It is divided in to 2 zones

- I. Cloud and cloudy
- II. Cloud and sunny

I Cloud and cloudy:

In India this type of climate can be experienced in **Shimla, Shillong, Srinagar, Mahabaleshwar.**

CHARACTERISTICS OF COLD AND CLOUDY CLIMATE:

Temperature

- In summer, 20-30°C during day & 17-27°C at night.
- In winter, 4-8°C during day & -3-4°C at night.

Humidity

- Humidity is generally high and ranges from 70 - 80 %.

Precipitation

- Annual total precipitation is about 1000 mm and is disturbed evenly throughout the year.

Sky conditions

- Sky is overcast for most part of the year except during the Brief summer

Solar radiation

- Solar radiation is low in winter with a high percentage of Diffuse radiation.

Wind

- This region experiences cold winds in the winter season.

Vegetation

- Vegetation is abundant in summer.

BUILDING CHARACTERISTICS

1. The building should be designed to reduce heat loss by insulation and infiltration, and promoting heat gain by directly admitting and trapping solar radiation within the living space.
2. Low ceiling provide insulation and conserve the warmth. Windows face the sun.

II. Cloud and sunny:

In India this type of climate can be experienced in **Leh, Mount Abu.**

CHARACTERISTICS OF COLD AND SUNNY CLIMATE:

TEMPERATURE

- In summer, 17-24°C during day & 4-11°C at night.
- In winter, -7-8°C during day & -14-0°C at night.

HUMIDITY

- Humidity is generally low and ranges from 10 – 50 %.

PRECIPITATION

- Precipitation is generally less than 200 mm per year.

SKY CONDITIONS

- Sky is fairly clear throughout the year with a cloud cover of less than 50%.

BUILDING CHARACTERISTICS

1. The building should be designed to resist heat loss by insulation and controlling infiltration, and promoting heat gain by directly admitting and trapping solar radiation within the living space.
2. Roof insulation, wall insulation and double glazing. Windows face the sun.

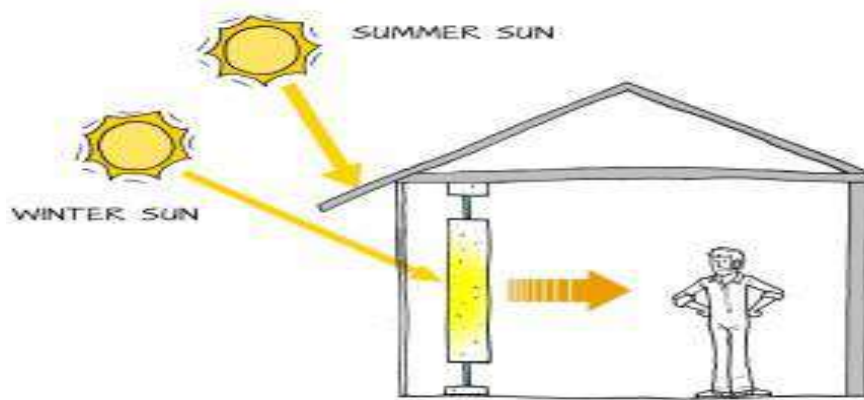


Fig 9: Trombe wall

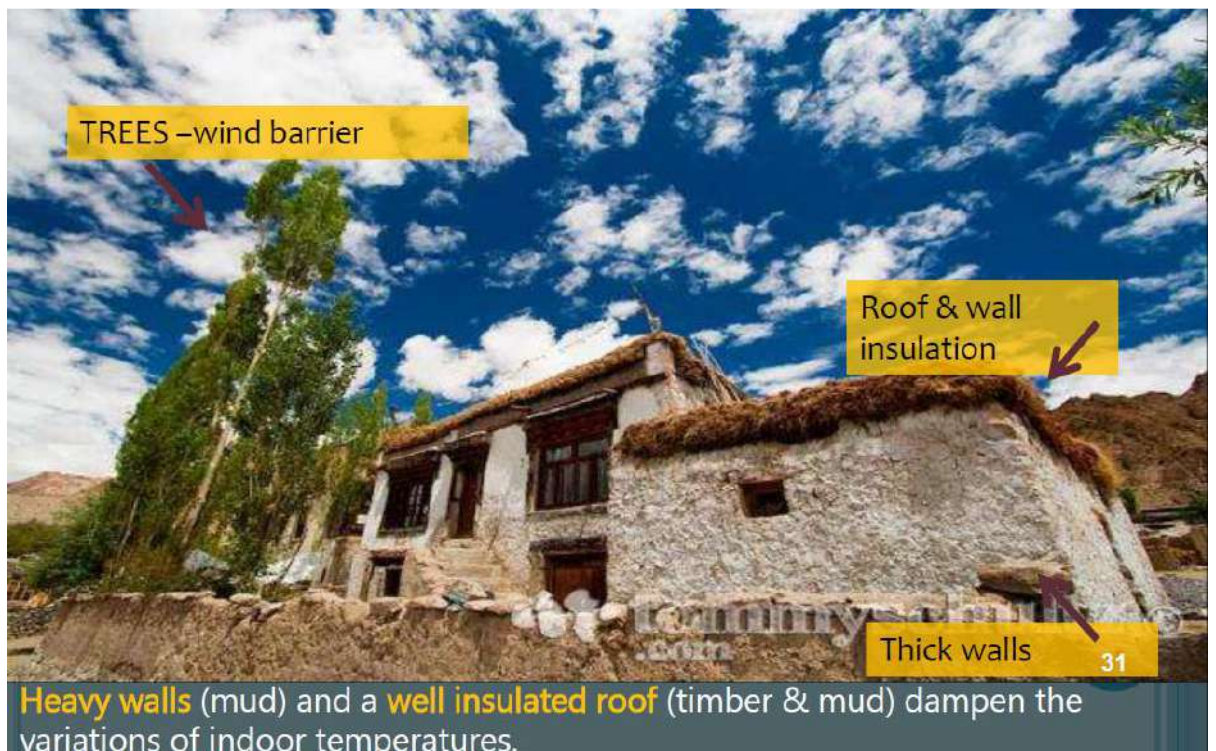


Fig 10: Protection against Cloud and sunny climatic zone

5. Moderate zone:

In India this type of climate can be experienced in **Bangalore, Pune**

CHARACTERISTICS OF MODERATE CLIMATE:

TEMPERATURE:

- In summer, 30-34°C during day & 17-24°C at night.
- In winter, 27-33°C during day & 16-18°C at night.

HUMIDITY:

- Humidity is low in winter and summer, varying from 20-55% & going up to 55-90% during monsoons.

PRECIPITATION:

- Precipitation is low.

SKY CONDITIONS:

- Sky is mostly clear with occasional presence of low, dense clouds during summers.

SOLAR RADIATION

- Solar radiation is more or less same throughout the year.

WIND

- Winds are generally high during summer.

VEGETATION

- Vegetation is fairly abundant.

BUILDING CHARACTERISTICS:

1. The building should be designed to reduce heat gain by providing shading and to promote heat loss by ventilation.
2. Buildings should have thick walls with high ceiling Rooms, surrounding by a shade giving verandah.
3. High ceilings reduce the effect of heat that would radiate down from the roof which would get hot under the sun. This will also allow the warm air to rise and escape through ventilators, high up in the walls.

CLIMATE AND COMFORT:

- 1) A temperature between 18° and 28°C shall be quite pleasant
- 2) A relative humidity between 15% and 70% gives us better comfort.
- 3) Air movement is not necessary during dry weather. It is a must in humid environment. Neither hot wind nor chill wind is welcome.
- 4) An air with a velocity of 0.3m/s goes unnoticed, a gentle soothing breeze of velocity 0.3 to 0.5m/s shall be quite present, a gently sailing wind at 0.5 to 1m/s makes its motion felt and a value of 1 to 1.5m/s is draughty

Room temperature	Relative humidity	Desirable velocity of wind for comfort
27°C	60%	0.3
	75%	1
	90%	1.7
30°C	30%	0.3
	40%	1
	50%	2
	60%	3

Table 2: Climate and comfort

- 5) At high temperatures, more velocities of wind are required for comfort. Similarly at low temperatures comfort can be achieved by controlling air movement.
- 6) Lighting should be such that adequate level of illumination falls on the work place.

Principles of planning of buildings: Principles of Aspect, prospect, privacy, roominess, grouping, circulation, sanitation, lighting, ventilation, flexibility, elegance, economy, practical considerations.

Principles of Aspect:

The arrangement of doors and windows in external walls of a building will allow the occupants to receive and enjoy nature's gift as sunshine, breeze and scenic beauty of landscape. The manner of arrangement of the doors and windows of the external walls of the building to draw maximum advantage from sun and wind is termed as Aspect. A room which receives light and air from a particular direction is said to have aspect of that direction.

Aspect is a very important consideration in the planning of a building. It influences the appearance of a building. A building must be designed to suit the site with all its varying aspects. Aspect not only provides comfort, but it is requisite from the hygienic point of view as well.

Each room of a residential building should have a particular aspect because certain rooms need morning sun and other rooms need less light.

Room	Recommended aspect	Influence factor
Bed	NW-W-SW	To receive plentiful of breeze in summer
Kitchen	E and rarely NE	To receive morning sun which is germicidal. It purifies the air.

Dining	N,NE,SE	Proximity of kitchen. It should be cool less illuminated
Drawing	SE-S-SW-W	Adequate natural lighting during winter and obviate the sun during summer.
Reading	N-NW	Light from north being diffused and evenly distributed and cool
Store	NW-N-NE	Dark and cool

Table 3: Aspect of different rooms in buildings

Prospect:

A building is said to have prospect when it presents a good and pleasing appearance when seen from outside. It is used to mean the external view as certain rooms of the building. Exterior wall painting and windows should be provided in an attractive manner. Projected windows permit more light and air inside the rooms

Privacy:

For residential building planning privacy is important is important consideration. For more privacy centre door location should be avoided. It is essential for bath room, water closet, bed room and an office room.

Privacy is broadly classified in to 2 types:

1. Internal privacy
2. External privacy.

Internal privacy: internal privacy is the privacy within the building it can be achieved by following points:

- a) Proper grouping of rooms as bed, dressing and toilet, kitchen and planning.
- b) Careful planning of entrance and circulation space.
- c) Better disposition of doors and windows and mode of their hangings.
- d) Locate the doors at one corner rather than at the middle.
- e) Doors with single shutter offer more privacy only when they have kept closed
- f) Doors with double shutter offer better privacy as one shutter can be closed and other opened.
- g) Internal privacy can be obtained by proper grouping of rooms and careful planning of circulation space.

External privacy: privacy of the whole building with reference to the surrounding buildings and roads.

- a) Having a compound wall to a height of 1.35m to 1.5m above the adjacent road level.
- b) Construction of porch or portico at the main entrance.

- c) Planting trees along the compound walls which act as a sound barriers and sight barriers as well.
- d) Providing curtain walls, dwarf walls.
- e) Planting the shrubs along the boundary of the building.

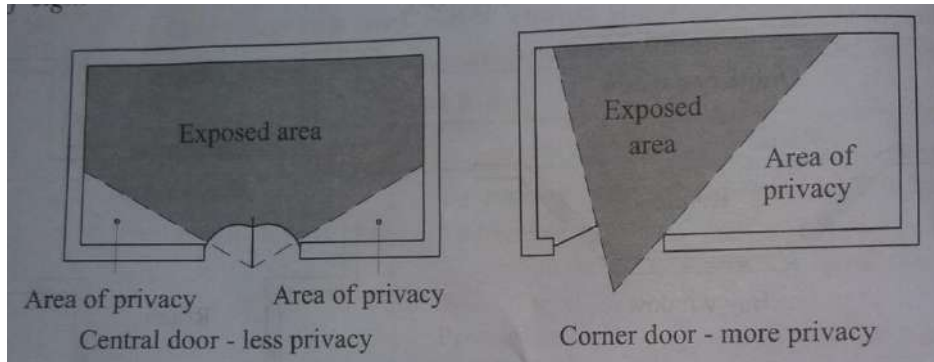


Fig 11a: Privacy

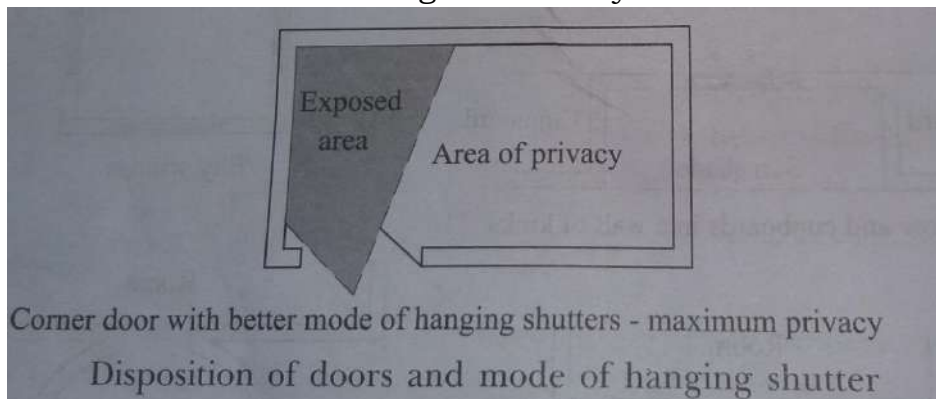


Fig 11b: Privacy

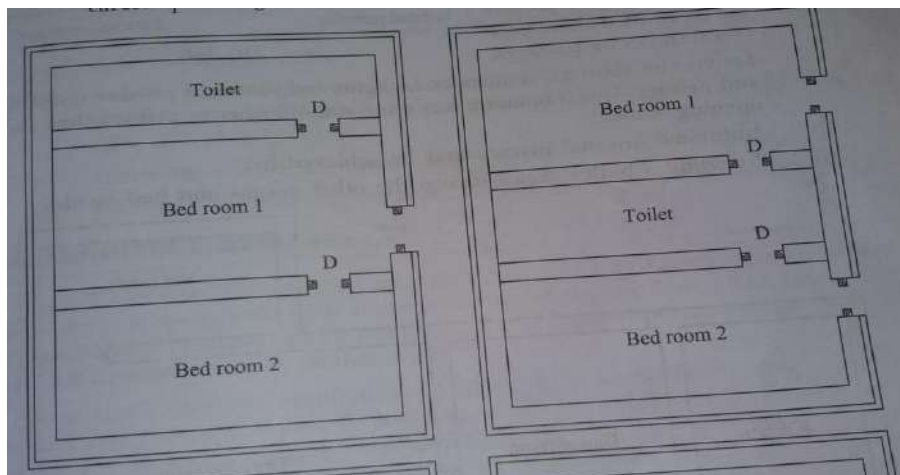


Fig 12 privacy in rooms

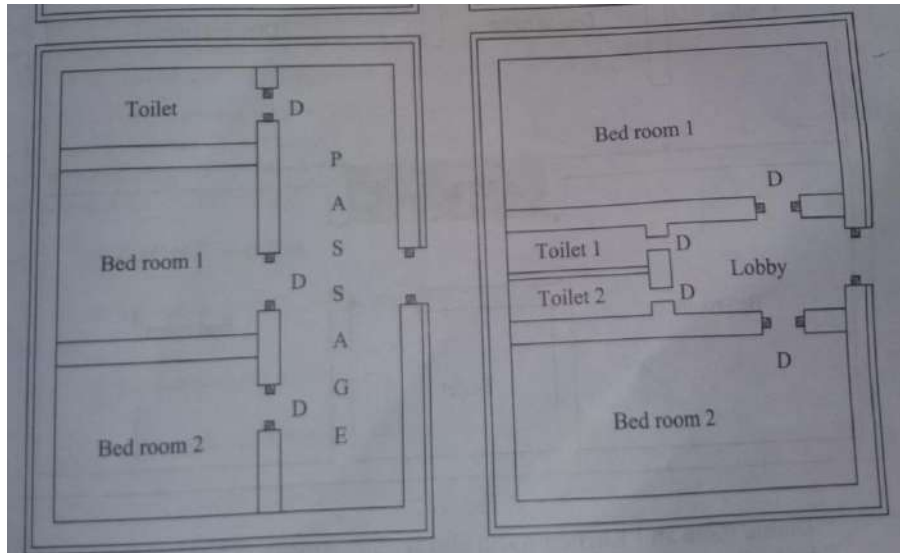


Fig 13 privacy of rooms having lobby or passage

Grouping:

Grouping is the planning of two or more related rooms in proximity of each other. It minimises the length of circulation and at the same time it provides comfort, privacy and convince of the inmates of the house.

Important points to be considered while planning residential building.

1. Verandah adjacent to the drawing room has its own advantage.
2. The dining room close to the kitchen permits an easy serving of dishes whether they are cold or hot.
3. The bed room, toilet and dressing room may be grouped together for better privacy.
4. Water closet and bath room should be nearer to each other this saves the length of the water supply pipeline.
5. Kitchen should be nearer to the backyard and the door and windows are so located that the house wife can have a free unobstructed sight of the children playing in the open space or in the drawing room.
6. If more than one bedroom is provided, they should have an easy access to the dining room.
7. Staircase should be located and easily accessible from drawing room.

- Grouping refers to be easy communication and utility of various rooms.
- Kitchen and dining room should be close to each other.
- Storeroom should be adjacent to kitchen
- WC and urinals should be far away from the kitchen
- Kitchen and toilet black not exposed to drawing room.
- Bedroom connected to bath and less exposed to drawing room.

Circulation:

- Circulation refers to providing through passage between rooms in building.
- It is necessary to permit horizontal circulation through passage, corridors and lobbies and vertical circulation through staircases, lifts and ramps in building.

Circulation area should be straight, short, bright, lighted and well ventilated. Circulation should neither affect the privacy of a room.

Circulation in a building is of two types:

- I. Horizontal circulation
- II. Vertical circulation

Horizontal circulation:

It is facilitated within the building by verandahs, corridors, halls and lobbies. Passages should never be narrow, dark, zigzag or winding. They should be free from obstructions.

No stationary object is to be placed in area of circulation. Area of Horizontal circulation may constitute about 20-25% of the total plan area of a residential building.

Vertical circulation:

It is the movement from one floor to another in a multi-storeyed building. It is possible because of stairs, ramps, elevators and escalators. Vertical circulation may constitute about 8-10% of the total plan area. Ramps are common for the movement of heavy objects like cars, bikes going up in the multi-storeyed building. Lifts (elevators) are provided when numbers of storeys are more than three.

Sanitation:

It is the provision and upkeep of the various components of a house to keep the inmates cheerful and free from diseases.

Factors influencing sanitation are:

- a) Lighting
- b) Ventilation
- c) Cleanliness

Lighting

It can be natural light as that obtained from the sun during day or artificial one as that from a filamentous bulb or fluorescent light. Fluorescent light produces more illumination per unit of power consumed and hence is cooler and produces a softer shadow.

Good visibility is a must for comfortable watching, reading, decoration avert confusion and for efficient security.

Day lighting:

Sun is the main source of light. Day light is treated a artificial illumination. Morning sun is pleasant and has vitamin D. it is best tonic for

rickets. Sun rays can kill the pathogenic bacteria and keep the vision clean. Natural light stimulates the blood. This stimulation controls T.B

The intensity of illumination depends up on

- Sky factor
- Solar altitude
- Latitude
- Season
- Orientation of windows.
- Transmission factor
- Reflection factor of walls, ceiling and flooring

Day light factor = incidental light + reflected light, 1% day light factor \approx 80 Lux

In a residence the following minimum illumination is needed:

Room	minimum illumination (Lux)
Kitchen	200
Drawing room	100
Bed room	50
Study room	150
Corridor, stair, dining	50
For causal seating	100
Office work	400
Very fine jobs	900
Extremely fine jobs	2000
Auditoriums	50
Showrooms	300
Shops	200
Airports	300
workshops	200

Table 4: Lighting

Cleanliness:

Dust is a hazardous bacterium. Besides rendering the surface dull, it creates health problems. Hence the floor, receives the most of the dust it should be smooth, impervious, non-absorbing and uniform sloping so that it can collect less dust and is easily cleaned. Dampness is the root cause of infection. Hence, walls and floors should be damp-proof.

Sanitary conveniences such as bath and water closet should be so designed that the waste water drains off as quickly as possible. Similarly waste water generated in the kitchen must find a way out in hygienic manner.

Flexibility:

Flexibility is the ease with in which a room planned for one function is used for other. It is the ease with which a room designed for a particular activity can accommodate more load temporarily or sometimes may have to supplement the activity of another room as the drawing room being used as a bed room for guests, kitchen as additional dining room etc. having a common bath room is more flexibility for guests. The plan of building should be prepared by keeping mind the future requirement.

Elegance:

Elegance is grand architectural appearance of a building because of grand elevation which in turn good plan. Elegance refers to the planning of elevation and layout of the plan to give an impressive appearance to the building. The proper width, height, location of doors and windows, materials employed in construction of exterior wall etc. create elegance. The result of elegance is aesthetics of building.

A better elegance can be obtained by

- a. Selecting superior building materials for facing such as polished stones of granite, marble or mosaic.

Glass- Transparent or opaque, coloured or plain.

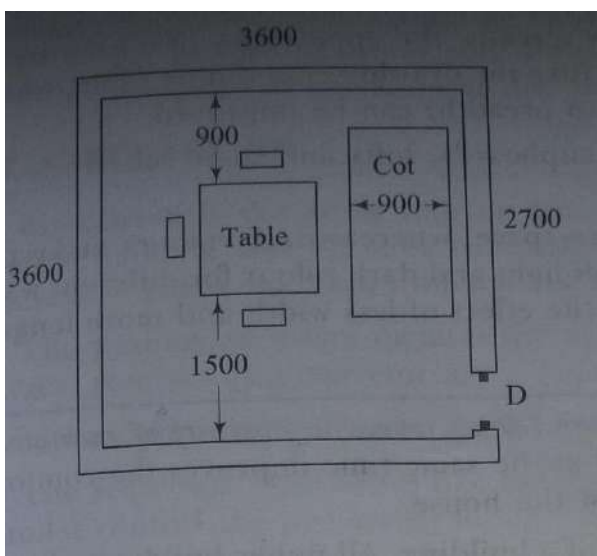
Timber – polished teak or sunglass

- b. Providing projections like sunshades, balconies, porch.

Roominess:

It is the general feeling created after a room is well-furnished with all permanent furniture as a spacious and well planned. The room should be such that it can be put the maximum use but having minimum possible dimensions.

Some rooms may create the impression of being crammed with furniture, whereas some others may create a tunnel like feeling as we enter.



Size of a room 3600*3600mm

Area =12.96m²

Chair=450*450mm

Table=1200mm*1200mm

Cot =900*1800mm

Fig 14: Roominess of a square room

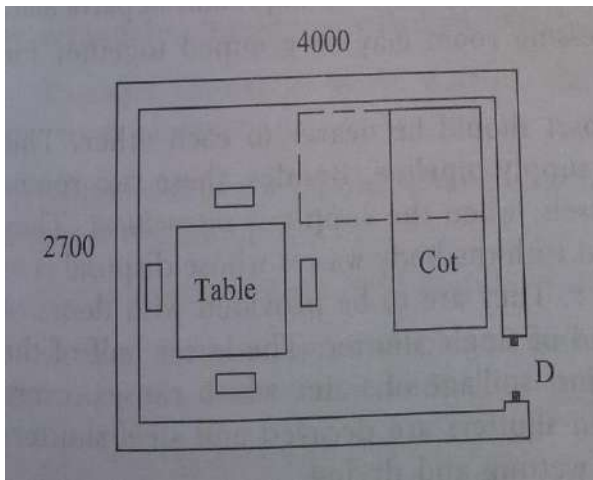


Fig 14: Roominess of a rectangular room

BUILDING PLANNING & DRAWING

UNIT 3

PLANNING OF PUBLIC BUILDINGS

UNIT-III: Planning of Residential and Public Buildings

Residential Buildings: Selection of site for residential buildings, Guidelines for planning and drawing of residential building.

Public Buildings: Requirements and planning of educational institutions, hospitals, banks, industrial buildings and bus station.

Learning material

Residential Buildings

Site selection for residential buildings

Every human being likes to work and live in comfortable and pleasant surroundings. The site for a residential building should present a peaceful environment, good landscape, sun for the most part of the day and uninterrupted flow of natural air. There are various factors to be considered in selecting a suitable site for construction of residential building and are as follows:

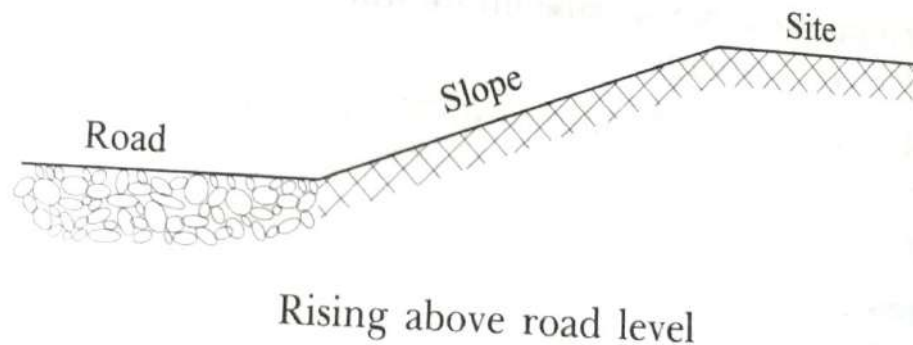
1. Topography
2. Nature of sub soil
3. Position of the ground water table
4. Facilities
5. Neighborhood
6. Certain things those should not be near the site
7. Vegetation
8. Shape of the site
9. Availability of men and materials
10. Proximity to sea-shore, river or lake or a place of natural beauty.

1. Topography

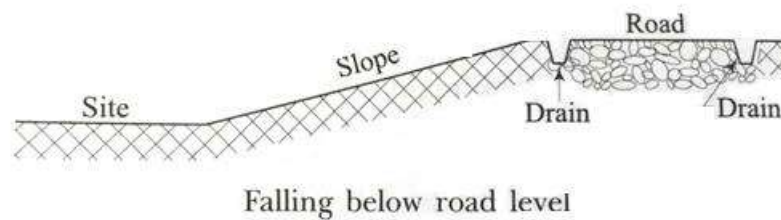
Plain grounds: plain sites offer easy marking, excavation and construction. No leveling is needed. But drainage becomes a problem and stagnant pools will be formed after a heavy rainfall.

Sloping grounds: a bare minimum of 1%(1 in 100) slope is required for effective drainage. 2%(1 in 200) is the minimum slope for the drainage lawns. Slope easily gets noticed when it exceeds 5%. Parking (for vehicles) area should not be steeper than 5%. 10% slope is the upper limit for a pedestrian ramp.

- a) *Site at higher level:* In such cases, where site is above the road level, drainage doesn't pose any problem and rain water and waste water flow down, if slopes are utilized properly.



- b) *Road at higher level:* Runoff from the road may rush into the site which is highly unhygienic and leads to health problem. It is to be intercepted by drains on either side of the road.



Undulating ground: building construction on undulating ground can be done after leveling. Sometimes split level construction is carried out when the fluctuations in undulations are very wide or the ground is sloping very steeply.

Elevated site: An elevated site gives a majestic appearance and enhances the beauty of the structure built over it. Such a site presence good view of the landscape.

Low lying area: a low lying area is to be avoided as far as possible. The engineering skills in construction and architectural rendering of the building will go un noticed.

2. Nature of sub-soil

Various types of soil that present beneath the earth are as follows:

- i. Rocky soil
- ii. Gravels
- iii. Hard moorum and sandy soil
- iv. Clayey soils
- v. Hard pan type soils
- vi. Fibrous soils rich in peat and organic matter
- vii. Made up or reclaimed soils

3. Position of ground water table

Water is quite essential for the survival of any form of life and also during construction of any building. Hence, if a well is dug at the site, potable water must be available at a reasonable depth.

4. Facilities

Various types of facilities that are needed near residential areas are as follows:

- a) Fire protection
- b) Police
- c) Water supply
- d) Gas supply
- e) Electrical power supply
- f) Drainage line
- g) Amenities such as schools
- h) Hospitals
- i) Telephone etc.

5. Neighborhood

Our living in environment is controlled by neighborhood. Residential buildings are undesirable in commercial and industrial areas.

6. Certain things those should not be near the site

Residential site should be as far as possible from certain things like

- a) Industries
- b) Sewage farms
- c) Marshes
- d) Garbage disposal land
- e) Markets and theaters
- f) Brick or lime kilns
- g) Quarries
- h) Stagnant pools
- i) Flood plains

7. Vegetation

A site having trees, shrubs and bushes over it is to be preferred to a bare and barren site. While trees with fruits and flowers give pleasant atmosphere, even others provide us with privacy, shade, oxygen during the day, greenery, pleasant sight and act as barriers of heat, dust and noise.

8. Shape of the site

Rectangular shape of sites of length one to two times its width and preferably the width being parallel to the road is ideal. Triangular shaped sites are to be avoided.

9. Availability of men and materials

Materials of construction as stones, bricks, timber, steel, lime, cement, sand and good quality water should be available at the site insufficient quantity.

10. Proximity to sea shore

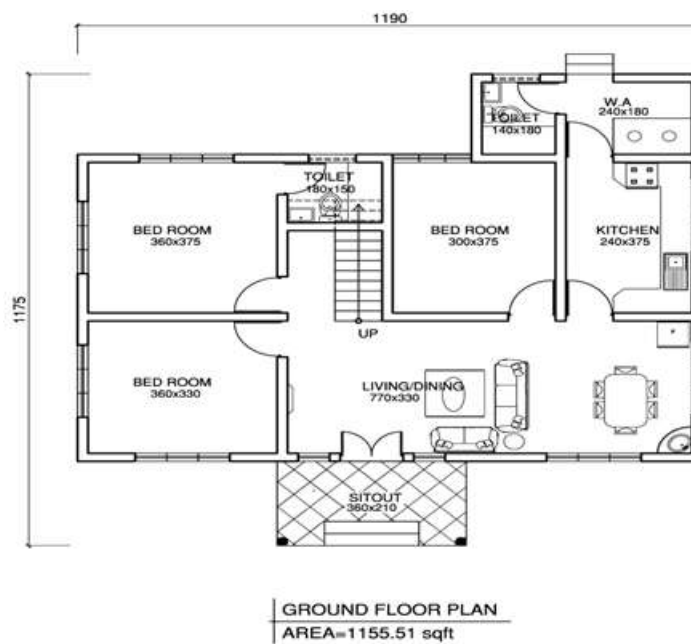
A building near seashore has following advantages

- a) Pleasant view of sun rise, sun set, moon rise
- b) Cool breeze during summer and slight warmth during winter
- c) Ozone of beaches induces exhilarating effect

Guidelines for planning and drawing of residential buildings

Residential buildings need to be planned according to

- Needs of the occupants
- Available funds for construction.
- Materials for construction
- Metrological conditions for the area.



PLANNING OF HOUSE

A house can be divided into three major areas. These areas are:

- LIVING AREA

- SLEEPING AREA
- SERVICE AREA

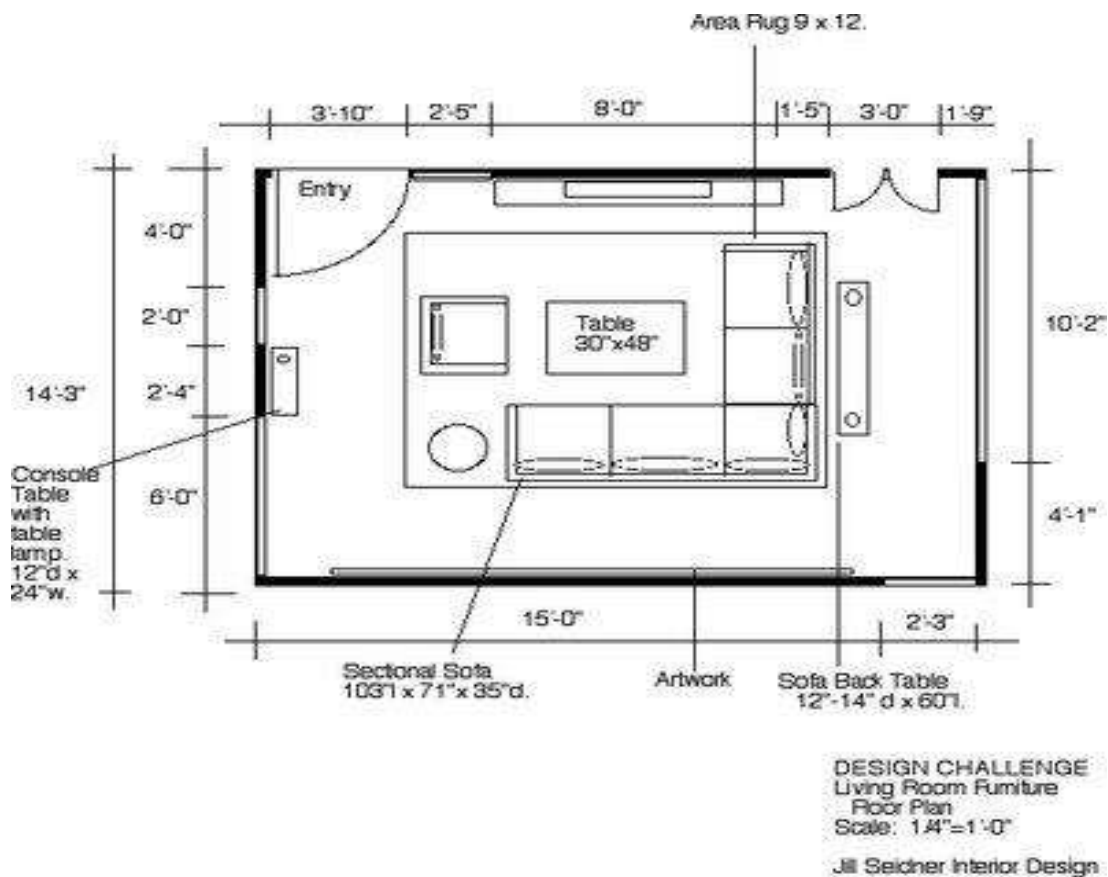
LIVING AREA

The living area of the house is that where the family meets friends relaxes and entertains. The first impression of any house is received from its living area. It should be

- Comfortable
- Sufficiently lighted.
- Spacious to accommodate furniture.
- Proper circulation of air.

Examples of living room

- Drawing room
- Dining room
- Office room
- Guest room
- Entrance foyer.
- Recreation or games.



SLEEPING AREA

It is designed for sleeping and relaxing, basic function is to provide facilities for max comfort and relaxation.

- Should be located in a quiet part of the house.
- Area consists of bedroom, bath, dressing and nurseries.

SERVICE AREA

It is the part of residence where the service functions are performed. it Includes

- Kitchen
- Store
- Bath room
- Garage

Rooms meant for the various activities

1. DRAWING OR LIVING ROOM

It is the very first room of the house, may be followed after a verandah.

Purpose: It has connection with all the rooms, main functions are

- To draw guests.
- Act as a lounge.
- Act as sitting or relaxing room.
- Listening to radio or watching TV.

- Playing.
- Social functions like bhajanas, religious discourses and get together.
- Bedroom for guests.
- Study room for children etc.

Requirements:

- Size of door should not be less than 1.0×2.0 m
- Window size should be 1.2×1.0m
- A minimum of two windows, one facing north and other towards east are desirable
- Minimum illumination of 100 lux.
- Minimum window area should never be less than 10% of floor area, but 20% is preferable.
- No built in cupboards are to be provided, a show case may be provided.
- Minimum floor area is 15 to 20m² and 20 to 40 m² is preferred.
- If it is to be used as a bedroom for guests the minimum floor area required is 23 to 28m².
- 3.5×5.5 m ----- small living or drawing room
- 5×6m----- comfortable
- 7×9m----- luxurious room

2. *DINING ROOM*

Purpose:

the place where family members used to take their breakfast, lunch , dinner. the total activity may take less than an hour. Incidentally be used as a study place for children, gathering place for ladies, music room for girls. Therefore providing a separate dinning room is a luxury for middle class people. A combined living cum dining room is the latest trend.

Requirements:

It should be cool and connected to kitchen.

Besides dining tables and chairs it should also accommodate a wash basin towel rail and cupboards to harbor steel and silver plates, glass ware, crockery and linen

- A shelf of 300mm wide and 6m long and preferably 10m long and 500mm wide is required.
- A minimum floor area of 15 m² and minimum width of 3m is needed.
- A brightness of 50 lux is adequate
- Min size of dining room is 4m×3m ,so as to accommodate dinning for six persons
- A dinning of 4m×5mcomfortable
- A dinning of 5m×6m.....spacious

Dining tables may be in different shapes as

- Rectangle
- Elliptical
- Boat shaped
- Square shaped
- Circular shape
- A minimum clearance of 900 mm is required around the table for movements and min clearance of 1200mm between the dinning table and cabinet.

3. KITCHEN:

Purpose:

- A kitchen is a place where food is prepared and stored
- The health ,comfort and happiness of family depend on the quality and cleanliness of food prepared in the kitchen
- It is classified as two types
 - Sitting type
 - Standing type
- Sitting type is generally used in olden days, where the fire place is at the floor level
- Standing type is used in modern ways of construction, where a stove is provided on platform at desired height

Requirements:

- Eastern or north eastern corner is the best location for kitchen
- A minimum illumination of 200 lux is required at day and night
- A window towards north to provide light with out heat and window towards east to receive the morning sun is needed
- Exhaust fan may be provided to remove pungent smells
- Kitchen should be adjacent to the dinning room, if possible to the children play area.
- Eastern or north eastern corner is the best location for kitchen
- A minimum illumination of 200 lux is required at day and night
- A window towards north to provide light with out heat and window towards east to receive the morning sun is needed
- Exhaust fan may be provided to remove pungent smells
- Kitchen should be adjacent to the dinning room, if possible to the children play area.

4. *BEDROOM:*

Purpose:

- Human spends 30%to 50% of his life in a bedroom.
- Major part of a day will be spent in bedroom.
- Privacy is most important factor to be considered during planning. Attached toilets and dressing rooms can be provided for better privacy.

Requirements:

- A bedroom be designed or 1 or 2 adults, should not for more children of different sex.
- Children above 10 should have separate bedroom.
- In case of girls, the bedroom should be nearer to parents.

5. *BATH AND WATER CLOSETS:*

- It is the place where we take bath and the water is collected and conveyed off in a hygienic manner.
- w/c is place of collection of human discharges of foul nature as urine and human excreta and conveyed off hygienically.

Requirements:

- Minimum breath 1.2m and length 1.5m with minimum width of 1.5m .

- Minimum floor area of 1.8 sqm is to be provided.
- Combined floor area of bath and water closet should not be less than 2.8sqm.
- Additional space is to be provided for wash basin, geyser and shower.
- Water closet should have a minimum width of 0.9 m and minimum length of 1.2 m.
- Minimum clearance of 600mm is needed between the front edge of the commode and the wall.
- Small -toilet -----1.5×2m.
- Big toilet -----2×3m.
- Biggest toilet-----3×4m.

6. *VERANDAH:*

It is the area open on one side, two sides or on three sides. It is an essential feature of tropical houses.

Purpose:

- Protects the interior rooms from sun.
- Best place to receive strangers.
- Serves as a sit-out in the evenings and nights with family members.
- Ideal place to keep shoes, raincoats, umbrellas etc.
- It serves as a passage between different rooms giving access to other rooms

Requirements:

- Minimum width of 1.5 and very rarely with a width of 4m is provided.
- Facing south and west can protect interior rooms from hot sun.
- Verandah roof is to be provided at a minimum height of 2.1m above the floor level.

7. *STORE ROOM:*

Purpose:

- Items of regular use as food grains, fire-wood or coal, spare gas cylinders, brooms.
- Broken furniture, condemned utensils etc.

Requirements:

- Should be situated nearer to the kitchen.
- Should be dark, cool, damp proof and rodent proof

Incase of no place for store room, the loft above bath, w.c and room below the stair landing may be used as a store. The minimum floor area of the store room should be 8sqm. If store room is provided with kitchen the minimum floor area should be 15 to 20sqm

8. *WORSHIP ROOM:*

- Purpose:

It is quite calm space to perform pooja to the god

Requirements:

Should be located in the N-E corner of the building as per vastushastra rules. As god will be facing west and devotees facing east. A little bit of darkness is necessary to create concentration. Diffused light comes from north direction.

Size of room be of 2.1×2.1m roughly 4m² area

9. *STUDY ROOM:*

Purpose:

It is the place where the study materials are stocked and read.

Requirements:

- Should be calm and free from noise.
- Minimum brightness of 150 lux is required.
- Area should be 10m² to 12m² a table with 1 or 2 chairs is required furniture.

10. GUEST ROOM:

Purpose:

Place where the guests are accommodated.

Requirements:

- It should be isolated from other bedrooms
- Should have an independent access to common bath and W.C
- Dimensions are similar to that of bedroom.
- Hobbies room– room to cater different types of hobbies

11. OFFICE ROOM

Purpose: basic function is to study, reading room or library.

It is necessary for professional work of lawyers ,engineers ,doctors and CA's etc.,

Requirements:

- Should be located nearer to verandah
- Preferably with diffused light and no glare
- Sufficient facilities such as storage of books, space for working ,reading ,relaxing and entertaining the guests

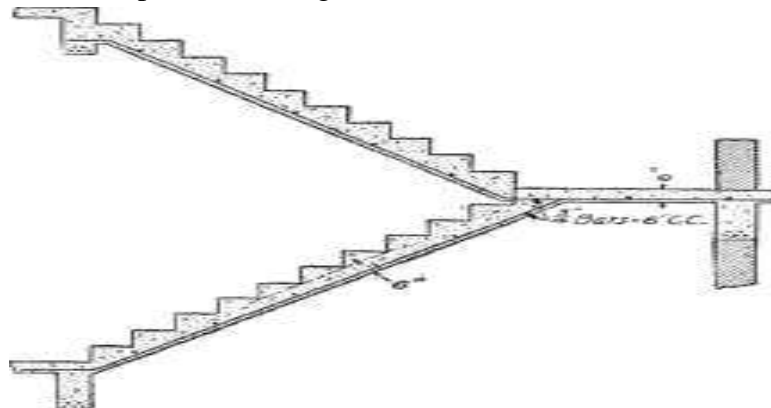
12. STAIRS:

Purpose: should be provided for vertical circulation

- Stair case is the flights of stairs with balusters ,hand rails

Requirements

- It should be fire proof
- Min width of 900mm for residential buildings
- Min rise :>/190 for residential building
:>/150 for public building
- Going :>/250 for residential building
:>300 for public building



13. GARAGE:

Purpose:

- It is the place where four wheelers are parked.
- It has become essential now a days due to rapid growth in the number of vehicles

Requirements

The dimensions of garage depend on the type of vehicle

- For scooters 1m×1.5m
- For cars 3m×6m
- For tractors..... 3m×5m with more height of 2.2m is to be provided
- A min of one window should be provided for lightening and ventilation
- Entrance gate of garage should have a min clear opening width of 2.23m
- Rolling shutters are preferable to folding shutters as garage doors.

PUBLIC BUILDINGS

Norms, requirements and planning of educational institutions: **School building**

A school is a place of learning.

Site Selection:

- Surroundings must be calm, quiet, peaceful and cheerful with natural breeze and sunlight.
- Site should be gently sloping and well drained.
- The site should never be flood affected.
- Away from industries

Principles of planning

- No public or railway line should not pass trough it
- The built in area should not exceed 25% of site area.
- Remaining area should be used for playground, gardens e.t.c.
- Min plinth height should be 750mm.

Components of school

- Class room

- Laboratories
- Drawing hall
- Library
- Auditorium
- Gymnasium
- Administrative area
- Staff room
- Play field

Design of class room:

- A class room should not be a mere enclosure of space but should meet the diverse needs of students.

Factors to be considered:

- Basic dimensions of children and their space requirements.
- Arrangement of furniture and equipment.
- Type of activities to be carried out.
- Seating arrangements for the students.
- Comfortable angle of vision of black board from any position in the class room

Dimensions:

- To be designed at the rate of 0.9 m² per pupil of primary school, 1.11 m² for middle schools and @1.2 m² to 1.5 m² for secondary school pupil.
- Desk size of --- 970mm×460mm.
- Space of 460mm between two rows of desks.
- Width --- 6, length 9m.
- 40 students per class is commonly accepted in Indian schools.
- 6.1m×7.3m- primary school and furniture
- 6.9×7.3m for middle and higher secondary schools.
- Black board size – 2.4×1.2m
- First row of students should be placed at a mini.Distance of 2.13m form the black board.

- A minimum sound of 78decimals should be received by the pupil in the last row.
- Area of window --- 20% of floor area.
- Verandah mini width of – 2.5m and should be on south and west directions.
- Windows and ventilators ---east and north.
- Adequate natural light of intensity of 150lux is required.
- Never plan more than three class rooms in a row.
- Door opening should have a mini width of 1.65m

Hospitals:

Site selection:

- It should be located in a quiet place which is well connected by convenient means of transport.
- The infectious disease hospitals are located away from the city with convenient means of transport.
- The size of site should be large enough to permit open planning which is essential in tropic countries.

Planning: divided in to 2 units

1. Out-patient
2. In- patient

Minimum requirements for hospital buildings:

- Floor area for consultant rooms -10sqm-12sqm.
- Width of entrance should be-3m-5m for easy access of wheel chair.
- Waiting hall space should be 1.4sqm per patient and 36sqm for minimum area.
- Emergency section and dispensary are 10sqm to 15sqm and 20sqmto30sqm.

In-patient department (IPD):

- All facilities required for treatment of patients admitted into wards.

Wards:

- Commonly used for admitting patients suggested by the doctors.
- Those are classified w.r.t to disease such as maternity ward, cardiology, surgical ward, emergency wards etc.

Measures for planning and design of wards:

- Area of ward per bed is 8 to 10sqm. No: of beds per ward is 24 to 30.
- Max distance from bed to w.c is 12m.
- Good design aims a clear view for nurse's from their station.
- Noise level should not more than 35 to 40db.
- Wards should be well ventilated and with a window area of 20% for floor area.
- Nurses' room and dispensing room area of 10 to 12sqm.

Operating theatres:

Theaters -----20sqm to 30sqm.

Sterilization room -----8sqm to 10sqm.

Anesthetic room ----- 10sqm to 12 sqm.

Doctors room ----- 10sqm to 12sqm.

Look after

- Radiology department.
- Pathology department

Staff quarters:

These are provided for the staff who ever working the hospital and should provide very easy rapid access to the casualty room and wards.

Sanitary units:

Sanitary units should be provided on the scale recommended by the building byelaws. According to NBC the units should be provided for in-patient and out-patient wards and staff.

Principles of planning a hospital:

Aspect: prior planning for the entrance doors and windows all over hospital.

Privacy: it plays a vital role for placing of operation theaters.

Roominess: wards should be spacious and easily accessible.

- Circulation: separate entrance for doctors and other staff for emergency.

- In addition to stairs and ramps, lifts should be provided for easy and efficient vertical circulation.
- Sanitation: less noise, free movement of natural breeze and avoiding hot sun during afternoon and cleanness to be considered as a compulsory process for the hospitals

Elegance: A minimum plinth height of 750mm for effective drainage.

DISPENSARIES:

The physical facility shall be developed and maintained to provide safe and secure environment for patients, their families, staff and visitors. It shall be situated in a place having clean surroundings and shall comply with local byelaws in force, if any from time to time.

- The minimum space requirement for carrying out the basic functions of the facility shall be as per Annexure 1.
- The area shall be well illuminated, ventilated and clean with adequate water supply.
- The clinic shall have a prominent board/signage displaying the name of the clinic in local language at the gate or on the building of the clinic.
- The following other signage shall be well displayed in the language understood by the local public in the area:

- a) Name of the doctors with registration number.
- b) Fee structure of the various doctors/ specialist
- c) Timings of the clinics (For ex from 8am -2pm)

Human Resource Requirements:

- The general practitioner/ specialist doctor /super-specialist doctors as per the scope of the clinic/polyclinic shall be registered with State/Central Medical Council of India.
- The services provided by the medical professionals shall be in consonance with their qualification, training, registration.
- If dispensing is done by Paramedic like pharmacist, he shall be qualified, trained and registered with pharmacy council

OFFICE BUILDINGS:

- The work primarily involves handling information and making decisions based upon the information.
- Much of office work is sedentary but involves space for machinery, canteen, meetings, filling, libraries and other ancillary activities. This may take 1/3 of space.

Entrance:

- For security point of view only one entrance is provided with a width of 2m to 4m.
- Room sizes of an office building are determined by space standards.
- A minimum of 4 Sq.m net usable areas per head to maximum of 25 Sq.m net per head is provided.

- Length not greater than 1.5 times its width is desirable.
- Single room depth should not exceed 6m.

Corridors:

- The main corridor width should not be greater than 3m and not less than 1.8m
- A central corridor with rooms on either side is desirable.

Storage:

- Filing cabinets, Drawer type filling are still predominant method of storing office papers.
- Office room150 lux
- Corridors50 lux
- Drawing office300 lux

Sanitary units

- These should be provided separately at every floor.
- In office the sanitary units may be attached to their office room or placed separately.

BANKS:

Banks are of 3 categories': savings banks, commercial banks and agricultural banks

The savings bank in addition to savings account transaction may provide its clients with lockers in the safe deposits vault. Commercial banks in addition to saving accounts, cash credits, collecting bills and cheque against receipts, shall be having transaction as advancing loan against mortgages of the goods kept in the custody of the banks.

Agricultural banks in additional to saving account transaction, shall be having loan sanction for agricultural development.

A bank has 3 main functional areas:

- 1) The banking space
 - 2) The vault area
 - 3) Operations
- The banking space includes all areas common to the public and bank officials and employees.

- The vaults include the banks money vault or vaults and generally a safe deposit vault. Operations are concerned with the internal affairs of a bank

Selection of a site:

- The selection of a site for a bank depends on its nature of business.
- Saving banks are generally located in residential suburban and rural areas.
- Commercial banks are located in a business locality, where commercial forms conduct their business and carry on trade.
- Agricultural banks are generally located in village where agricultural activities are prominent.

Functional units

- The activity of banking needs areas of public space, working spaces for tellers counter and officer's platform.
- the size of public space will be decided by the volume of bank business and the span of working hours.
- The public lounges may be provided with accompanying toilet facilities for convenience of customers. Sufficient seating arrangements, desks with chairs, stand-up-counters for writing may be provided in aspirate lounge or in a large public space.
- Writing desk of at least 600mm width and 450mm depth per person are to be provided. the basis for provision for working space and public space may be adopted as 5m² to 6.5m² per counter window or teller for working space and 12.5m² to 17.5m² as public waiting space
- The length of counter about 1.2m to 1.5m per clerk and height from the floor is usually kept at 1.6m to 1.8m width of cabinet or depth of the counter may be varying from 450mm to 900mm depending upon the requirements.
- Senior officers are placed in the more remote parts of the platform for greater privacy. An area of 9.25 m² to 11m² per officer is generally provided.

Safe deposit and money vaults:

- Safe deposit and bank vaults should be placed along a side of load bearing wall or the rear wall or if possible in a rear corner. if the bank has a basement floor or if it is a split level building, place the vault area at the lower level.

Operations:

These are concerned with affairs of a bank. the main functions are:

1) Processing, or a clerical work

2) book-keeping

A small bank may house all its operations in on enlarge space. a large bank, on the other hand will be departmentalized with nth operating space broken by function i.e., loan, personal loan, trust money transfer, letter of credit and collections credit, to name but a few. For efficient working accommodation for manager, his assistant and clerical staff may be provided in the same apartment. However, a manager needs a separate room near the entrance as he has to deal with the public.

- Various spacing standards for planning a new bank building are given below:

1) Entrance and moving space by the side of a counter----2m wide (minimum)

2) Counter height-1.6m to 1.8m

Counter width-----0.4m to 0.8m

3) Working space behind a counter-3m wide

4) Managers room-----10to 15 m²

5) Meeting hall-20 to 40 m²

6) Working space for clerk-8 to 10 m²

7) Retiring space per person-1 to 1.5 m²

INDUSTRIAL BUILDINGS:

- The provisions given below are applicable only to single storey industrial buildings (factories and storage buildings) covering large floor areas without subdividing/ separating walls which are usually designed to meet modern production methods.
- The requirements of fire and explosion venting of industrial buildings, as dealt with in this section, fall under two categories: (a) Smoke and fire venting, and (b) Explosion relief vent.
- The smoke and hot combustion products from a fire, being lighter than the surrounding air, tend to rise and on reaching the roof or ceiling spread out (mushroom) on all sides and form a layer which floats on top of the cold air beneath.
- In the absence of vents, this layer becomes progressively deeper until the whole building is filled with hot smoky gases. The time consumed for this to happen may be only a few minutes, depending on variables like, type of materials on fire, process/ storage conditions involved, etc.
- The hot gases at the roof level moved by convection currents contribute to rapid lateral spread of fire.

- The provision of property designed and suitably located vents in adequate number helps the speedy removal of smoke and hot gases, thereby preventing spread of fire, besides reducing risks of explosion of unburnt gases and reducing damage to the contents and structure of the building by heat and smoke.
- In addition, they facilitate fire fighting operations, and minimise personal hazards to the firemen

HOTELS AND MOTELS:

- Hotel is a superior type of building to accommodate strangers.
 - Lodging, boarding
 - Arrangement for comfortable stay.
- Motel is a type of hotel located by the side of road to provide food and accommodation to motorists.
- Mostly sited at important junctions and on outskirts of cities.
- Resort hotels are located at seaside or river banks or near hills for holidaying.

Site selection:

- Location will be one of the important factor for commercial success.
- Generally sited near main road or motor way intersections, rail stations, airport, commercial and business centers or recreation centers.
- Ideal hotel should be located at quite environment to provide sound sleep of its inmates and should have better paring facilities.

Planning of hotel :

- Hotel business will depend almost entirely on its ability to attract customers.
- Most important factors to be considered during planning and design of hotel building are:
 - Entrance foyer
 - Public rooms
 - Bedrooms
 - Kitchen and food stores

Building services.

- Entrance foyer: main entrance should be located nearer to the road. The gate of entrance should be 3m to 6m wide.
- Reception, registration, billing counter should be in entrance.

Public rooms:

Consists of Restaurant, Bar, Lounges, Recreation rooms, Function rooms and meeting halls.

- Space requirements for bars excluding counter is 1.3sq m to 1.7sq m per person.
- Multipurpose rooms for meeting, parties & exhibitions, separate access for guests & services are desirable.
- Space requirement for room is @0.5sq m to 1.3sq m per person.

Bed Room:-

- It is a service unit of a hotel building and the number of bedrooms to be provided is controlled by floor area & the relevant prevailing building bye laws.
- The layout to bed room is of open type i.e., I, L, F, E, H, T, U, Y or Z shapes.
- Sound transmission between bed room & corridors should be minimized to 45 dB to 50dB.

Kitchen & Food Stores:-

- It should be planned at one level if possible to serve all catering outlets.
- Space allowances for kitchen planning includes food storage, cold room, wash up, chiefs office.
- Kitchen area $1.4 \times \text{number of users}$
- Service area $0.2 \times \text{number of users}$
- Coffee shop $0.3 \times \text{number of users}$
- Floor should be non slippery & walls should be tiled up to a height of 1.8m.

Laundry:-

- A space of approximately 15sq m to 20sq m is required.

Building Services :-

- Emergency Electrical Supply
- Fire Alarm system.

- Air conditioning.
- Lighting.

Sanitary units:

- Every bed room should be provided with an attached toilet block comprising all the facilities.

BUILDINGS FOR RECREATION: A CINEMA BUILDING

Cinemas are playing important role in communication of thought and expression, especially to the masses in and out of the way.

- A cinema building is used for a cinematograph exhibition. in India the number of cinema buildings is quite inadequate to meet the needs of public and also many existing cinema buildings do not have minimum basic requirements such as ventilation ,clear audibility, fire safety, sanitary units,lighting,well designed exits etc., for planning and construction of these buildings, existing bye-laws vary from state to state.

Site selection:

The construction of cinema buildings is not allowed in residential areas and streets of heavy traffic because these buildings create problems to the public and also the local authorities. Therefore, the following point should be kept in mind while selecting a site for a cinema building.

- The site is easily accessible from all localities and approachable by local transport.
- The area of the site should be sufficient to locate cinema building, drive ways, water fountain, garden, car-parks and cycle stand. It should be a minimum of 0.2-0.4 hectares.
- it should be at a minimum distance of 185m from schools, hospitals and places of worship.

The cinema building may be divided into 3 parts

Reception

- Auditorium
- Stage

Reception: Entrance, booking hall, foyer, manager office

Auditorium:

- Auditorium is an enclosure where people can assemble for watching a picture projected on screen through exhibition of cinematographic films.
- The size of the auditorium is decided by the number of seats to be accommodated.
- The rates of ticket are different for different positions of chair in the auditorium and it increases as the distance of chair from the screen. Some portion of the auditorium is covered by the balcony and it has the highest rates of tickets.
- The size of the auditorium should be such that it should not cause excessive strain to the eye because of poor visibility and to the ears of irregular audibility
- It is observed that auditoriums designed with the capacity of 3.50 m^3 To 4.20 m^3 per person gives better acoustical performance. Floor area should be a minimum of 0.6 sq.m to 0.9 sq.m Per person. This includes the area of aisle, gangways; stage etc, for cinema auditoriums, ratio of height to width to length is taken as 1:2:3.

The following measures should be taken in cinema auditoriums for achieving excellent acoustic results

- Ceiling should be of broken planes rather than a smooth curve
- Back wall should not follow last row seating curvature
- Convex surfaces should be employed near stage to reflect sound to rear seats and also to distribute reflected sound uniformly throughout the theater
- Volume of auditorium of average size should not exceed 4.5 m^3 per seat.
- air-borne or solid-borne noise originating inside and from outside the auditoriums' (such as from openings) must be prevented or controlled
- A little divergent walls i.e., the long walls making 1000 with the cross wall near stage are to be provided to avoid multiple reflection of sound
- Distance from front row of seats is determined by maximum allowable angle between sight line from the first row of top Screen.
- A maximum angle of 30 to 35 degrees is recommended. Limit of 350 above horizontal produce distance to screen on centre line of $1.43 \times$ height
- depth of theater should be such that last row should not be at a distance greater than 23m from the screen for better synchronization of the lip movement and actions and for clear visibility. The slope of auditorium varies from 1 in 10 to 1 in 20

- Balcony is generally constructed in big theatres. It should not project more than $\frac{1}{3}$ rd length of the auditorium from the rear wall. Maximum line sight angle from the balcony stage is 30°.
- The doors of auditorium are accessible from lobbies, verandah and foyer and width of doors is less than 1.8m at least one door should be provided for every 200 seats in the auditorium.

Screen system

- Cinema screen in past was fitted into adapted theatre. Now a days; increased picture size determines interior design.
- Traditional cinemas had small picture. The width of screen for it is 7.5m whereas 3 projectors original Cinerama system has 30.5m screen
- This is surpassed by new single projector IMAX system with 70mm film used horizontally to enlarge frame size and provide 36m picture, seating being placed close, screen preventing whole picture being seen without both vertical and horizontal movement of head.

Projection room

- The projection room should be large enough to enable the operator to work freely at the film projection and any other equipment.
- The projection room consists two 35mm projectors, a lantern for commercial and cinema advertisements and a record player.
- The line of projection should not make an angle of less than 80° with screen. Usually a minimum of 16 to 20 sq.m area is considered sufficient for a projection room. Fire and burglar alarms may be provided in the projection room.

Foyer and lobbies

- The circulatory space or waiting platform is provided in the form of foyers near entrance and at balcony level. The space for the foyer is usually worked out at the rate of 0.05 m² Per seat in auditorium.
- The lobbies are passages for taking out the audience of the preview show. Staircase providing an access to the balcony should not have a rise more than 150mm and a tread less than 280mm and maximum of 2 successive flights.
- Landing at top, bottom and in between flights should be of equal width.

Box office

- These are the small cabins each of an area of about 5 m² And provided near the entrance for issuing ticket for different places

Managers' office

- Separate office for manager, general and circle staff should be provided at an upper floor

Sanitary units

- Sanitary units should be provided on the scale recommended by the building -laws